Neapolis University Pafos

Neapolis University Pafos

Proceedings of the

17th European Conference on Innovation and Entrepreneurship

hosted by Neapolis University Pafos, Cyprus

15-16 September 2022



Edited by

Pantelis Sklias and Nikolaos Apostolopoulos

A conference managed by ACI, UK

aci

Proceedings of the

17th European Conference on Innovation and Entrepreneurship ECIE 2022

Hosted By

Neapolis University
Pafos, Cyprus

15-16 September 2022

Copyright the authors, 2022. All Rights Reserved.

No reproduction, copy or transmission may be made without written permission from the individual authors.

Review Process
Papers submitted to this conference have been double-blind peer reviewed before final acceptance to the conference. Initially, abstracts were reviewed for relevance and accessibility and successful authors were invited to submit full papers. Many thanks to the reviewers who helped ensure the quality of all the submissions.

Ethics and Publication Malpractice Policy
ACIL adheres to a strict ethics and publication malpractice policy for all publications – details of which can be found here:
http://www.academic-conferences.org/policies/ethics-policy-for-publishing-in-the-conference-proceedings-of-academic-conferences-and-publishing-international-limited/

Self-Archiving and Paper Repositories
We actively encourage authors of papers in ACIL conference proceedings and journals to upload their published papers to university repositories and research bodies such as ResearchGate and Academic.edu. Full reference to the original publication should be provided.

Conference Proceedings
The Conference Proceedings is a book published with an ISBN and ISSN. The proceedings have been submitted to a number of accreditation, citation and indexing bodies including Thomson ISI Web of Science and Elsevier Scopus.

Author affiliation details in these proceedings have been reproduced as supplied by the authors themselves.

The Electronic version of the Conference Proceedings is available to download from https://papers.academic-conferences.org/

The Conference Proceedings for this year and previous years can be purchased from http://academic-bookshop.com

E-Book ISBN: 978-1-914587-49-8
E-Book ISSN: 2049-1069
Book version ISBN: 978-1-914587-48-1
Book Version ISSN: 2049-1050

Published by Academic Conferences International Limited
Reading, UK
+44-118-972-4148
www.academic-conferences.org
info@academic-conferences.org

Contents

Paper Title	Author(s)	Page No
Preface		ix
Committee		x
Biographies		xii
Keynote Outlines		
Research papers		
Non-Formal Social Ties as Threat to the Implementation of Innovations	Aleksandr Aksiutin, Konstantin Bagrationi, Michael Morozov and Ilya Trochin	1
Business Model Innovations in the French Food Sector During the Covid Crisis	Laurice Alexandre and Nathalie Sarrouy-Watkins	8
Learning Based on Co-Creation Processes: A Glimpse of the (Demola) Pedagogical Innovation Training Course at IPV	Susana Amante and Rosina Fernandes	15
Factors Enabling Student Start-ups to Commercialise Scientific Research for Demonstrating Social Impact	Dwitya Amry, Ali Ahmad and Dawei Lu	22
Health Digitalisation and Innovative Entrepreneurship Status. A Qualitative Exploration of the Private Sector in Greece and a Synthesis of Main Issues	Sotiris Apostolopoulos, Ilias Makris and Stravros Stavroyiannis	32
The Inevitable but Altered Roles of Universities Within an Innovation Ecosystem	Linde Baaijens, Maria Freidel, Denice Groenen, Antonios Matzakos Chorianopoulos, Jordan Vasseur, Matthijs Zwemmer, Emőke Takács and Toon Abcouwer	40
Innovation as a Challenge for Peripheral Regions: An Israeli Case	Raphael Bar-El, Sharon Hadad, Liran Maymoni, Ran Ben-Malka and Reut Megidish	48
Innovation in the Circular Economy	Lukáš Blažek	58
Economics of Data Systematic Review for Planning Strategies in the InsurTech industry	Claudio Bonvino and Marco Giorgino	66
KIBS Role in the Innovation and Internationalization Processes of Firms: A Bibliometric Overview	Alexandra Braga, Joana Ferreira and Jorge Sousa	76

Paper Title	Author(s)	Page No
Psychological Capital and Entrepreneurial Tendencies	Tiina Brandt	85
Insights on Creative Networks: A Social Network Analysis of Five Arts Organisations	Fraser Bruce, Shaleph O'Neill and Sharifa Hawari-Latter	92
Conceptualising Digital Entrepreneurship: Artifacts, Platforms and Infrastructures	Anthony Paul Buckley and Kisito Futonge Nzembayie	101
Exploring Business Model Innovation in the Norwegian Grocery Market	Beniamino Callegari, Adeline Hvidsten and Ranvir Rai	107
Changes in the Perception of Business Risks to the Threat of Bankruptcy Due to COVID-19	Martin Cepel and Anna Kotaskova	115
A Framework for Social Business Models Analyses	Irene Ciccarino and Susana Rodrigues	124
Benefits of CSR Through Quinoa Biotrade in South American Communities	Franklin Cordova-Buiza, Jesus Julio Antaurco-Perez, Braulio Edson Espinoza-Prieto and Lucero Nicole Huerta-Tantalean	133
Strategic Management of E-Commerce in Commercial Companies: A Systematic Review (2016 -2020)	Franklin Cordova-Buiza, Kiara Hernandez-Zuniga, Katherine Julca-Carrasco, and Lucero Nicole Huerta-Tantalean	141
Entrepreneurial Business in the Wine Sector: A Business Model Proposal for the Setúbal Peninsula	Teresa Costa, Nuno Teixeira, Sandra Nunes and Mário Cravidão	148
Entrepreneurship Education: The International Pedagogical Project COTADAS – Co-Creation to Analyses and Development of Strategic Scenarios	Teresa Costa, Pedro Mares, William Borges and Nuno Teixeira	159
A Structural Equations Approach Applied to Social Innovation	Jorge Cunha, Carla Ferreira, Claúdio Vasconcelos, Madalena Araújo, Manuel Lopes Nunes and Paula Ferreira	169
A Proposal for an Assessment Tool of Social Innovation Impact	Jorge Cunha, Wellington Alves, Fernanda Pontes and Madalena Araújo	179

Paper Title	Author(s)	Page No
The Entrepreneurial Perspective in Impact Investing Research: A Research Agenda	Christin Eckerle, Sarah Manthey and Orestis Terzidis	189
Do we Practice What we Preach? Applying Startup Practice to Entrepreneurship Education	Gali Einav and Maria Blekher	197
Choosing Collaborative Learning Options for Preparing Innovative Entrepreneurs	Tiit Elenurm	206
Collaborate or Perish: A Conceptual Framework for Banks and FinTechs Partnerships	Alessandro Faes, Vito Gunnella and Marco Giorgino	214
From Teachers' Innovative Practices to Students' Co-Creation: A Glimpse of the Project "Link Me Up – 1000 Ideias"	Rosina Fernandes and Susana Amante	226
Supporting Innovation in Energy Sector: The SMEs Role and DIGIFED Success Cases	Gabriele Gaffuri, Isabelle Chartier, Pablo Ribeiro, Sonja Nastran, Margherita Volpe, Isabelle Dor, Gonzalo Murillo, Emmanuel Chanson, Iñigo Gonzalez and Marvin Hofer	232
Shared Stressors and Stress Coping Strategies in Start-up Teams	Liudmila Gapeyeva-Yukce, Juha Saukkonen and Henna Kautto	240
Enabling Undergraduate Student Entrepreneurs to Structure Their own Experiential Learning Course	Kenneth Grant	249
Capturing Competitive Advantage Through Product Innovation: Study of a Small Culinary Business	Jurry Hatammimi and Amelia Thahara	258
Assessment Dimensions and Items for the Evaluation of the Technological Maturity of Applied R&D Organizations	Fabian Hecklau, Florian Kidschun and Holger Kohl	266
Social Entrepreneurship and Sustainable Development Goals: A Conceptual Framework	Anton Herutomo, Wawan Dhewanto and Eko Agus Prasetio	275
The All-Wales Academy for Innovation in Health and Social Care	Tom James, Roderick Thomas, Daniel Rees and Gareth Davies	284

Paper Title	Author(s)	Page No
The Role of Motivation and Entrepreneurial Role Models in Shaping Entrepreneurship Competence of Higher Education Students	Sanna Joensuu-Salo	290
Engaging Literature Students in Entrepreneurship: Could use of art Help?	Alexandros Kakouris and Panagiotis Liargovas	297
Innovation in Healthcare: Success Factors for Innovative Healthcare Change Processes	Stefan Lagrosen and Yvonne Lagrosen	305
Calibrating Entrepreneurship Education for a Constantly Changing World	Matthew Lynch, Nils Sanne, Øystein Stavo Hovig and Kari Håvåg Voldsund	311
Fashion Upcycling and Social Impact: A Case Study	Diana Machado, Marisa Ferreira, Amélia Carvalho, Alexandra Braga and Vítor Braga	319
Tackling the Critical Hurdles: Revising Technology-Based Ideation Processes	Sarah Manthey, Christin Eckerle and Orestis Terzidis	327
Entrepreneurship: Analysis by Country Through Machine Learning Techniques	Antonieta Martínez-Velasco and Antonia Terán-Bustamante	340
Towards a Theory of Motivations and Roles in Business Ecosystems	Margaret Mastropetrou , George Bithas and Konstadinos Kutsikos	351
Strategic Alliances, Innovation Capability, Cost Reduction, Customer Loyalty and Competitive Advantage in B2B Alliances	Soebowo Musa	361
The Role of Trust in Forming a Social Innovation Service System	Thao Nguyen and Vy Pham	370
Implications of Blockchain Application to Accounting Education and Accounting Practice	Ana Novak, Ivana Barišić and Katarina Žager	378
SMEs Digitalisation Through Clustering, the Role of Open Innovation: A Research Agenda	Mirhiga Peter Okuwhere , Thanh Huynh, Cherisse Hoyte and Andrew Johnston	386
How to Increase the Efficiency of Social Enterprises in Russia During the COVID-19 Pandemic?	Ruslan Pavlov	394
Entrepreneurship: The Ideas of J.A. Schumpeter and R.A. Dahl	Tor Helge Pedersen	400

Paper Title	Author(s)	Page No
How Swiss Start-Ups Deal With Business Model Innovation	Stefan Philippi, Andreas Hinz and Laila Kabous	408
The Importance of Entrepreneurship on Economic Development. Evidence From the OECD Countries	Sara Proença and Elias Soukiazis	416
Lean Startup Practices: Operationalizing the Technological Business Planning Process in an Academic Environment	Luciana Reis, June Fernandes, Márbia Araújo and Martin Beaulieu	423
Managing Knowledge and Identity across the Boundary of Academic and Commercial Science	Kent Rondeau, Justin Dillon, Nasser Mansour and Jason Daniels	432
From Six Learner Personas of Teampreneurship to a Learner-Led and Co-Creative Entrepreneurial Model?	Juha Ruuska	441
Financial Innovation for Financial Inclusion: Mapping Potential Access to Finance	Egidijus Rybakovas and Gerda Zigiene	451
The Risk Attitude and the Motivation to Online Purchase	Arik Sadeh and Cristina Feniser	458
Identifying new Product Opportunities From Waste: Eliminating Waste in Tomato Production	Diana Salgado, Nicholas Ford and Christopher Simms	464
Context-Aware Entrepreneurship Education: Exploring the Educators Perspective	Juha Saukkonen and Alexandros Kakouris	472
The Development of Entrepreneurial Thinking in STEM Education: A Teaching and Learning Module for Elementary Students	Nyet Moi Siew and Jamilah Ahmad	481
The Technology Transfer University Capability: A Case Study From the Triple Helix Perspective	Sergio Evangelista Silva, Eloiza Luzia Boanerges de Castro and Luciana Paula Reis	491
Subsidised Start-Ups for the Unemployed in Less Developed Region: Effects Behind Efficiency	Miroslav Šipikal	499
Legal Incentives and Constraints on Innovation: Keeping the Balance	Robert Brian Smith and Mark Perry	504

Paper Title	Author(s)	Page No
Intellectual Capital of Social Sciences and the Efficiency of its Formation at the Scientific Institutions	Inese Spica, Baiba Berzina, Ernests Spics and Rozite Katrina Spica	512
Academic Entrepreneurship and Inequality: Evidence From Administrative Data	Joseph Staudt	521
Digital Adoption in The Family Business: A State-of-the-art Review	Nyayu Lathifah Tirdasari, Wawan Dhewanto and Neneng Nurlaela Arief	529
The Role of Accelerators in Shaping Entrepreneurial Identity	Anita Ellen Tobiassen, Ingunn Elvekrok and Line Skreosen	539
Digitally Transforming Organisational Cultures: Ensuring Enhanced Innovation in a Remote Working World	Stephen Treacy	548
A Network Approach to the Digital Innovation Hub as an Ecosystem Supporting the Digital Transformation of Enterprises in a Region	Anna Ujwary-Gil and Anna Florek-Paszkowska	557
Start-up Performance: Looking for an Explanation in Entrepreneurial Characteristics and Financing Choice	Ine Umans, and Nadine Lybaert	567
Cascade Funding as an Alternative Funding Source for Innovative Investments	Margherita Volpe, Iñigo Gonzalez Rojas, Omar Veledar and Simona Cavallini	575
The Role of Crowdfunding in Delivering Entrepreneurship Within the Hospitality Sector: A Case Study Analysis	Kelly Wang and Kate Johnston	582
The use of Algorithm-Assisted Feeding for Innovation and Increased Productivity in Aquaculture	Knut Ingar Westeren, Morten Helbæk and Øyvind Korsøen	590
Emerging Business Models for Circular Economy: A Systematic Literature Review	Tirufat Woldeyes, Moreno Muffatto and Francesco Ferrati	599
The Impact of Organizational Culture on Business Innovativeness: The Case of SME's	Panagiota Xanthopoulou and Alexandros Sahinidis	608
Assessing the Current State of University-based Business Incubators (UBIS) in Canada and the UAE	Naveed Yasin and Sayed Abdul Majid Gilani	617

Paper Title	Author(s)	Page No
Digital Innovation: The Challenges of a Game-Changer	Antonios Zairis and George Zairis	630
PHD Papers		638
Innovation and Entrepreneurship of Professors in Public Universities: Case Study in Brazil	Paula Geralda Barbosa Coelho and Márcia Siqueira Rapini	639
University Science Parks as an Innovative Tool for University-Business Cooperation	Klaudia Glittová and Miroslav Šipikal	648
Innovative Practices for Pollution Prevention and control Implemented by Companies in Romania	Andreea Maria Gabriela Militaru, Andreea-Mihaela Rotărescu, Bogdan Fleacă and Elena Fleacă	657
Consumer Innovativeness: Cross-Cultural Differences and Influence on Acceptance of Product Service Systems	Anna Németh	665
Born Green: Drivers and Competencies of Green Entrepreneurship	Pedro Pimentel and Maria José Sousa	673
Masters Research Papers		683
The Effect of Entrepreneur's Fear of Failure on Firm's Entrepreneurial Orientation	Merihan Attia and Iman Seoudi	684
Enterpreneurial Strategies for the Female Sector: Leveraging Instagram Sales During the Pandemic	Rafaela Elias, Luciana Reis, Thaise Delfino and June Fernandes	692
A Case Study of the Entrepreneurial Education in a Sino-Foreign University in China	Yimei Mi	701
Work In Progress Papers		708
Effectuation in Practice: How is it Embedded in Innovation-Driven Start-Ups?	Andreas Hinz, Stefan Philippi and Laila Kabous	709
Start-up Incubators for Refugees: How to Develop and Deploy Entrepreneurial Skills to Generate Impact	Andreas Hinz and Claus Daub	713
Linking Effectuation Logic With Business Model Innovation in the Context of Swiss Start-Ups	Laila Kabous, Andreas Hinz and Stefan Philippi	717

Paper Title	Author(s)	Page No
Impact of Collaborative Problem Solving on Youth Social Entrepreneurial Intention	Ronan McArt, Veronica McCauley and Paul Flynn	721
EntreComp and GreenComp for Entrepreneurship: What is the 'Real' Relationship?	Christopher Moon, Andreas Walmsley and Nikolaos Apostolopoulos	726
Exploring Legitimacy in Entrepreneurship Education: Towards a Theoretical Framework	Andreas Walmsley and Birgitte Wraae	733
An Empirical Study of Entrepreneurial Intention and Youth Entrepreneurship Policy in Hong Kong	Jiahao Zhuang, Rui Xiong and Hongyi Sun	737
Late submission		741
Gender Bias in Idea Generation and the Evaluation of Creative Ideas: An Online Behavioural Experiment	Jo'Anne Langham, Caihui (Veronica) Lin, Anna Jenkins, Ivano Bongiovanni, Karolina Mikolajewska-Zajac and Neil Paulsen	742

ECIE Preface

These proceedings represent the work of contributors to the 17th European Conference on Innovation and Entrepreneurship (ECIE 2022), hosted by Neapolis University, Pafos, Cyprus on 15-16 September 2022. The Conference Co-Chairs are Rector, Professor Pantelis Sklias at the Neapolis University Pafos and Assistant Professor Nikolaos Apostolopoulos at the University of Peloponnese and Research Fellow at the Neapolis University Pafos.

ECIE is now a well-established event on the academic research calendar and now in its 17th 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 Paul Jones*, Swansea University, UK speaking on "Entrepreneurial Behaviour and Small Business Management: Post pandemic perspectives". There is an afternoon keynote by *Professor Robert Newbery*, Northumbria University, UK talking about "Reconstructing the Entrepreneurial Landscape". The second day of the conference will open with an address from *Professor Panagiotis Liargovas*, University of Peloponnese, Greece on the topic of "Green Entrepreneurship and Sustainable Development in the Post Pandemic Era: The Case of Greece" and a final keynote will be delivered by *Professor Artur Steiner*, Glasgow Caledonian University, UK with the title "Entrepreneurship and Innovation for Social Purpose: Learning from research, policy and practice".

With an initial submission of 208 abstracts, after the double blind, peer review process there are 76 Academic research papers, 5 PhD research papers, 3 Masters Research papers and 7 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia, Belgium, Brazil, Canada, China, Croatia, Cyprus, Czech Republic, Dubai, Egypt, Estonia, Finland, France, Germany, Greece, Hong Kong, Indonesia, Ireland, Israel, Italy, Latvia, Lithuania, Malaysia, México, Netherlands, Norway, Peru, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Sweden, Switzerland, UK, USA and Vietnam.

We hope you enjoy the conference.

Pantelis Sklias and Nikolaos Apostolopoulos,
Neapolis University, Pafos
Cyprus
September 2022

ECIE 2022 Conference Committee

Iiris Aaltio, University of Jyväskylä, Finland: Nasser Abouzakhar, Anzar Property Group, Manchester, UK: Prof Dr Zafer Acar, Piri Reis University, Istanbul, Turkey: Prof Małgorzata Adamska, Opole University of Technology, Poland: Dr Emma Agusita, UWE Bristol, UK: Dr Hamid Alalwany, Ithmaar Group/ UQ University/ Brunell University, UK: Dr Laurice Alexandre Leclaire, Sorbonne Paris Cité University, France: Dr Jose Alvarez-Garcia, University of Extremadura, Spain: Dr Fabrizio Amarilli, Politecnico di Milano, Italy: Walmsley Andreas , Plymouth Marjon, UK: Dr Rumen Andreev, Bulgarian Academy of Sciences, Sofia, Bulgaria: Dr Christos Apostolakis, Bournemouth University, UK: Prof Lina Artemenko, National technical university of Ukraine "Igor Sikorsky Kyiv Politechnical University"", Ukraine: Dr Manuel Au-Yong-Oliveira, GOVCOPP, Dept of Economics, Management, Industrial Engineering & Tourism, University of Aveiro., Portugal: Dr Daniel Badulescu, University of Oradea, Romania: Prof Alina Badulescu, University of Oradea, Romania: Dr S.R. Balasundaram, National Institute of Technology, Tiruchirappalli, India: Dr Ivana Barišić, Faculty of Economics & Business, University of Zagreb, Croatia: Dr Paulo Bento, CEMRI, Open University of Lisbon, Portugal: Prof Cristin Bigan, Ecological University of Bucharest, Romania: Tiina Brandt, Haaga-Helia UAS, Helsinki, Finland: Fraser Bruce, University of Dundee, UK: Dr Acma Bulent, Anadolu University, Turkey: Oscarina Conceição, Polytechnic Institute of Cavado and Ave, Barcelos, Portugal: Dr Elizabeth Conradie, Central University of Technology, Free State, South Africa: Prof Teresa Costa, Instituto Polit cino de Set bal | Escola Superior de Ci ncias Empresariais, Portugal: Assistent Professor Cosmulese Cristina Gabriela, “Stefan cel Mare” University of Suceava, Romania: Prof Ana Daniel, Universidade de Aveiro, Portugal: Prof Armando Carlos de Pina Filho, Federal University of Rio de Janeiro, Brazil: António de Sousa Rocha, University of Minho, Minho, Portugal: Dr María de la Cruz del Río-Rama, University of Vigo, Ourense (Spain), Spain: Prof Laura Diaconu Maxim, Faculty of Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania: Prof Anca Otilia DODESCU, University of Oradea, România: Dr Karolina Drela, University of Szczecin, Poland: Dr Ramadan Elaiess, University of Benghazi, Libya: Dr Scott Erickson, Ithaca College, USA: Dr Mercy Escalante Ludena, USP, Brazil: Prof Luis Fé De Pinho, Universidade Lusíada de Lisboa, Portugal: Prof Elisabete G. S. Félix, University of Évora, Portugal: Francesco Ferrati, University of Padova, Department of Industrial Engineering, Italy: Prof João Ferreira, University of Beira Interior, Covilhã, Portugal: Prof Maria Joao Ferreira, Departamento de inovação, Ciência e Tecnologia, Portugal: Dr Pedro Ferreira, REMIT, University Portucalense, Portugal: Fátima Ferreiro, nstituto Universitário de Lisboa, Portugal: Dr Silvia Florea, Lucian Blaga University of Sibiu, Romania: Dr Heather Fulford, Aberdeen Business School, UK: Dr Dale Heywood, University of Liverpool, UK: Prof Dr Ramaswamy Ganesan, National Foundation for Entrepreneurship Development, India: Dr Mario Gomez Aguirre, Universidad Michoacana de San Nicolas de Hidalgo, Mexico: Iwona Gorzeń-Mitka, Czestochowa University of Technology, Poland: Prof Ken Grant, Ryerson University, Toronto, Canada: Dr Jennifer Harrison, Southern Cross University, Australia: Dr Mahmoud Hassanin , Ahram Canadian University , Egypt: John Howard, Public Health and Clinical Sciences, UK: Dr Magdalena Jurczyk-Bunkowska, Opole University of Technology, Poland: Prof Maria do Rosário Justino, Lisbon Accounting and Business School, Portugal: Dr Nowshade Kabir, Trouvus, Canada: Dr Alexandros Kakouris, University of Peloponnese, Greece: Dr Paul Kamal Chandra, University Putra Malaysia(UPM), Malaysia: Dr Yusniza Kamarulzaman, University of Malaya, Kuala Lumpur, Malaysia: Dr Monika Klimontowicz, University of Economics in Katowice, Poland: Prof Jesuk Ko, Universidad Mayor de San Andres, Bolivia: Dr Marko Kolakovic, Faculty of Economics & Business, Croatia: Dr Sam Kongwa, Walter Sisulu University, Mthatha, South Africa: Dr Ilker Kose, Istanbul Medipol UNiversity, Turkey: Dr Konstadinos Kutsikos, Business School, University of the Aegean, Greece: Dr Stefan Lagrosen, Linnaeus University, Sweden: Sharifa Latter, University of Dundee, UK: Dr Jonathan Lean, University of Plymouth Business School, UK: Kiefer Lee, Sheffield Hallam University, UK: Eng. Ph.D. Anna Lemańska-Majdzik, Czestochowa University of Technology, Faculty of Management, Poland: Dr Margaret Mangion, Edward de Bono Institute for Creative Thinking and Innovation, University of Malta, Malta: Dr Agnieszka Malkowska, Faculty of Management and Economics of Services of the

University of Szczecin, Poland: Prof Stelios Marneros, European University Cyprus, Nicosia, Cyprus: Dr Renetchie Martinez, Department of Education, Philippines: Prof Ana Martins, University of KwaZulu-Natal, South Africa: Prof Isabel Martins, University of KwaZulu-Natal, Portugal: Florinda Matos, University of Lisbon, Portugal: Dr Stephanos Mavromoustakos, University of Windsor, Canada: Philip McClenaghan, Augsburg University of Applied Sciences, Germany: Dr Clemente Minonne, Institute for Innovation and Technology Management, Switzerland: Dr Christopher J Moon, Middlesex University, UK: Dr Fernando Moreira, IJP, REMIT, University Portucalense, IEETA, University of Aveiro, Porugal: Dr Rabeh Morrar, An-najah National University, Palestine: Dr Ana Novak, Faculty of Economics & Business, University of Zagreb, Croatia: Dr Melao Nuno, Polythecnic Institute of Viseu, Portugal: Dr Maria Obeso, University of Cantabria, Spain: Dr Małgorzata Okręglicka, Czestochowa University of Technology, Poland: Prof Pedro Oliveira, Polytechnic Institute of Santarém, Portugal: Dr Jane Queen Omenga, Jomo Kenyatta University of Agriculture and Technology, Kenya: Prof Dr Elisabeth T. Pereira, University of Aveiro, Portugal: Prof Maryna Pichugina, National Technical University of Ukraine, Ukraine: Sara Proença, CERNAS, ESAC/Polytechnic Institute of Coimbra, Coimbra, Portugal,: Dr Aneta Ptak-Chmielewska, Warsaw School of Economics, Poland: Prof Maurizio Rija, University of Calabria, Italy: Prof Cristina Rodrigues, University of Minho, Portugal: Prof Ricardo Rodrigues, NECE / University of Beira Interior, Portugal: Prof Susana Rodrigues, Polytechnic of Leiria, Portugal: Fernando Romero, University of Minho, Portugal: Álvaro Rosa, ISCTE Business School, Portugal: Dr Joanna Rosak-Szyrocka, Częstochowa University of Technology , Poland: Dr Navjot Sandhu, Birmingham City University, UK: Juha Saukkonen, JAMK University of Applied Sciences, Jyväskylä, Finalnd: Dr Ousanee Sawagvudcharee, Liverpool John Moores University, Thailand: Prof Dr Cezar Scarlat, University "Politehnica" of Bucharest, Romania: Dr Ana María Serrano-Bedia, University of Cantabria, Spain: Dr Kamran Siddiqui, Imam Abdulrahman Bin Faisal University, Saudi Arabia: Dr Zdenek Smutny, University of Economics, Prague, Czech Republic: Assoc Prof Shahryar Sorooshian, University of Gothenburg, Sweden: Cristina Sousa, ISCTE-IUL, Portugal: Prof Manuel Sousa Pereira, IPVC, Portugal: Dr Marzena Starnawska, University of Warsaw, Poland: Prof Dr Rolandas Strazdas, Vilnius Gediminas Technical University, Lithuania: Christy Suciu, Boise State University, USA: Dr Mangaleswaran Thampoe , Vauniya Campus of the University of Jaffna, Sri Lanka: Dr Stephen Treacy, University College Cork, Ireland: Dr Anna Ujwary-Gil, Institute of Economics, Polish Academy of Sciences, Warsaw, Poland: Dr Maria Urbaniec, Cracow University of Economics, Poland: Dr Younos Vaki Alroaia, Islamic Azad University, Iran: Dr Thea van der Westhuizen, University of KwaZulu-Natal, South Africa: Prof Filipa Vieira, University of Minho, Portugal: Dr Marcia Villasana, Tecnologico de Monterrey, Mexico: Bernard Vollmar, Carl von Ossietzky Universität Oldenburg, Germany: Dr Mukesh Yadav , SIRT, SAGE University Indore, India: Asst Prof Nurul Mohammad Zayed, Daffodil International University, Bangladesh: Dr Krzysztof Zieba, Gdansk University of Technology, Poland: Dr Justyna Żywiołek, Faculty of Management, Poland.

Biographies

Conference and Programme Chairs



Pantelis Sklias is a Professor of International Relations and International Political Economy (IPE) and since September 2018 Rector of the Neapolis University Pafos. He served (2016-2018) as a member of the Board of the Cyprus Agency of Quality Assurance and Accreditation in Higher Education (DI.P.A.E.). In the academic year 2017-2018, he was the Dean of the School of Security and Global Studies at the American University in the Emirates in Dubai. From February 2020 onwards, he has been appointed President of the Rectors' Conference for Cypriot Universities.



Nikolaos Apostolopoulos, PhD, is an Assistant Professor in European Policies in Sustainability and Entrepreneurship at the University of Peloponnese and visiting fellow at the Neapolis University Pafos. He also acts as scientific advisor at the Labour Institute of General Confederation of Labour (INE/GSEE) in Greece. He is co-editor of the edited volumes entitled: "Universities and Entrepreneurship: Meeting the Educational and Social Challenges", "Entrepreneurship and the Sustainable Development Goals and Entrepreneurship", "Institutional Framework and Support Mechanisms in the EU".

Keynote Speakers



Paul Jones is Professor of Entrepreneurship and Innovation at Swansea University. Professor Jones is an active researcher in the entrepreneurship discipline with over 260 research outputs including edited books, academic journals, book chapters and conference papers. Professor Jones has published research in information communication technology, entrepreneurship and small business management and entrepreneurship education. Professor Jones is Editor in Chief of the International Journal of Entrepreneurial Behaviour and Research and Associate Editor of the International Journal of Management Education. Professor Jones is a visiting Professor at Coventry University, Anglia Ruskin University, Manchester Metropolitan University and the University of South Wales. He is a Senior Fellow of the Higher Education Academy.



Panagiotis Liargovas professor of economics, University of Peloponnese. PhD in Economics from Clark University, Worcester MA, and been Fulbright Scholar, Bakalas Foundation Scholar, Teaching Assistant Scholar (Clark University) and European Commission trainee (Brussels). Former Head of Parliamentary Budget Office at Hellenic Parliament. Currently director of Jean Monnet Centre of Excellence, University of Peloponnese. Founded "Sustainable Development and Entrepreneurship Laboratory" , Faculty of Economics. Authored a series of articles and books regarding the European integration and the role of Greece.



Robert Newbery is a Professor of Entrepreneurship and Head of the Entrepreneurship, Innovation and Strategy department at Newcastle Business School, Northumbria University. He has worked extensively in Asia, Africa, Europe and North America and has founded and run a number of entrepreneurial businesses having a PhD, MSc, MBA and BSc. He is co-editor of the International Journal of Entrepreneurial Behaviour and Research, the only Entrepreneurship journal to be promoted

in the recent CABS ABS journal review (2* to 3*). He is currently conducting research into the entrepreneurial experiences of people operating in 'peripheral' communities. As such, he has recently conducted research on the livelihoods of artists operating in the creative and cultural sector of East Africa (working with visual artists, writers and curators to identify the intersections between entrepreneurship and arts practice).



Artur Steiner is a Professor in Social Entrepreneurship and Community Development. He leads the Community, Citizenship and Participation Research Group at the Yunus Centre, Glasgow Caledonian University. His research is about community disadvantage and actions to ameliorate isolation and, through entrepreneurship, co-production and participation, raise resilience and empowerment. Artur's work is concerned with evidencing how, through social innovation, entities, policies and interventions tackle social inequalities and vulnerability including geographical disadvantage and frailty of specific groups in the society. His research outputs span multiple disciplines, chiefly entrepreneurship, rural development, public policy and health-related social sciences. Currently, Artur is a member of the Editorial Board of Entrepreneurship & Regional Development, Journal of Social Entrepreneurship and the Social Enterprise Journal.

Mini-Track Chairs



Nasser Abouzakhar is the director of Anzar Property Investment Limited, founded in 2017 and author of the book Real Estate Investment: In the pursuit of building income-producing assets to grow your wealth. Between 2004 and 2019, he worked at different universities in the UK as an academic, teaching and researching different technology-related subjects. He has a good understanding of the property investment business and finances. Nasser has firm relationships with professionals in banking, legal, accounting, and valuation which assist with his responsibility as the company director. He leads a highly professional and experienced property management team.



Sofia Daskou, PhD is an Associate Professor in Business and Customer Management, at Neapolis University Pafos. She holds a PhD awarded from the University of Strathclyde and has served as a scholar in various UK universities for 20 years. She the President of the International Advisory Council for the Marketing Profession (IACMP). Her research focuses on entrepreneurial thinking, digital relationship marketing & CRM, and various consumer issues, such as: customer satisfaction & loyalty, disordered eating, mindful and ethical consumption. She is the editorial board of International Journal of Economics and Business Research.



Mitt Nowshade Kabir is a serial entrepreneur, technology evangelist, business accelerator and an investor. He holds M. Sc. in Computer Science, MBA, PhD in Information Technology, and a DBA in management. His current interests are Innovation, Artificial Intelligence, Machine Learning, Consciousness, Entrepreneurship, and Strategic Management. He is the CEO of Trouvus.com, an AI consulting and development company. Dr Kabir penned numerous scholarly papers and generic articles. He also published a book on Knowledge-based Social Entrepreneurship. He worked as an advisor to various levels of government. Presently, he is writing a book on "AI and the future of humanity".



Alexandros Kakouris, PhD, PhD, is an Assistant Professor in entrepreneurial learning and education at the Departmnt of Management Science and Technology of the University of Peloponnese and at the Hellenic Open University. He holds PhD in Physics, PhD in Entrepreneurship and a MSc in Adult Education. His special interests concern: fostering entrepreneurship and innovation to science graduates, context-aware entrepreneurship, support of youth entrepreneurship through teaching and counselling as well as nascent entrepreneurship, transformative and experiential learning.



Andreas Masouras, PhD, is an Assistant Professor at Neapolis University in Marketing and Communication. He holds a PhD (Honors) from the Dept of Political Science and International Relations, University of the Peloponnese. The title of his doctoral dissertation is: "Entrepreneurship and Competitiveness through the lens of the Institutional Analysis: The Case of Cyprus". He holds a Professional Doctorate in Management (D.Mgt.) from Monarch Business School (Switzerland) and MPhil from Brighton University. Dr Masouras is actively writeing scientific articles and is constantly involved in international conferences where he presents his research.



Christos Papademetriou, PhD is an Assistant Professor in Management - Human Resources Management at the Neapolis University Pafos. He obtained a BA (Hons) in Accounting and Business and MA in International Management from the University of Sunderland. He also gained a BSc (Hons) in Computing and the Postgrad Certificate in Information Systems from the University of Portsmouth. He holds a doctorate (PhD) in Social Science from the University of Leicester, UK. His research interests focus on the following: entrepreneurship and innovation, human resource management, tourism management and marketing, social media, and leadership.



Andreas Walmsley, PhD, is Associate Professor in Business at Plymouth Marjon University. He conducts research in entrepreneurship, especially entrepreneurship education, graduate entrepreneurship and responsible entrepreneurship. He is on the editorial boards of the journals Entrepreneurship Education and Pedagogy and the International Journal of Entrepreneurial Behaviour and Research.



Birgitte Wraae, PhD, is an Associate Professor in Entrepreneurship at the Faculty of Business and Technology and the Department of Applied Business Research at UCL University College Denmark. Her research interests are in entrepreneurship, especially entrepreneurship education: identity formation, emancipation, and employability. She excels in doing research in connection with the entrepreneurial learning space. She has recently published a book on the entrepreneurial learning journey.



Antonis Zairis, PhD is an Assistant Professor of Business Administration at Neapolis University, Cyprus as well as Associate Vice President of the Board of Directors of The Association of Business and Retail Sales of Greece (H.R.B.A). His doctoral dissertation was on Consumer Behavior, specializing in Retail Trade. He has served for 32 years as Managing Director of Sales and Marketing in various Multinational Companies and Large Greek Enterprises. He also served as Deputy

National Representative at the UN Intergovernmental Expert Committee on Sustainable Development . He is also author of 27 books in business and marketing topics.”.

Workshop Facilitators



Rajiv Vaid Basaiawmoit, Ph.D., MBA, is the Head of Sci-Tech Innovation & Entrepreneurship at Aarhus University, Denmark. He is an award-winning Entrepreneurship Educator and works at the intersection between innovation, entrepreneurship, interdisciplinary-collaboration and gamification. He designs and embeds Entrepreneurship into curricular education. He is an invited speaker at many conferences and events around the globe and he has spoken on various well-known platforms such as TEDx, ECS and NATO-CoE.

Biographies of Contributing Authors

Nasser Abouzakhar Director of Anzar Property Investment Limited founded 2017. Author of Real Estate Investment: In the pursuit of building income-producing assets to grow your wealth. Award-winning author & regular guest on BBC Arabic TV channel. 2004-2019, worked at different universities in UK as academic, teaching & researching different technology-related subjects. Good understanding of property investment business & finances. Firm relationships with professionals in banking, legal, accounting, and valuation all assisting responsibility as company director. Leads highly professional/experienced property management team.

Susana Amante is an associate professor at the School of Technology and Management of the Polytechnic Institute of Viseu (IPV). She holds a PhD in English Philology from the University of Salamanca, and she was awarded the "Doctor Europaeus" Mention, as part of the joint supervision programme with the University of Coimbra (2011). She is PI of the 'Learning based on co-creation processes' project at IPV, and her research areas focus on Literatures and Cultures, Gender Studies, Language Didactics, Translation, and Languages, Innovation and Entrepreneurship.

Dwitya Amry is a doctoral researcher at University of Warwick, UK. Her research looks at student start-ups as a university technology transfer mechanism for societal impact. She has been teaching entrepreneurship, business and management since 2010 in Indonesia prior to pursuing her doctoral degree. Her other research interest includes social entrepreneurship and entrepreneurship education.

Jesús Julio Antaurco-Perez, studied International Business and Administration at the Universidad Privada del Norte, Peru, Logistical Developer of the cargo agency EUROPARTNERS PERU; with experience providing technical assistance to micro-enterprises in matters of management, logistics and entrepreneurship.

Sotiris Apostolopoulos PhD candidate at University of Peloponnese in Department of Accounting & Finance. PhD work and research interests focus on healthcare and entrepreneurship in disadvantaged areas. Background in health economics and business administration. Acts as a Chief Operating Officer (COO) of largest private general health clinic of Peloponnese Region in Greece. Research articles published in major journals focusing on public health policies, rural development and European financing tools in health sector have been published in major scientific journals.

Merihan Attia is an assistant lecturer in universities in Canada in Egypt. She got her MSc in Management major in entrepreneurship from the German University in Cairo in 2022. She graduated with triple majors if finance, innovation, and strategic management. She mainly focuses on how to help business founders and their SMEs perform better.

Edward Bace is a lecturer/trainer, long experienced in financial risk analysis, from banking and lecturing. He has published extensively, presenting at conferences worldwide. He has a PGCE and is a SFHEA. He has an MBA from NYU and a PhD from The University of Michigan. He is a CFA, Chartered MCSI, and member of PRMIA.

Raphael Bar-El is Professor Emeritus at Ben Gurion University and faculty member of the of the Applied Economics Department at the Sapir Academic College. He specializes in regional economic development and innovation policy, with extensive experience in Israel, Brazil, Ethiopia and other countries. Was head of the Economic Planning Authority in Israel.

Daniel Berliner is a PhD Research Fellow at the School of Business and Law, University of Agder, Norway. He studies investors' decision-making criteria within the entrepreneurial finance domain. He has presented his papers at several international conferences and co-authored a book chapter in Advances in Crowdfunding: Research and Practice.

Lukáš Blažek PhD from the University of Economics in Prague. Practice: operates in the financial sector, corporate finance, investment and business development support. Academic activity: University of Finance and Administration - Department of Economics and Management Focus on: strategic business management, change and innovation management, circular and shared economy issues, industry 4.0

Claudio Bonvino is a PhD Student of Management Engineering at Politecnico di Milano, Italy. His main research areas encompass finance, management and strategy and relate to data for start-ups and incumbents, valuation and access to the FinTech and InsurTech industry.

Tiina Brandt is a Dr., docent and researcher at Haaga-Helia University of Applied Sciences. She received his PhD of Management at 2005 and she has published over 140 papers of the areas of leadership, teams, personality and entrepreneurship. She is interested of international cooperation especially in field of entrepreneurship and leadership both in research and development projects (e.g Horizon, Erasmus+).

Fraser Bruce Senior design academic at University of Dundee with 20 + years of teaching, research and consultancy experience. Currently Programme Director for MSc Product Design course where he delivers specialist lectures and workshops on design thinking, service design and innovation. Research interests lie in integration of biomimetic design with practice of product design and innovation management. Conducted research that explores the impact of digital technologies and the use of big data in the creative industries.

Anthony Buckley is the Assistant head, School of Marketing at the Technological University Dublin, Ireland. He holds a PhD in management from Lancaster University. In addition to his published journal articles in the enterprise domain, he is also the co-Author of the recently published book 'Digital Entrepreneurship – Disruption & New Venture Creation' (Edward Elgar, 2022).

Martin Cepel, Ph.D., MBA, DBA is an Assistant Professor at the University of Entrepreneurship and Law in Prague, Czech Republic and at the Faculty of Economics and Business, Pan-European University in Bratislava, Slovakia. His research and research activities focus on Entrepreneurship, Entrepreneurial Economics, Financial Risk Management, Business Administration and Marketing. He is the author of many scientific articles in international journals and proceedings of international scientific conferences indexed in Web of Science and Scopus.

Paula Coelho is a PhD candidate in technological innovation at UFMG, Brazil. Her main research areas are academic entrepreneurship with wealth creation and open innovation.

Teresa Costa has a PhD in management, having completed her post-doctorate at the University of São Paulo. She is member of the CITUR Research Center, professor at School of Business Sciences, Polytechnic Institute of Setúbal, author of book chapters and articles, researcher of projects funded by FCT and EU, editor-in-chief of ETHR. ORCIDiD: https://orcid.org/0000-0001-5252-121X

Alexandra Maria da Silva Braga. pHD in Management, University of Beira Interior; Master and graduated in Management in UTAD. Lecturer (assistant professor) at School of Technology and Management. Director of the graduation in Business Sciences and member of CIICESI. As researcher has several publications in the area of innovation. Topics of interest: innovation, social innovation, knowledge, decision making, internationalization, strategy and sustainability.

Gareth Davies: Professor in Swansea University's School of Management, with research interests in innovation management and regional economic development. Alongside his academic role, he has practitioner interests, including recently with the Swansea Bay City Region Internet Coast City Deal, the AgorIP/Accelerate initiatives, and the RE&I workstream of the ARCH (A Regional Collaboration for Health).

Thaise Daiara Delfino is Master's degree student in Production Engineering at the Federal University of Ouro Preto, Brazil. She is gratuated in Information Systems from the University of Ouro Preto, Brazil. She is a digital media professional at the Bio Extratus Natural Cosmetics.

Christin Eckerle Since 2020 is a research associate and PhD student at the Institute for Entrepreneurship, Technology Management and Innovation. She studied Political and Administrative Science at the University of Konstanz. Before joining EnTechnon, she worked as a project manager at CyberForum e.V. In addition, she worked as a business development manager until May 2021. (55 words)

Tiit Elenurm is the entrepreneurship professor at the Estonian Business School, business angel and mentor for start-up entrepreneurs. Ph. D. in 1980 for the dissertation "Management of the Process of Implementation of New Organizational Structures". Author of more than 130 research publications. Research interests include knowledge management, innovative entrepreneurship and social media for networking.

Ingunn Elvekrok is a professor in organisation, leadership, and innovation at Kristiania University College and adjunct professor at the University of South-Eastern Norway. Her main research interests are networks, innovation, and strategic management. She has published in journals such as Tourism Management and Regional Studies.

Alessandro Faes Graduate in Economics and Social Sciences at Bocconi University, Alessandro Faes is currently a PhD candidate in Management Engineering and has been a researcher at the Fintech & Insurtech Observatory of Politecnico di Milano for 3 years, focusing on broadened competition in financial services, Open Finance and sustainability in finance.

June Fernandes holds PhD in Business Administration from Getúlio Vargas Foundation (Brazil), and a postdoctoral in HEC Montréal. He is Adjunct Professor at the Department of

Production Engineering from Federal University of Ouro Preto (Brazil). His main research areas are lean healthcare, Toyota Kata, lean methodology, lean management, 4.0 industry, startups and innovation management.

Rosina Fernandes is an associate professor of psychology at the Polytechnic Institute of Viseu (IPV), Portugal. She received her PhD in psychology from Coimbra University in 2013. She is the coordinator of Link Me Up – 1000 ideias Project, focused on innovation and entrepreneurship in higher education students. Her main research areas are psychology, well-being, career counselling and social intervention.

Marisa R. Ferreira PhD in Business Sciences – Marketing and Strategy specialization. Lecturer (associate professor) at Instituto Politécnico do Porto - Escola Superior de Tecnologia e Gestão. Vice director of the research center CIICESI.Topics of interest: marketing, social marketing, corporate social responsibility, sustainability, nonprofit sector, social innovation.

Gabriele Gaffuri is an Innovation Consultant for Zabala Innovation Europe, specialised in the preparation and management of R&D EU funded projects. He is part of the DigiFed consortium, with the role of monitoring the implementation of the selected Application Experiments and the cascade funding activities.

Liudmila Gapeyeva-Yukce is a research associate and a Ph.D. student at the Department of Strategic Management of the Martin Luther University Halle-Wittenberg, Germany. She received her Master degree in Business administration from Jönköping International Business School in Sweden. Her research interests are stress in new ventures, entrepreneurship development in transition economies, corporate environmentalism.

Klaudia Glittová is a PhD student within the University of Economics in Bratislava, especially on Department on Public Administration and Regional Development since 2020. She is particularly interested in innovation and innovative collaboration between universities and enterprises. Her dissertation thesis is concerned with the support of research infrastructures in V4 countries.

Iñigo González is an innovation and project consultant at Zabala Innovation Consulting Brussels where he is part of the EU proposals team. He directly supports the implementation of the cascade funding DigiFed project, and he is one of the coordinators of the EC funded ETIP SNET platform for the European green transition.

Ken Grant, Dr. Department of Entrepreneurship & Strategy in the Ted Rogers School of Business Management at Toronto Metropolitan University (formerly Ryerson University), is a passionate teacher and coach, committed to improving the educational experience of his students and of other young entrepreneurs. He was the first Ted Rogers Faculty Teaching Chair.

Jurry Hatammimi is an assistant professor of entrepreneurship at Telkom University, Indonesia. He received his PhD in management from University of Hull in 2020. He is a head of Startup and Small Business Development interest group at School of Economics and Business. His main research areas are entrepreneurship, creative economy, and MSMEs.

Fabian Hecklau, M. Sc., studied industrial engineering (Otto-von-Guericke University Magdeburg) and started working in applied research (Fraunhofer IFF in Magdeburg). Since 2015, works for Fraunhofer IPK (Berlin) Involved in international research and consulting projects in the strategic management of organizations and innovation institutions. Head of the Competence Center Innovation Systems & Structures at Fraunhofer IPK since 2020.

Anton Herutomo is a social innovator and entrepreneur in information technology sector with more than 20 years of experience. He has been spending his career time in tech positions and blended with entrepreneurial leadership in various vertical startups. He currently undertakes doctoral research at School of Business and Management, Institut Teknologi Bandung, Indonesia.

Andreas Hinz is lecturer and researcher at the Institute of Management, FHNW School of Business. His entrepreneurship research focuses on start-up behaviour, sustainable business models and start-up incubator programmes for refugees. Andreas teaches (digital) entrepreneurship, innovation, management and economics in undergraduate and MBA programmes in Switzerland as well as Asia.

Tom James: Head of Healthcare Innovation and Technology for the Welsh Government since 2014. HE is responsible for Welsh health & care innovation policy, the development of the Health chapter of the Integrated Innovation strategy for Wales and manages funding for a broad range of local, regional and national innovation projects.

Sanna Joensuu-Salo is Principle Lecturer at Seinäjoki University of Applied Sciences, Finland. She works also as adjunct professor at LUT University. Dr. Joensuu-Salo has 20 years of work experience in higher education, teaching and research in the field of entrepreneurship. Her research areas are entrepreneurship education, digitalization-driven firm growth, hybrid entrepreneurship and business transfers.

Kate Johnston is a Lecturer at Dundalk Institute of Technology. Her teaching and research interests in the areas of financial management, innovation and entrepreneurship. Kate is widely published and currently supervises a number of postgraduate students in the area of crowdfunding, entrepreneurship, intrapreneurship and economic development.

Katherine Merly Julca-Carrasco studied Administration and Marketing degree from the Universidad Privada del Norte, Peru, a member of the UPN Research Seedbed, a participant in CADE Universitario 2021. She has worked in organizations that provide advice to small businesses

Laila Kabous is lecturer and researcher at the Institute of Management, FHNW School of Business. Her entrepreneurship research focuses on start-up behaviour, business model innovation and entrepreneurial behaviour. Laila Kabous teaches entrepreneurship, innovation, and marketing in undergraduate and postgraduate programmes in Switzerland.

Alexandros Kakouris is Assistant Professor in entrepreneurial learning and education, Department of Management Science and Technology, University of Peloponnese and tutor at the Hellenic Open University. He holds PhD in Physics, PhD in Entrepreneurship and a MSc in Adult Education. His special interests concern: context-aware entrepreneurship, support of youth entrepreneurship, transformative and experiential learning.

Dmitry Kotchekov is a Candidate of Sciences in economics and MBA. Now, Dmitry is an external PhD researcher at the Center for Science and Technology Studies of Leiden University (Netherlands) and senior researcher at Ural Federal University (Russia). His research interests include scientometrics, knowledge economy, higher education research, and innovation policies.

Stefan Lagrosen is a professor of business administration at Linnaeus University, Sweden. His research mainly concerns quality management, particularly in schools and healthcare as well as work-related health. He has published widely in those areas. In addition, he is an experienced educator, teaching on all levels.

vonne Lagrosen holds a PhD in quality management from Chalmers University of Technology in 2006. She is currently active as an associate professor of quality management at Mälardalen University, Sweden. Her main research interests are organizational learning and quality management – both values and practices related to health and fitness, education, creativity and brain functioning.

JoAnne Yong-Kwan Lim is currently a Senior Lecturer at the Singapore University of Social Sciences (SUSS). She has taught in the United States and France. She has published in Entrepreneurship Theory and Practice, Journal of Small Business Management, Information and Organization and Sex Roles: Journal of Research, Team Performance Management and has papers accepted at reputable conferences including ICIS, AOM, PACIS and JAIS Theory Development Workshop.

Manuel Lopes Nunes is Assistant Professor at the Department of Production and Systems, University of Minho. He is researcher at the ALGORITMI Research Center, in the Industrial Engineering and Management (IEM) research group, with interests in the fields of: Product Innovation; Marketing and Productivity; Cost Systems; Thermo-Economic Optimization; Time-to-market of New Products; Sustainability; Entrepreneurship.https://orcid.org/0000-0003-1313-2523

Nadine Lybaert is Full Professor of Accountancy at Hasselt University, Belgium (Faculty of Business Economics). There, she is associated with the Research Center for Entrepreneurship and Family Firms. As such, her research interests are situated at the intersection of accountancy and private (family) firms. She is also guest professor at the University of Antwerp (Belgium).

Matthew Lynch is an Associate Professor at the Norwegian University of Life Sciences. He teaches on the Innovation and Entrepreneurship Masters. His research interests relate to entrepreneurial mindset, design thinking, systems thinking and how these themes are interconnected to help prepare students to flourish in a rapidly changing world.

Sarah Manthey is a research assistant and PhD student at the Institute for Entrepreneurship, Technology Management and Innovation since 2019. She studied Integrative Social Science at the University of Kaiserslautern. After graduating, she worked in sales at a spin-off of the DFKI. In addition, she worked as a business development manager until May 2021. (54 words)

Antonieta Martínez-Velasco is a professor and researcher at Engineering School at the Universidad Panamericana. She received her Ph.D. in engineering from Universidad Panamericana. Her main research areas are data analytics and Artificial Intelligence, and Machine learning techniques applied to social and health sciences.

Margaret Mastropetrou studied in Athens University of Economics and Business in the Economics department, completed her MBA in the University of the Aegean and currently continues with her PhD on business ecosystems. Furthermore, she joined WAVE lab, where academics, business executives and partner organizations, challenge each other in identifying and exploiting disruptions, and turning them into growth options for organizations.

Ronan McArt is a lecturer in Marketing, Management & Entrepreneurship in the School of Home Economics at St Angela's College, Sligo. Ronan is currently a part-time PhD student in the School of Education in the National University of Ireland, Galway. Research interests include Entrepreneurship, Social Entrepreneurship, Entrepreneurial Self-Efficacy, Entrepreneurial Intention and Entrepreneurship Education.

Stephan Meyer studied business psychology at RWTH Aachen University, Germany. He received his PhD in business administration on the topic of change management from the University of Gloucestershire, UK. Dr Stephan Meyer believes in radical progress through radical change. He advises companies on digital transformation. His clients include Novartis, Zurich, PWC, Daimler and Volkswagen

Yimei Mi is a Chinese student with two master's degrees of language education and global education. She graduated from University of East Anglia and the University of Liverpool with distinction. She is a researcher and her main research areas are second language education, intercultural communication competence, comparative studies, and higher education.

Andreea Maria Gabriela Militaru PhD student in the second year at University Politehnica of Bucharest, Faculty of Entrepreneurship, Engineering and Business Management (FAIMA). Graduated the master program in 2019 at the same university. I currently am a teaching assistant in FAIMA and a part-time employee at the ERASMUS+ Office in charge with counselling incoming and outgoing students.

Chris Moon is a fellow of Enterprise Educators UK, lead judge of the international Innovation and Entrepreneurship Teaching Excellence Awards, judge of the UK's National Enterprise Educator Awards, judge of the F Factor competition, judge of the global Green Stories competition, Research and Dissemination lead for Enactus UK, and a multiple award winning eco and social entrepreneur. He is visiting Professor at University of Paphos with a PhD from Imperial College and over 100 publications including co-editor of the 2021 book Universities and Entrepreneurship.

Soebowo Musa Assistant professor , strategic management and Head of Graduate School of Business MBA Program, Swiss German University, Indonesia. PhD in Strategic Management from University of Indonesia; MBA in Finance and International Business from Stern School of Business, New York University ; BS and MS in Electrical Engineering from Tandon School of Engineering, New York University. Authored several books in corporate finance and banking.

Speaker in several management conferences. Researches strategy, strategic leadership, organizational capabilities, innovation, digital transformation, entrepreneurship and M&A.

Anna Németh is a PhD candidate at the Masaryk University, Brno, Czech Republic. Her dissertation focuses on cross-cultural consumer behaviour in circular economy. She received her master degree in Economics and currently getting her BA in Psychology. She is interested in consumer behaviour research, psychology, culture and innovation.

Thao K. Nguyen is a lecturer of international business management at the University of Economics Ho Chi Minh City, Vietnam. She received her doctoral degree in International Business from the Victoria University of Wellington, New Zealand, in 2017. Her research interests are global value chain, strategic entrepreneurship, and social innovation. She is interested in investigating the inter-organizational relationships between firms to internationalize their business or promote social innovation.

Ana Novak is an associate professor of accounting at Faculty of Economics and Business, University of Zagreb, Croatia. She received Ph.D. in accounting from Faculty of Economics and Business, University of Zagreb in 2012. She is (co)author of several scientific and professional papers. Her research interests are accounting, accounting information systems, and accounting education.

Sandra Nunes holds a PhD in Mathematics, with a Specialization in Statistics from FCT/UNL. She is member of the Center for Mathematics and Applications (CMA/FCT/UNL), Coordinator Professor at School of Business Sciences, Polytechnic Institute of Setúbal, author of book chapters and articles, researcher of projects funded by FCT. ORCIDiD: https://orcid.org/0000-0002-0123-5771

Mirhiga Peter Okuwhere is a PhD student at Coventry University in the United Kingdom. He earned a Master of Science from Bournemouth University, Dorset, United Kingdom. Mirhiga also holds a diploma in Accounting, Bachelor of Science in Business Administration and Master of Business Administration from the University of Benin, Benin City, Nigeria. He can be contacted through omomirhiga@gmail.com

Joe Pearce is the Head of Business Support at SETsquared Exeter and the University of Exeter, with a focus on building the community of businesses which exist in and around the Innovation Centre. Working closely with the client businesses Joe addresses issues arising as well as supporting the growth and development of clients.

Tor Helge Pedersen is an associate professor at Inland Business School, at Inland University College of Applied Sciences, Lillehammer, Norway. He received his PhD in political science from University of Tromsø in 2009. His main research areas are within public administration, organization and innovation.

Stefan Philippi is lecturer and researcher at the Institute of Management, FHNW School of Business. He is also head business office of the Swiss Innovation Challenge and coached and supervised numerous start-ups. His entrepreneurship research focuses on start-up/entrepreneurial behaviour and business model innovation. Stefan teaches

entrepreneurship and innovation in undergraduate and postgraduate programmes in Switzerland.

Pedro Pimentel is an Assistant Professor in Universidade Europeia, Lisbon and PhD student in ISCTE Lisbon University Institute. MSc in Business Management (ISCTE, Lisbon) he is currently engaged in his PhD thesis on the topic of Green Entrepreneurship drivers and competencies. His main research areas are Entrepreneurship, Strategy, and Corporate Finance.

Sara Proença. Director of INOPOL Entrepreneurship Academy of Polytechnic Institute of Coimbra Adjunct professor at ESAC/Polytechnic Institute of Coimbra. Integrated member of CERNAS – Research Center for Natural Resources, Environment and Society. Ph.D. in Economics, ISEG/University of Lisbon, Portugal, 2013. M.Sc. in Applied Economics and Degree in Economics, Faculty of Economics/University of Coimbra, Portugal.

Ranvir S. Rai is an Associate Professor in Innovation and Entrepreneurship at Kristiania University College. He holds a PhD from BI Norwegian Business School. His research interests concern innovation processes, disruptive innovation and use of design thinking as organizational capability. He has published in international journals, such as Information & Management and Service Industries Journal.

Daniel Rees: Lecturer in the All-Wales Academy for Innovation in Health & Social Care, Dr Rees was previously seconded to the position of Innovation Technologist working for the pan-Wales Accelerate programme through Swansea University's School of Management and Medicine. Dr Rees' research interests focused on commercialisation of medical research, technology and healthcare innovation.

Susana Rodrigues is a management professor and researcher at the Polytechnic Institute of Leiria (Portugal). Her work contributes to strategy, entrepreneurship, and innovation. Since 2015, she lectured executives' courses sponsored by European funds and Erasmus Mobility Program. Between 2017 and 2019, she was President at Agency for Assessment and Accreditation of Higher Education.

Fernando Romero is a lecturer and a researcher at the University of Minho, PT. He holds a Ph.D. in Science and Technology Studies from the University of Manchester. His main research interests are in the areas of innovation systems and innovation management, with a special interest in the relationships between university and society.

Arik Sadeh is a former dean of the Industrial Engineering and Technology Management Faculty at the Holon Institute of Technology HIT, Israel. He holds a Ph.D. from Texas A&M University.

His primary areas of research and publications are innovation and entrepreneurship, product management, project management, system engineering, financial engineering, risk assessment and operations research.

Diana Salgado works in the Business faculty of the University of Portsmouth as a Fellow in a knowledge transfer partnership with an English tomato grower. She gained her PhD from the University of Leeds, England, her Masters degree from the University of Vigo, Spain and her bachelor's degree in Mexico, where she is from.

Nils Sanne is a University Lecturer at the Norwegian University of Life Sciences and is the head of the Innovation and Entrepreneurship Masters, where he also teaches. His research interests relate to entrepreneurship pedagogy. Nils has received multiple grants related to establishing innovative teaching and has a track record of creative experiments within teaching.

Nathalie Sarrouy-Watkins is a lecturer and researcher in entrepreneurship at Ferrandi. Her research is in the field of hospitality entrepreneurship, more specifically on *business models*, effectuation, sustainable development or entrepreneurship education. She has been published in the top ranking peer reviewed journals, eg. Management International, the Review of Entrepreneurship or the Revue Internationale PME.

Juha Saukkonen, D.Sc. (econ.), holds a position of a Senior lecturer of Management at JAMK University of Applied Sciences in Finland. He has published both individually and in multinational research teams on topics of Foresight, Knowledge Management and Entrepreneurial Education. He is a guest lecturer on these topics in various universities and organizations abroad.

Lisa Schrewentigges is a PhD student at TU Dortmund University, Germany. She has an academic and professional background in Management and Economics. Her main research areas are entrepreneurship and innovation management with a focus on antecedents and outcomes of fear of failure.

Nyet Moi Siew is an associate professor at the Faculty of Psychology and Education, Universiti Malaysia Sabah, Malaysia. Her primary research interests are in the area of scientific and mathematical creativity and thinking, and STEM Education. She has written over 45 research papers published in international peer reviewed journals.

Sergio Evangelista Silva holds a PhD degree in Production Engineering from Federal University of São Carlos, Brazil. He did a postdoc at Federal University of Minas Gerais with research visiting Lisbon University, Portugal. He is an associate professor at the Federal University of Ouro Preto, Brazil, researching in innovation and knowledge management.

Miroslav Šipikal is Associate Professor at the University of Economics in Bratislava. Since 2005 he has been teaching at the Department of Public Administration nad Regional Development Faculty of National Economy of University of Economics in Bratislava. His main research interest has been evaluation of public policies, specially regional, innovation and education policy.

Robert Smith holds a PhD in Engineering and is currently a candidate for a PhD in law focussing on innovation in the Association of Southeast Asian Nations. He also works as an international development consultant in South and Southeast Asia where his research interests are focused. He is passionate about institutional development.

Elias Soukiazis holds a Ph.D. in Economics by the University of Kent, U.K. (1995), and he is currently Associate Professor at the University of Coimbra, Faculty of Economics, Portugal, and a researcher of CeBER (Centre of Business and Economics Research). He has published a large number of articles in international journals, chapters in books and he is co-Editor of

three textbooks. His main research interests are on applied Economics (URL:http://www4.uc.pt/elas)

Inese Spica is leading researcher at the scientific institution Business competence centre and professor at the ISMA University. She received her PhD in economics sciences from University of Latvia in 2001. She is editor of scientific journals, monographs and has been managed three international conferences on Business Competences; Trade Marketing; Business Environment.

Joseph Staudt is a Senior Economist at the Center for Economics Studies (CES) at the U.S. Census Bureau. He formerly worked at the Census Bureau's Center for Big Data Research & Applications. He received his Ph.D. from Ohio State University in 2016.

Antonia Terán-Bustamante is a Researcher and Professor at the School of Economics and Business Administration at the Universidad Panamericana, México. She has a Ph.D. in Administration Sciences and Master's in Administration International Business from the Universidad Nacional Autónoma de México (UNAM). Her research is focused on Human Capital, Competitiveness, Innovation, and Entrepreneurship.

Nyayu Lathifah Tirdasari is a researcher of Entrepreneurship and Technology Management at School of Business and Management, ITB. She is an editor of the local journal and has been involved in organising several international conferences. Her main research area is family business.

Justyna Tomala is a PhD candidate and research and teaching assistant in Department of Entrepreneurship and Innovation at Cracow University of Economics. She holds M.Sc. with Honours in International Relations from the Cracow University of Economics. Her research focuses on mining industry, resource curse, sustainable development and eco-innovations. She can be contacted at justyna.tomala@uek.krakow.pl.

Stephen Treacy is a lecturer of business information systems at Cork University Business School, Ireland. He received his PhD from University College Cork in 2016. His work has been published in several outlets including the Journal of Information Technology (JIT). His main research areas are open innovation, data compliance, and digital entrepreneurial ecosystems.

Anna Ujwary-Gil, PHD and habilitation in economic sciences in the field of management at the Warsaw School of Economics (SGH). Professor at the Institute of Economics, Polish Academy of Sciences (IE PAS). Editor-in-Chief of the *Journal of Entrepreneurship, Management and Innovation (JEMI).* Founder and expert of the Network Analysis Laboratory. Founder and President of the Cognitione Foundation for the Dissemination of Knowledge and Science.

Maria Urbaniec, PhD, is Associate Professor and Head of the Department of Entrepreneurship and Innovation, Cracow University of Economics (Poland). She completed her PhD in Economics at the International Graduate School Zittau of the Technische Universität Dresden, Germany. She is author or co-author of over 150 scientific papers in academic journals and monographs. Her research interests include entrepreneurship, innovation, sustainable development, labour market and digital economy.

Korneel Verhaeghe is the Project Manager for the SETsquared partnership's IKEEP programme. He oversees the delivery of student training, recruitment of project organisations and the running of student knowledge exchange projects between students and companies across the Universities of Bath, Bristol, Exeter and Surrey.

Andreas Walmsley, is an Associate Professor in Business at Plymouth Marjon University, UK. His research interests are primarily in entrepreneurship, especially entrepreneurship education. He also publishes in the area of labour markets, with a particular focus on the service industries.

Knut Ingar Westeren has been a Professor of Economics at Nord University in Norway since 2001. He teaches knowledge management, knowledge and competitiveness and public economics at Nord University. He has numerous books and publications dealing with aspects of aquaculture, knowledge and competitiveness, the public sector and regional development.

Tirufat D. Woldeyes is a doctoral student in Management Engineering. She got her MSC in Industrial Engineering from Addis Ababa University, Ethiopia. In addition to being a lecturer, she has been working for a manufacturing company. She is currently a full-time researcher at the University of Padova, Italy, working on business models and circular economy.

Birgitte Wraae, is an Associate Professor in Entrepreneurship, at UCL University College Denmark, Denmark. Her research interests are in entrepreneurship, especially entrepreneurship education: the role of the entrepreneurship educator, identity formation, emancipation, and reflection. She excels in doing research in connection with the entrepreneurial learning space.

Naveed Yasin is a Professor of Entrepreneurship at the Canadian University Dubai. He has experience working in the UK and the Gulf region delivering the British and North American Higher Education curricula. He has won the 'Outstanding All-Round Academic Award 2015' conferred by the Teaching and Learning Institute, UK., published in entrepreneurship and business management journals, and examined doctorate programs in Europe, Africa, and Asia.

Antonios Zairis has studied Political Science and holds an MBA. His doctoral dissertation was on consumer behavior, specializing in retail. He has 32 years of experience as General Manager in various multinational and Greek companies and has taught at Universities in Greece, Tirana, Prague and Cyprus. He has several academic publications with the peer review system.

George Zairis has studied Economics and holds a MSc in Banking and Risk. He is currently a PhD Candidate specialized in Sustainable Finance. He is currently working as a Senior Consultant in the business advisory department of the European Institutions in one of the biggest worldwide advisory firms in Luxembourg.

Gerda Žigienė Professor of finance, Kaunas University of Technology, specialising in corporate finance management and fintech. Previous experience as a professor at Vilnius University, Kaunas University of Technology, Fribourg University, Kristainstad University, and IMD Business school (Switzerland). PhD in management from IMS university. Business experience

covering CEO/CFO. Initiator/organiser of international business finance conferences. Experience creating & transforming domestic & international study programs. Spearheaded innovative educational strategies redesigning current teaching systems, these being actively implemented at ECIU and inter-alliance working group, within framework of the European Commission initiative “European Universities”.

Matthijs Zwemmer: I’m a driven and eager to learn graduated Data Science student. At this conference, I would like to learn more about what others have done in the field. After graduating I found a job in the mobility workspace where I hope to apply everything that I learned during my master's and during this conference.

Non-Formal Social Ties as Threat to the Implementation of Innovations

Aleksandr Aksiutin, Konstantin Bagrationi, Michael Morozov and Ilya Trochin
HSE University, Moscow, Russia
anaksyutin@edu.hse.ru
kbagrationi@hse.ru
mimorozov_1@edu.hse.ru
itrochin@edu.hse.ru

Abstract: This paper aims to provide novel insights about the barrier associated with organizational development, namely, resistance to new management practices implementation which emerges from tightly knit social networks – the "blat". We follow claims for more empirical studies as we provide Social Network Analysis to present a real-life study of how blat networks of operational management lead to the failure of digital transformation attempt at the Russian metallurgical enterprise. We analyzed underlying forces, but deliberately stayed away from developing theories from our case. The close association with CEO allowed us to benefit from the rich and deep "local knowledge" and present case that provided valuable insights into different forms of behavior of line management and the social dynamics at the time of digital transformation attempt.

Keywords: blat, employee resistance, innovation, digital transformation, readiness for organizational change

1. Introduction

It is only logical that western business community delved into innovation technologies long ago, since the letter can enable upgrading the industry and boosting the efficiency levels. The same rout has been chosen by the developing economies, such as those in China and India, that focus on business-process development based on IT.

In fact, all the management levels are affected by the complexity of implementation of new technologies. It implies that those processes are launched at upper levels, with their gradual descent and constant need to overcome resistance to change. The problem of resistance to change is not new as it has been thoroughly researched since 1948, (Coch, L. and French, J.R. Jr; 1948), "Overcoming resistance to change", Human Relations, Vol. 1 No. 4, pp. 512-532.), however, the predominant majority of this research is based on the western practice.

It is common knowledge that the business environment in eastern Europe (consisting of the former Soviet countries and the countries of the Warsaw Pact) has a number of peculiarities that prevent one from using western best practices unabridged (Cohen, 2015). It is known for a fact that the implementation of innovative technologies and modern approaches to management in the post-Soviet continuum has been around as an ongoing process since the middle of 2000s. Nevertheless, the market with its specifics results in the cases that must be reviewed irrespectively of the western practice.

One of the peculiarities of this business environment consists in the importance of non-formal social ties (see Ledeneva, 2009) that are, nevertheless, typical of other communities (Smith, 2011; Chen, 2011; Ferreira, 2012).

Staff members tend to start non-formal social ties establishing special rapports that can manipulate and even push not only colleagues but also management. Thus, those members raise their social value and build a company within the company.

This factor may turn into a real threat when introducing innovations, since staff members, who possess a high level of non-formal status within the company, may reject innovation implementation or even try to undermine the workflow. Meanwhile, they clearly realize that the responsibility is highly unlikely to rest with them in the end as they are actually more powerful than their position suggests.

2. Blat as an obstacle to digital transformation

Getting ready for deep organizational change is a challenge for top management, which sets the framework for change, defines its means and goals, transmits the values of digital transformation to company employees and, as a result, receives the lion's share of attention in scientific papers and articles (Cortellazzo et al., 2019).

However, despite their crucial role, there are very few studies that would shed light on cases where company's transformation was threatened by informal personal connections of the employees, the phenomenon that called "blat" in ex-soviet countries.

Social life in the Soviet and post-Soviet world has long spun around finding ways to bypass formal procedures through the blat system (Arnstberg and Boren, 2003; Ledeneva, 2009; Michailova and Worm, 2003). The term "blat" is widely used in post-Soviet societies and describes an informal connection between people who expect special treatment and mutual benefit from each other (Michailova and Worm, 2003). Such social networks, aimed at helping friends or relatives, were indispensable during the Soviet Union time, when goods were in short supply, and direct access to them depended on informal relationships. Money as such was much less in demand than in the Western countries, since the amount of goods that could be bought with it was significantly limited. In a way, blat was a substitute for market mechanisms of exchange based on social status and the ability to help other people (Ledeneva, 2009; Onoshchenko & Williams, 2013). Therefore, blat also had a positive connotation (Ledeneva, 2013; Van Schendel & Abraham, 2005). A person who got a job in an organization through blat was associated with their patron. Thus, blat facilitates a network based on strong ties (Granovetter, 1973).

Although the urgent need to obtain scarce goods through personal networks is no longer relevant, blat is still a central part of social networks (Arnstberg & Boren, 2003). Nowadays personal networks have begun to play a substantial role in gaining access to such assets as, for example, a position in a company or a free-of-charge place in a university (Ledeneva, 2013). Empirical studies show that many Russian managers use blat to get their desired position in the organization (Clarke, 2002). Since the new form of blat is more money-related and aimed at enriching the members of its network (Smith & Stenning, 2006), it becomes much less socially acceptable and receives a negative connotation (Michailova and Worm; 2003). Blat is often mentioned in connection with corruption or nepotism (Ledeneva, 2009).

Personal connections are used to by-pass bureaucracy limitations. In the Arab world, for example, the term wasta is used (Smith et al, 2011); in China, these networks are called guanxi (Chen et al., 2011), in Brazil, jeitinho (Ferreira et al., 2012). Thus, it would be wrong to associate this phenomenon only with the post-Soviet space. Examples of personal networks are present in all societies, irrespectively of whether or not they have a specific term in the language. The organizational culture of "blat" is built on negative power that stops organizational development, rather than stimulating change. For example, managers in a firm may be heavily dependent on personal connections with their colleagues, clients, contractors, and subordinates.

3. Methodology

In order to quantitatively study the social space, the paper provides an Analysis of Social Networks (Social Network Analysis, hereinafter SNA).

This method is used in the framework of the current research, since it enables creating the concept of a network of the employees' ties with the social concept which would be deemed as impossible when using the individualistic approach. Nevertheless, all the particular features of each employee play an important role for the higher SNA accuracy, therefore, they should be taken into account as well (Knoke & Kuklinski, 1982). SNA regards the communities (denoted as a "network") as the connection of particular relationships (called "edges") that are supported and exploited by the employees (aka "objects") with the view to communication (C. Wetherell et al., 1994).

Based on the observation of the operational process for 30 days, a data pool (see Table 1) was collected to build a graph of social interactions of employees of the enterprise: the interactions of middle and top management, as well as key counterparties of the company, were analyzed, the number of employees' communications with each other and the degree of influence of each individual communication were taken into account for the company, which was estimated in accordance with the expert assessment of the CEO. For example, communication in the context of operational activities between the warehouse foreman and the warehouse

manager is less important than the communication of the "warehouse manager - counterparty representative" type. The frequency of communications and their significance are clearly displayed through the edges of the graph (see Figure 1), that is, the thicker the edge between the two individuals in the SNA, the more often and more important their connection is.

It is important to point out that the data concerning the quantity of edges is based on the information about the targets, i.e. showing the communication recipients of each object. However, due to the big volume of the original CSV-file and for the sake of transparent visualization of the result of the current research, Table 1 contains the total data about the quantity and weight of each object's interactions.

Table 1: Data pool based on observations and interview with CEO of the company

Object	Total Edges	Total Weight
The CEO	11	101070
The CFO	10	26365
The COO	10	14045
The Executive Director	6	5100
The head of sales department	10	12865
The head of the warehouse	47	60592
The head of the workshop	13	12850
The manager of the warehouse (1)	28	8836
The manager of the warehouse (2)	28	9676
The manager of the workshop(1)	11	4515
The manager of the workshop(2)	11	5360
The warehouse foreman(1)	8	3112
The warehouse foreman(2)	8	3028
The warehouse foreman(3)	8	2921
The workshop foreman(1)	11	2218
The workshop foreman(2)	11	2198
The workshop foreman(3)	11	2250

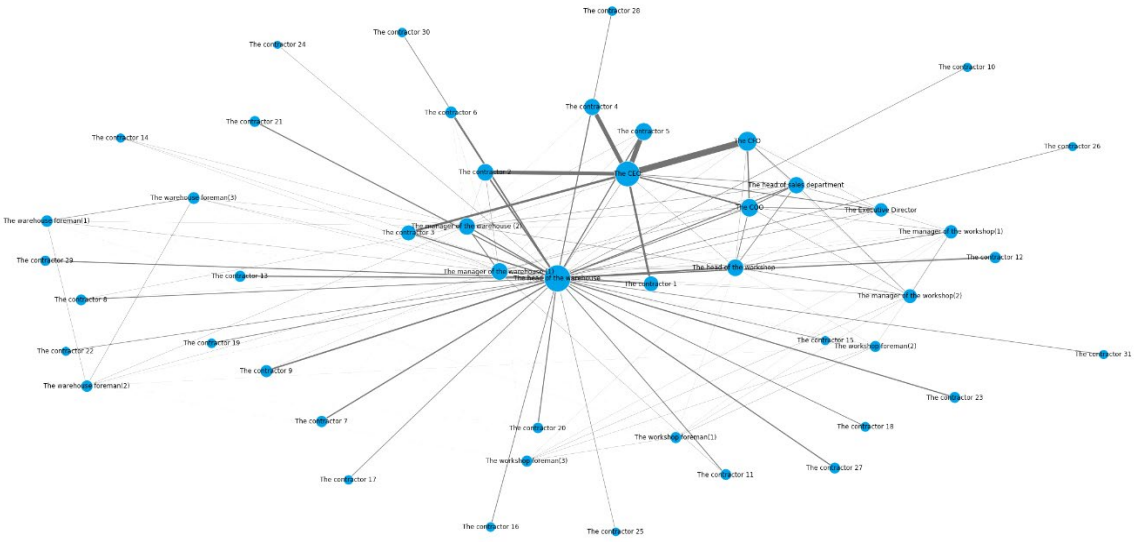


Figure 1: Social Network Analysis (SNA)

4. The company case

The enterprise for the processing of secondary resources (accumulator batteries, lead, copper, brass and bronze scrap) produced alloys and various products made on lead and copper base, and then sold both on the domestic Russian market and outside the country. Experiencing cash gaps at the stage of concluding contracts with different deferred payment terms with traders and buyer factories (a fairly typical situation for such enterprises) during the currency crisis of 2014–2015 in Russia, the enterprise was unable to meet its obligations and,

therefore, became an asset of a bank - the lender. Over the next few years, the bank carried out anti-crisis management in the enterprise, and as a result, sold it to a large trader in non-ferrous scrap.

After the departure of the crisis management team, the new owner of the enterprise, together with his partners, set up a new top management team, as well as appointed new managers in key positions, which includes the general director, operating director, financial director, as well as initial sales departments. Moreover, the owner started to independently ship part of the raw materials to the enterprise. Together with him, 2/3 of the total volume of raw materials was supplied by his colleagues, who were ready to provide a certain fixed tonnage in short term with a 3-month deferred payment. The remaining 1/3 of the volume was shipped to the enterprise by means of local suppliers, contacts with whom were established by the warehouse manager. The warehouse manager and the chief executive of the company were hired by the anti-crisis management team and were kept to carry out their functions with the new owner's team.

Thus, after the purchase of the enterprise by the owner, the new management of the company consisted of the top management team invited by the owner, as well as part of the employees who remained at the enterprise after the bank's anti-crisis team.

A few months later, the owner and his partners decided to digitally transform the enterprise. At the first stage, it was supposed to digitize the processes of receiving metal at the plant, followed by the introduction of an ERP system for the entire enterprise. However, when the information about the upcoming digital transformation was sent down to the employees, the CEO and his team were surprised at the internal resistance caused by those changes.

For example, during an attempt to install the necessary programs on the computers of the warehouse manager, one of the porters damaged the Internet wire, thereby postponing the installation of the programs for some time. After restoring access to the network, the installer team faced aggression from the deputy heads of the warehouse and refused to provide services to the enterprise to implement the necessary items.

Thus, local confrontations that hindered the implementation took place for over the course of 2 months. The owner, who learned about the ongoing difficulties, ordered to suspend the digital transformation due to inefficient spending of funds (payment of a penalty under the contract of the first company and advance payment of the second).

The peak point of the escalation of the conflict was an open threat from the head of the warehouse that 1/3 of the volume of raw materials supplied by local counterparties would cease to flow to the enterprise in case of external intervention with his usual duties.

After this incident top-management realized, that behind the resistance there was the personal interest of the warehouse manager and his subordinates, caused by blat, that was created during company's hard-times, when top-management and bank representatives were not focused on the lower-level operating activities.

5. Triangulation and analysis

According to the CEO of the company, blat plays a rather serious role in the resistance of the company's employees to digital transformation, because employees constantly interact with each other with the view to solving problems and dubious issues. Moreover, there is communication outside the organization with suppliers and competitors to exchange information and monitor existing market trends.

Although such close interactions traditionally receive a positive connotation, in this case they move to a qualitatively different level - the level of blat networks. As part of the SNA, monitoring of the number of iterations of communication between employees was used. After the acquisition of the enterprise by the new owner, a close-knit team came to the position of top management, including the general director, financial director, head of the sales department, operating director, as well as a number of raw materials counterparties, who were to supply about 2/3 of the total volume of raw materials used at the enterprise. It can be well seen how big the points formed by the new command are and how wide the lines between the clusters in the respective spots of the graph are (see Figure 1).

However, the warehouse manager and his deputy, who retained their positions due to the lack of people in the new team capable of performing indispensable procedures, have as large a spot as the new management team does. It means that the warehouse manager and the general manager are almost equally able to influence the communication network. Moreover, although the thickness of the lines in the graph at the points related to the head of the warehouse and his deputies are thinner, however, they are bigger in quantity, which means the ability to "activate" the resistance of a significant number of employees of the enterprise.

Turning to the overall picture of the communication network, it is clearly understandable that some of the company's counterparties, supplying 1/3 of the total volume of raw materials, communicated directly with the warehouse manager and his deputies, bypassing the general director and his team: local counterparties had not yet managed to establish strong ties with the management. Consequently, the shipment took place through the usual communication channel - the head of the warehouse.

Thus, the warehouse manager and his deputies turned out to be the bottleneck between the two large communities: the contractors-suppliers and the new team involved into the internal processes. When the owner of the enterprise made an attempt at digitalization, the warehouse manager realized that increasing the transparency of processes would significantly impair his ability to implement his own plans at the junction of the two communities, which led to resistance on his part.

6. In conclusion

Summing up, the lack of control on the part of top management allowed the lower-level managers to form enterprises in the internal and external environment controlled by the head of the warehouse of a blat network. The blat networks allowed the community that had formed around the warehouse manager to derive additional benefits that were contrary to the interests of the enterprise. The increase in process transparency, which usually accompanies digital transformation, posed a direct threat to the established communications network.

It is highly likely that the value of the informal structure turned out to be more important than the need to follow institutional norms for the participants in the process. This led to open resistance from the warehouse manager and his subordinates.

Thus, resistance to innovative practices implementation is likely to be expected from managers who, due to the introduction of new business technologies, are afraid of losing their role in the networks of blat that previously used to secure their position. As can be seen from the study, the head of the warehouse by all means tried to protect his networks of blat. Consequently, the problem of studying the obstacles and impediments to digital transformation is less a subject of technological applications and rather a matter of organizational development.

The top managers intending to introduce modern technologies or western management models should monitor social networks of the company in terms of the non-formal social ties and their influence within the company. The introduction of new management models may not only face resistance to change, but also ruin the company if "blat" networks prove to be highly influential in reverting company's processes at all levels.

In order to avoid dramatic measures, such as firing the staff members who show a high level of influence using their non-formal ties and even sabotage day-to-day operations, it is recommended to hold training sessions, which are to clarify why changes in the company are indispensable and cannot be altered. It could make the development strategy understandable for all the whole team including the members with the active involvement into non-formal ties. There is a great possibility to convert those members into the agents who are not resistant, but prone to change.

However, not all the cases can be positively resolved in terms of resistance, which was proven by the case reviewed in the article. Sometimes the managers of a company with a high level of informal influence turn out to have pursuits that openly conflict with the current interests of the company. It means that the top manager of the company is likely to be forced to take more serious steps aimed at changing the system of power relations. Should the situation be neglected, the entire future of the company will be under threat of stagnation, and the company will solely function for the interests of a narrow circle of informal leaders who are not interested in introducing any changes that may decrease the level of their influence. The search for new methods to outrule

the influence of the informal leaders determines the relevance of studying the topic of non-formal social ties and ways to control them within the framework of the available nominal management system.

As follows from the current article, there was a real case of resistance to the digital transformation constellated by staff members of a Russian metallurgical enterprise who had non-formal social ties and were involved in an informal social network within the company. Despite the fact that the situation did not have any positive outcome and turned out to be beneficial neither for employees nor the company, the authors of the article believe that further study of this topic will allow them to come up with the solution that could contribute to a more productive resolution of such and similar contingencies. Other researchers are also welcome to share their case studies related to non-formal ties and informal social networks within companies, substantial and relevant experience in resolving them and theoretical knowledge on how to reduce the effect on the existing management system in the company.

References

Ajwani-Ramchandani, R., Figueira, S., de Oliveira, R. T., Jha, S., Ramchandani, A., & Schuricht, L. (2021) “Towards a circular economy for packaging waste by using new technologies: The case of large multinationals in emerging economies”, *Journal of Cleaner Production*, Vol. 281: 125139.

Arnstberg, K. O., & Boren, T. (2003) *Everyday Economy in Russia, Poland and Latvia*, Södertörns högskola.

Bennett, J. W. (1976) “Anticipation, Adaptation, and the Concept of Culture in Anthropology: A synthesis for a "preparadigmatic" science is suggested by the philosophy of AN Whitehead”, *Science*, Vol. 4242, No. 192, pp 847-853.

Bocken, N. M., Olivetti, E. A., Cullen, J. M., Potting, J., & Lifset, R. (2017) “Taking the circularity to the next level: a special issue on the circular economy”, *Journal of Industrial Ecology*, Vol. 21, No. 3, pp 476-482.

Chauhan, C., Parida, V., & Dhir, A. (2022). “Linking circular economy and digitalisation technologies: A systematic literature review of past achievements and future promises”, *Technological Forecasting and Social Change*, Vol. 177: 121508.

Chauhan, C., Sharma, A., & Singh, A. (2019) “A SAP-LAP linkages framework for integrating Industry 4.0 and circular economy”, *Benchmarking: An International Journal*, Vol. 28, No. 5, pp. 1638-1664.

Chen, Y., Friedman, R., Yu, E., & Sun, F. (2011) “Examining the positive and negative effects of guanxi practices: A multi-level analysis of guanxi practices and procedural justice perceptions”, *Asia Pacific Journal of Management*, Vol. 28, No. 4, pp 715-735.

Clarke, S. (2002) *Making ends meet in contemporary Russia*, E. Elgar.

Cohen, S., (2015) “Humanizing Soviet Communication: Social-Psychological Training in the Late Socialist Period”, *Slavic Review*, Vol. 74, No. 3, pp. 439-463

Cortellazzo, L., Bruni, E., & Zampieri, R. (2019) “The role of leadership in a digitalized world: A review”, *Frontiers in psychology*, Vol. 10:1938.

De Medeiros, J. F., Ribeiro, J. L. D., & Cortimiglia, M. N. (2014) “Success factors for environmentally sustainable product innovation: a systematic literature review”, *Journal of cleaner production*, Vol. 65, pp 76-86.

Denzin, N. K. (1989) *Interpretive interactionism*, Newbury Park, CA: Sage.

Ellen MacArthur Foundation. (2013) “Towards the circular economy: Opportunities for the consumer goods sector”, *Ellen MacArthur Foundation*, pp 1-112.

Ferreira, M. C., Fischer, R., Porto, J. B., Pilati, R., & Milfont, T. L. (2012) “Unraveling the mystery of Brazilian Jeitinho: A cultural exploration of social norms”, *Personality and Social Psychology Bulletin*, Vol. 38, No. 3, pp 331-344.

Forsman, H. (2013). “Environmental innovations as a source of competitive advantage or vice versa?”, *Business Strategy and the Environment*, Vol. 22, No. 5, pp 306-320.

Geertz, C. (1973) *The interpretation of cultures: Selected essays*, New York: Basic Books.

Granovetter, M. S. (1973) “The strength of weak ties”, *American journal of sociology*, Vol. 78, No. 6, pp 1360-1380.

Humphreys, M., & Brown, A. D. (2002) “Narratives of organizational identity and identification: A case study of hegemony and resistance”, *Organization studies*, Vol. 23, No. 3, pp 421-447.

Ingemarsdotter, E., Jamsin, E., Kortuem, G., & Balkenende, R. (2019) “Circular strategies enabled by the internet of things—A framework and analysis of current practice”, *Sustainability*, Vol. 11, No. 20: 5689.

Jaffe, A. B., Newell, R. G., & Stavins, R. N. (2005) “A tale of two market failures: Technology and environmental policy”, *Ecological economics*, Vol. 54, pp. 164-174.

Jones, R. A., Jimmieson, N. L., & Griffiths, A. (2005) “The impact of organizational culture and reshaping capabilities on change implementation success: The mediating role of readiness for change”, *Journal of management studies*, Vol. 42, No. 2, pp 361-386.

Knoke, D., Kuklinski, J.H. (1982) “Network Analysis”, *Sage University Paper Series on Quantitative Applications in the Social Sciences*, No. 07–028.

Ledeneva, A. (2009) ”From Russia with blat: can informal networks help modernize Russia?”, *Social Research: An International Quarterly*, Vol. 76, No. 1, pp 257-288.

Ledeneva, A. V. (2013) *Can Russia modernise?: sistema, power networks and informal governance*, Cambridge University Press.

Maxwell, J. (1992) “Understanding and validity in qualitative research”, *Harvard educational review*, Vol. 62, No. 3, pp 279-301.

Michailova, S., & Worm, V. (2003) “Personal Networking in Russia and China: Blat and Guanxi”, *European Management Journal*, Vol. 21, No. 4, pp 509-519.

Onoshchenko, O., & Williams, C. C. (2013) “Paying for favours: evaluating the role of blat in post-Soviet Ukraine”, *Debatte: Journal of Contemporary Central and Eastern Europe*, Vol. 21, No. 2-3, pp 259-277.

Rennings, K. (2000) “Redefining innovation—eco-innovation research and the contribution from ecological economics”, *Ecological economics*, Vol. 32, No. 2, pp 319-332.

Reuter, M. A. (2016) “Digitalizing the circular economy”, *Metallurgical and Materials transactions B*, Vol. 47, No. 6, pp 3194-3220.

Saarikko, T., Westergren, U. H., & Blomquist, T. (2020) “Digital transformation: Five recommendations for the digitally conscious firm”, *Business Horizons*, Vol. 63, No. 6, pp 825-839.

Sadeghi, A. R., Wachsmann, C., & Waidner, M. (2015) “Security and privacy challenges in industrial internet of things”, *2015 52nd ACM/EDAC/IEEE Design Automation Conference (DAC)*, pp 1-6.

Smith, A., & Stenning, A. (2006) “Beyond household economies: articulations and spaces of economic practice in postsocialism”, *Progress in human geography*, Vol. 30, No. 2, pp 190-213.

Smith, P. B., Torres, C., Leong, C. H., Budhwar, P., Achoui, M., & Lebedeva, N. (2012) “Are indigenous approaches to achieving influence in business organizations distinctive? A comparative study of guanxi, wasta, jeitinho, svyazi and pulling strings”, *The International Journal of Human Resource Management*, Vol. 23, No. 2, pp 333-348.

Teulier, R., & Rouleau, L. (2013) “Middle managers' sensemaking and interorganizational change initiation: Translation spaces and editing practices”, *Journal of Change Management*, Vol. 13, No. 3, pp 308-337.

Van Schendel, W., & Abraham, I. (2005) *Illicit flows and criminal things: States, borders, and the other side of globalization*, Indiana University Press.

Vial, G. (2019) “Understanding digital transformation: A review and a research agenda”, *The journal of strategic information systems*, Vol. 28, No. 2, pp 118-144.

Wetherell, C., Plakans, A., & Wellman, B. (1994) “Social networks, kinship, and community in Eastern Europe”, *Journal of Interdisciplinary History,* No. 24, pp 639–663.

Business Model Innovations in the French Food Sector During the Covid Crisis

Laurice Alexandre[1] and Nathalie Sarrouy-Watkins[2]
[1]Université de Paris, France
[2]Ferrandi Paris, France
laurice.alexandre-leclair@parisdescartes.fr
nsarrouywatkins@ferrandi-paris.fr

Abstract: This article attempts to answer the followed research question : how did the restaurants innovate their business model in order to adapt it to the COVID crisis?. A study of two cases shows that the activities, the resources and skills, the revenue model, and the beneficiaries have been transformed even sometimes reinforced in order to keep the business on. In the two cases, the inner resources were mobilised and the offer was changed. As regards the suppliers, their profiles have been changed because of the take away offer which pushed the restauranteurs to have new recipients and new materials in order to adapt their offer.

Keywords: business model, innovation, food sector, covid

1. Introduction

The food sector and more particularly the restaurants was severely hit by the Covid pandemic crisis. Even though the French Government offered subsidies to support the restauranteurs, they had to innovate their business model in order to survive, seize new market opportunities, and as such demonstrate organisational resilience.

According to (Sobaih et al. 2021, p.2), "organisational resilience deals with diverse responses to extrinsic changes and shockwaves that affect business performance and innovation. It can be defined as the enterprise's capability to remain and withstand extraneous environmental changes, relieve and overcome the negative effects caused by the changes, and rebound forward to a new state for sustaining future performance.
It focuses on the ability of enterprises to respond effectively, adapting and developing in the face of critical crises. In a crisis situation such as Covid, the question could be asked how French restaurants were able to adapt their strategy and business model to face the crisis. Harms et al. (2021) declare that even innovating 'only' one core dimension of the business model, usually leads to changes in the remaining dimensions (Harms et al., 2021, p.3).

In this paper, we intend to explore the business model innovations developed and implemented by French restaurants during the crisis. The definition of Foss and Saebi (2017, p.201) which defines a business model innovation as a "designed, novel, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements" was retained. We will be focusing on these different elements which allow companies to generate external added value.

During the two Covid lockdowns imposed by the French government of the industry, the restauranteurs' main concern was to retain their existing customers by expanding their offer for example with new value propositions, click & collect and delivery systems.

This paper aims to fill the gap in the literature addressed by few authors and considers the business model innovations put forward during the Covid crisis. It also provides recommendations on how to adapt a business model during a period of crisis in the food sector.

So, our research question is: **how did the restaurants innovate their business model in order to adapt it to the COVID crisis?**

To explore this question, a qualitative survey was conducted before twenty restaurant managers. A preliminary analysis was made on two case studies that will be discussed in this paper. We first present the conceptual model, followed by the methodology, the results and a discussion.

2. Conceptual model

There is a large body of literature on business models offering a wide range of models focusing on one or different core value propositions. An increased use of technology has been observed when it comes to adapting the restaurants business model during the crisis. It increases the role of customers as co-creators of value and transforms them into engaged prosumers. During the different lockdowns, the consumers had the budget and time to consume even better than before without caring about the costs of the produce.

Research has shown that consumers generally form an attachment to their favourite hospitality products. According to Peng and Chen (2021), consumers' brand/product attachment is more able to contribute to their purchase intentions than the contrary. One can then assume that during the Covid crisis of 2020 and 2021, consumers were not ready to abandon their favourite restaurant and that restauranteurs responded to this demand by adapting their offer.

In order to identify the restauranteurs' business model innovations deployed during the pandemic, we started collecting data based on a large model combining the models of Verstraete et al. (2012) and Osterwalder & Pigneur (2010). This model takes into account the following items: (1) Value proposition 2) Customers 3) Skills and resources 3) Activities, 4) Partners 5) Communication and 6) Distribution (Figure 1).

Based on this model we will study how the restaurants' value proposition and activities have been adapted during the crisis, how they mobilised their skills and resources, whether they managed to establish new partnerships, reach new customers, how they changed their distribution and communication networks. The objective is to identify the main components that have changed and shaped their new business model.



Figure 1: Conceptual model

3. Methodology

Semi structured interviews were conducted with the managing teams of 20 Parisian restaurants during the months of July, August and November 2021. The participants were selected via the purposeful criterion sampling method to gather information about the research topic (Patton, 2002). All participants were either the creators or were part of the managing team of the restaurants which had been created before 2020. The interview protocol was designed to lead the interview. Semi structured questions allowed the interviewees 1) to answer open-ended questions focusing on the *business model* innovations that they have deployed to cope with the restrictions and the two lockdowns of 2020 and 2021 (Doody & Noonan, 2013) and 2) express their own viewpoints (Järvenpää & Lang, 2005). The interviews were conducted over the phone (Irvine, Drew & Sainsbury,

2012), audio-recorded and transcribed into text files. The average time for each of the interviews was 42 minutes. The interview guide included all the items presented above in the conceptual model.

The data analysis process followed the content analysis process of Miles and Huberman (1994) which consists in 1) data reduction, 2) data display and 3), conclusion drawing. Interviews were read several times, coded and organised based on the two business models of Verstraete *et al.* (2012) and Osterwalder & Pigneur (2010). In this paper, we present the study of 2 cases out of 20 because the research is still in process at this level.

In this paper, we present two opposite case studies in order to show two opposing situations: a social and solidarity restaurant, and a gourmet restaurant. Both of them where situated in the heart of Paris.

Case N°1 – Parisian social and solidarity restaurant

Created in 2018, the restaurant A. Paris is a link in a chain of solidarity restaurants around the world. The Parisian establishment was founded by the association of a three-star chef, a tour operator and a contemporary artist. S.M. is in charge of the establishment next to Mr. B.D., its resident head. The restaurant prepares and serves gourmet dishes for people suffering from social exclusion in a mythical place, the crypt of a Parisian church. It is both a gourmet restaurant and a cultural project, *"it is a bridge to connect* people".
The restaurant mainly sources unsold products from the Food Bank, Metro and other large retailers. The products are then worked with *love,* by a team of employees and volunteers, and this, in the kitchens of an existing restaurant. Renowned chefs are regularly invited to develop menus based on consumable products but removed from distribution channels. The hall was decorated by successive & renowned artists. The beneficiaries, called "the guests" are sent by partner associations equipped with cards, to identify the guest and lead him to his place in the room. The Restaurant A. team counts on several patrons who each bring their own touch to the project. Restaurant A. serves a hundred meals every day using 130 kg of food which ordinarily would have been disposed of. It employs eight people and has thousands of volunteers. The lockdown imposed during the Covid health crisis did not stop the restaurant's actions. The team had to adapt to the restrictions imposed by opting for the delivery of packed lunches to poor families.

Case N° 2 - Michelin-starred Parisian gourmet restaurant

F.U. is a Starred Chef, "Meilleur Ouvrier de France" who opened a gourmet 20 seat restaurant in Paris, in June 2019, which quickly became starred in January 2020, and which offers contemporary cuisine balanced with quality tasty produce, using seasonal ingredients with the attention to detail on order to propose a high quality meal.
The COVID crisis hit him hard, six weeks after having obtained his first star. The success of the restaurant which quickly became popular in this district of Paris, was totally halted, leaving F.U. struggling with staff leaving, high bills and government aid which was difficult to obtain due his lack of a baseline year.
The closure which totalled 11 months, prompted him to continue with a takeaway service and meal plateaus delivered to a local hotel, in order to maintain a contact with his customers and for him and his wife, to maintain some kind of activity.

4. Results and discussion

The Covid crisis has forced French restauranteurs to close their establishments on two occasions, the first between 14 March and 3 June 2020, and the second from 29 October 2020 to 19 May 2021 with the partial opening of terraces, but they had to wait till the 9 June 2021 for the complete reopening including the interior of their establishments.

These imposed closures completely disrupted the sector forcing restauranteurs to adapt to the situation by showing ingenuity just to survive. At the same time and under the same conditions, the activity of fast food and dark kitchens[1] experienced a remarkable growth, thanks to a particular business model based on takeaway, delivery platforms and click & collect. In order to minimise losses and maintain some kind of activity, some restauranteurs didn't hesitate to use the same economic models adapting them to their own way of working.

1 The dark kitchens are what are called "ghost restaurants". These are virtual, online restaurants that do not rely on the reception of the public. They are a big success with employees at noon and young workers in the evening.

The tables below show the detail of the business model innovations deployed by the two restauranteurs to cope with the months of forced closure. The analysis of the data collected during the interviews permitted the emergence of four categories reflecting the main business model innovations that they have put into place: Innovations in the restaurants' 1) activities, 2) resources, supplies & skills, 3) revenue model and 4), beneficiaries of value creation.

Table 1: Business model innovations of a Michelin-starred Parisian gourmet restaurant

Michelin-starred Parisian gourmet restaurant of 20 seats	**What was unchanged**	**What was eliminated**	**What has been added**
Activities		On-site gourmet catering	**Gourmet catering to take away:** 2/3 of the activity during the lockdown new takeaway card respecting gastronomic codes Restitution with assembly of the dishes by the customer at home 15/20 meals a day (rather on weekends) **Meal trays delivered for room service at a contiguous Parisian hotel** 1/3 of the activity during the lockdown Development of a specific offer for the hotel Peak of 80 trays for Valentine's Day 2021
Resources, supplies and skills	**Human resources**: The Chef entrepreneur **Food supplies:** Same suppliers to keep the same gastronomic line **Service Providers:** Maintaining the Website Manager **Material resources:** Restaurant equipment (vacuum packing machine) **Skills**: Catering skills already acquired	**Human resources:** 7 employees on furlough who did not return after the lockdowns	**Human resources**: The wife of the Chef entrepreneur (packaging, bagging) Supplies: Packaging for takeaway **Skills**: New staff (to be trained before the reopening in June 2021). **Service providers**: Web page dedicated to takeaway and display on the front of the restaurant
Revenue model	**Cost structure**: *Fixed Costs* Rents maintained Loan drafts maintained *Variable Costs* Certain wage costs (ACMS, occupational medicine) maintained Same multiplier coefficients to maintain the same food quality URSSAF costs maintained Certain variable costs (electricity, gas) maintained	**Revenue** On-site gourmet catering **Cost structure**: *Fixed Costs* Cancellation of the rent increase *Variable costs* Salaries of employees paid by the state **Financial balance**: Not achieved, significant losses	**Revenues: 80% drop in turnover** Gourmet catering to take away Sale of meal trays to a hotelier Monthly aid from the state (difficult to unlock because no reference year, opening of the restaurant in June 2019, start January 2020, aid 2 months late) No State-Guaranteed Loan Use of the restaurant's own funds

Michelin-starred Parisian gourmet restaurant of 20 seats	What was unchanged	What was eliminated	What has been added
Beneficiaries of value creation	**Clientele**: Same large neighbourhood clientele to maintain the link that has been keen to support the restauranteur		**Clientele**: Some new customers

The entrepreneur and Chef decided to maintain an activity during the forced closures to keep a presence in the restaurant which was important for its newly acquired clientele and to maintain physical activity. Very quickly, and relying on skills acquired from catering, he developed a takeaway menu which respected the gastronomic codes of his starred restaurant and whose produce was intended to be assembled by customers in their own kitchen.

In addition, to assist a hotel neighbouring the restaurant that was not able to maintain its activity without offering a catering service, he started to produce food trays that he delivered, operating in particular on the weekend and on special occasions.

His opinion on this period is simple, "*Without state aid, I would not have survived, it is the state that saved us*". He also had to overcome other acute problems during the same period: the loss of all his staff at the reopening, uncertainty about the reopening dates and significant financial losses in 2020.

The analysis of this first case study reveals that the main components of the business model which were able to evolve were: 1) the activities, 2) the resources and skills, and 3) the revenue model. As we can see in Table 1, the resources were adapted, even innovated in order to accommodate the restaurant's new activities. Since the restauranteur has lost many of his employees (some because they were scared to be contaminated and some others because the restauranteur couldn't afford to pay them), his wife had to step in to replace the labour force and take care of the packaging among other responsibilities.

In this example, the restauranteur and Chef was able to prepare the meals. He demonstrated his resilience, adapting to the situation and innovating to continue to serve their customers. To help promote their new activities, he created a Web page dedicated to takeaway menus. Even though the turnover dropped by 80%, he declared having acquired new customers and developed a business to business activity by selling to the hotels.

Table 2 presents the business model innovations of the Parisian social and solidarity restaurant during the months of forced closure of 2020 and 2021.

Table 2: Business model innovations in the Parisian social and solidarity restaurant

Parisian social and solidarity restaurant (Association Law 1901)	What was unchanged	What was eliminated	What has been added
Activities	**Publishing** (anti-waste cookbook)	**Gastronomic catering** on site (100 seats/day, unsold recycling) **Art gallery** (collage, paintings, sculptures...) **Event**	**Packed lunches** (5000 baskets/ day) **Logistics management of deliveries**
Resources, supplies and skills	**Human resources**: 100 Grand Chefs (in rotation), 100 volunteers per evening, 8 employees	**Material resources:** Existing restaurant (kitchen, room)	**Material resources**: Cuisines of partner chefs

Parisian social and solidarity restaurant (Association Law 1901)	What was unchanged	What was eliminated	What has been added
	Supplies: Unsold from mass distribution, Food Bank		
The revenue model	**Revenues**: Patronage (Accor Hotels, Carrefour Foundation, Voyageur du monde...), publishing. **Cost structure:** Donations of food products (The Food Bank, Metro, Carrefour, Intermarché, Elle & Vire, ...) Grand Chefs offering their time gracefully Volunteers (aviation, gastronomy, logistics...) **Financial equilibrium achieved**	**Revenue:** Events	**Cost structure**: Use of volunteer Chefs' kitchens
Beneficiaries of value creation	**Employees:** Salary, adequacy with values in SD, especially social **Volunteers:** Alignment with SD values, especially social **Community**: Fight against waste, recycling, **Patrons**: Strengthening of their CSR policy, involvement of their employees (volunteering) **Association**: Associative activity maintained.	**Guests**: Gastronomic experience, cultural experience, social reintegration.	**Families staying in hotels by the SAMU social:** Meeting nutritional needs **Community**: Preparation of packed lunches (SAMU Social residents in hotels)

After a week of administrative closure, the Parisian social restaurant had to adapt its offer. Very quickly, the management team decided to start with another model based on standardising meals, outsourcing kitchens, and devoting themselves to logistics. The restaurant had to manage two additional activities for the benefit of a new category of beneficiaries (the families of the Emergency Outreach service for the Homeless). They had to prepare packed lunches (which replaced table service), their logistics and delivery. These new activities required greater involvement of partners, ranging from volunteering to material resources (i.e. kitchens of volunteer Chefs and partners).

As opposed to the previous case, more activities were cancelled than added, even though these new activities were very innovative. New resources based on volunteer work by other Chefs reduced costs. In this case, added value was created for new beneficiaries which is a distinct contrast to the first case.

5. Conclusion

Inspired by fast food business models, the restauranteurs discovered new skills, new markets and new models of value creation. They developed new ways to maintain their activity.

Restaurant n°2's social and solidarity mission allowed it to quickly bounce back from other activities. Business model innovations, carried out during and after the Covid 19 health crisis, were always taken to preserve the company's mission, first social, then environmental. The restaurant transformed its activity and launched into the manufacture of packed lunches (5000 / day at the busiest time) for families staying in the Emergency Outreach Service for the Homeless hotels. Its cost and income model based on the donation of unsold goods and volunteers allowed it to stay afloat and maintain a financial balance in 2020.

The situation is more complex for the Starred restaurant n°1 which barely opened and as such must adapt to 11 months of closure. Building on its recent success with a neighbourhood clientele, it has relied on its skills to

develop a takeaway service, intended mainly for a local clientele, and a specific offer of food trays for a hotel adjacent to the restaurant. Despite state aid (furlough for its staff, and state aid for monthly activity), the restaurant made a substantial loss in 2020, with activity remaining low (an 80% drop in turnover) and the high overheads of the restaurant (rents, loans, staff wages, employer costs, electricity etc.).

According to this study, we could obtain some preliminary answers to our research question: how did the restaurants innovate their business model in order to adapt it to the Covid crisis? The results show that the activities, the resources and skills, the revenue model, and the beneficiaries have been transformed even sometimes reinforced in order to keep the business. In the two cases, the inner resources were mobilised and the offer was changed. As regards the suppliers, their profiles have been changed because of the take away offer which pushed the restauranteurs to have new recipients and new materials in order to adapt their offer. But as presented in the conceptual model, all the items presented were not especially discussed by the restauranteurs. They were in a survival situation and they had to focus on the core items of the business model: the activities, the resources & skills management and the revenue model. Even with the significant results of this paper, it is limited by the fact that we present and analyse two case studies which don't allow us to generalise the results. The future study of 20 managers will cast more light on the restauranteurs practices during the Covid crisis.

References

Doody, O., & Noonan, M. (2013). Preparing and conducting interviews to collect data. *Nurse Researcher*, 20, 28–32.

Foss, N.J. & Saebi, T. (2017). Fifteen years of research on business model innovation: How far have we come, and where should we go? *Journal of Management*, 43 (1), 200–227.

Harms R., Alfert C., Cheng-Cheng C. & Kraus S. (2021), Effectuation and causation configurations for business model innovation: Addressing COVID-19 in the gastronomy industry, *International Journal of Hospital Management*, 95, 2021.

Irvine, A., Drew, P., & Sainsbury, R. (2012). Am I not answering your questions properly? Clarification, adequacy and responsiveness in semi-structured telephone interviews and face-to-face interviews. *Qualitative Research*, 13, 87–106

Järvenpää, S.L. & Lang, K.R. (2005). Managing the paradoxes of mobile technology. *Information System Management*, 22(4), 7-23.

Miles, M.B. & Huberman, A.M. (1994). *Qualitative Data Analysis, 2nd edition*, Sage Publications, Thousand Oaks, CA.

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers* (Vol. 1), John Wiley & Sons.

Patton, M. (2002). *Qualitative Research & Evaluation Methods, 4th edition*, Sage publications, Saint Paul, MN.

Peng, N. & Chen, A. (2021), Consumers' luxury restaurant reservation session abandonment behavior during the COVID-19 pandemic: The influence of luxury restaurant attachment, emotional ambivalence, and luxury consumption goals, *International Journal of Hospitality Management,* 94.

Sobaih, Elshaer, I., Hasanein, A.M. & Abdelaziz, A.S. (2021). Responses to COVID-19: The role of performance in the relationship between small hospitality enterprises' resilience and sustainable tourism development, *International Journal of Hospitality Management,* 94.

Verstraete, T. *et al.* (2012). Le business model : une théorie pour des pratiques », *Entreprendre & Innover*, 1 (13), 7-26.

Learning Based on Co-Creation Processes: A Glimpse of the (Demola) Pedagogical Innovation Training Course at IPV

Susana Amante and Rosina Fernandes
Polytechnic Institute of Viseu and CI&DEI, Viseu, Portugal
susanamante@estgv.ipv.pt
rosina@esev.ipv.pt

Abstract: The development of technologies, services and products in our increasingly global, interconnected, and digital world implies the training of future professionals capable of solving challenges, embracing diversity, and co-constructing innovative and disruptive scenarios. Higher Education (HE) has been adapting to these times of change and, consequently, the academy has started to open doors to partnerships with local organisations, in synergies that go beyond internships to include research and a modernisation agenda, with clear benefits for all the stakeholders and with positive effects on the national economy. Thus, pedagogical practices need to be updated, and Demola model aims at contributing to innovation processes by fostering academia-industry collaboration. In this study, we will focus on the first edition (January-June 2021) of the project entitled "Learning based on co-creation processes," funded by POCH, developed in a partnership with Demola Global, and in close connection to another project, Link Me Up, integrated in a consortium of 13 Polytechnic Institutes, including the Polytechnic Institute of Viseu (IPV). Specifically, we will focus on 1) the Demola methodology and tools used by the participants in the Pedagogical Innovation Training course at IPV, Viseu, Portugal; 2) the questionnaires applied to the team of IPV trainees/facilitators; and 3) the reports they wrote at the end of the process to a) analyse the profile of the teaching staff seeking alternatives to improve their teaching practice; b) assess their perception of the Demola pedagogical innovation course, and c) the implications on their future practices. Our findings reveal that this project that offers pedagogical innovation is highly valued by the participants at IPV, as they feel they are more open: to collaboration within and outside the academia; to use innovative tools and platforms; to acknowledge the need to accept and manage uncertainty and to facilitate societal challenges in multidisciplinary teams of (inter/)national students.

Keywords: co-creation, pedagogical innovation, Higher Education Institutions, Demola methodology and tools, Polytechnic Institute of Viseu (IPV)

1. Setting the scene: From knowledge production and transfer to hands-on knowledge co-creation and sharing

> *… they [Higher Education Institutions] are seen as essential engines of development, fertile grounds for new generations of professionals, and indispensable providers of smart solutions to future questions. (Noorda, 2018, p. 25)*

The Bologna Declaration of ministers from 29 European countries, signed in June 1999, and which resulted in the so-called Bologna process (now with 49 signatory countries), intended to create a European Higher Education Area (EHEA), establish the Bachelor-Master system, increase staff and students' mobility, and facilitate employability within and across Europe. Even though it failed to fulfil its convergence ambitions, it is arguably a dynamic force for the competitiveness of European Higher Education Institutions (HEI), and it has contributed to reforms and deep transformations, such as:

> *… the adoption of a system of easily understandable and comparable degrees; the adoption of a system essentially based on two cycles (…); the establishment of a system (of accumulation and transfer) of credits; the encouragement of students', teachers', researchers' and other personnel's mobility; cooperation in quality assessment and the European competitive dimension regarding higher education. (Ramos et al., 2013, p. 69)*

The Bologna Process paradigm has been linked to the massification and democratisation of education, internationalisation, the growth of a knowledge society, and market and economic imperatives, which envisioned an alignment of Higher Education (HE) with these market-driven trends. This became even more prevalent with the Lisbon Strategy in 2000, an initiative that connected HE to the goals of economic growth and competitiveness.

This reliance of knowledge production and acquisition upon HEI is not new, albeit being associated with the cultivation of a virtuous character in Aristotelian times rather than with practical skills. HEI have always been thought of as spaces of excellence and knowledge production, as Lis (2021, p. 1) puts it: "the raison d'être of a university is to fulfil the role of a citadel of knowledge to its environment", but it has had to adapt and adjust to

the changing needs of our fast-paced and capitalist society and, consequently, be ready to prepare students for a technologically advanced, innovative, entrepreneurial, and globalised labour market. In light of this, and according to Noorda's words, quoted in the epigraph to this scientific article, we may say that HEI have played a decisive role in this connection between research and teaching and, more recently, they have also had to respond to the challenges posed by the marketisation and commercialisation of what once was considered but a mission and now "appear[s] to be conscious strategies to translate university knowledge into revenue" (Shore & McLauchlan, 2012, p. 267). This academic entrepreneurialism, which some call "third missions" to distinguish them from the two traditional core missions mentioned above, has called for a technical intelligentsia with imaginative minds and hands-on learning that applies knowledge outside academic environments and is able to strengthen the dialogue between HE and Industry (Perkmann et al., 2013; Pinheiro et al., 2015; Rybnicek & Königsgruber, 2019). Manuel Heitor (2015, p. 277), Portuguese Minister of Science Technology and Higher Education, further extends this partnership to include the government into the "so-called 'Triple Helix' of university-industry-government relations," reflecting upon a metaphor that emerged in Amsterdam in 1996.

Academia-industry collaboration is advantageous to all parties involved: it enables the latter to benefit from new knowledge generated in HEI, minimising internal R&D costs; academia also benefits from these partnerships since it can receive research funding not only from the government and other public agencies but also from the private sector, while also participating in, and providing students with, real-life challenges that the industry faces, and contributing to the economic and social wellbeing of society; students can take advantage of innovative learning environments in which classrooms are transformed into hubs for innovation and co-creation (Catalá-Perez et al., 2020; O'Dwyer et al., 2022). If HEI have become business corporations, and professors, rather than just devoting their time to research and teaching, have been turning into entrepreneurial academics, then students have these role models to look up to. Additionally, today's students know that entrepreneurial attributes are key aspects of most jobs, since permanent positions or long-term contracts with one employer are scarcer day by day forcing them to engage in freelance work and, therefore, they feel the urge to acquire enterprising skills. As Scarborough & Cornwall (2018, p. 20) remind us, "the principles of entrepreneurship apply to every avenue of life." But can these principles and skills be taught/learnt at HEI? As Amante et al. (2021a, pp. 221-222) point out:

Enterprising skills and behaviours, such as autonomy, confidence, divergent thinking and creativity, flexibility, and problem solving have been stimulated by immersion in real-life situations required by the [Project-Based Learning] PBL method in which students develop and pursue solutions to problems, ask and redefine questions, and share and debate ideas and findings, making the most of their hands-on experience, and, consequently, being empowered intellectually, emotionally, and socially.

PBL is a teaching method that has been highly valued in HE, renewing educational practices and allowing for interdisciplinary, student-centred, meaningful, flexible, and collaborative work (European Commission, 2018; Amante et al., 2021a; Amante et al., 2021b). While both the teaching staff and students become more motivated and engaged in their hands-on work, the latter clearly benefit from these learning environments based on co-creation processes (Davies et al., 2013; Pocol et al., 2022), undertaking action research, and developing competencies that will be of great importance in their forthcoming professional lives.

In this study, we will take a closer look at this interplay and the forces that drive innovation from the point of view of the teachers that participated in the project entitled "Learning based on co-creation processes," funded by POCH, and developed in a partnership with Demola Global. Therefore, in the next sections, we will focus on the Demola Portugal Initiative and, then, provide the reader with a glimpse of the Demola methodology and tools. After analysing pedagogical innovation and co-creation at the Polytechnic of Viseu, through the Demola programme, we will present a summary of the data collected from the questionnaires applied to the team of IPV trainees/facilitators and the key findings that emanated from the reports they wrote at the end of the process.

2. Demola Portugal Initiative

Starting formally in January 2021, Demola Portugal Initiative is a programme launched by thirteen Portuguese Polytechnic Institutions and Demola Global, supported by the Portuguese government through POCH and COMPETE funds.

The teacher training programme, "Learning based on co-creation processes" (POCH-04-5267-FSE-000818), is a three-year project, run through 6 semesters, and that aims at involving "900+ teachers" from the consortium. It is completely interrelated with and dependent upon Link Me Up – 1000 Ideias (POCI-03-33B5-FSE-072070), a project that operationalises the information and learning gained from the training course, by turning the participating teachers/trainees into facilitators of societal challenges that mobilise "600+ partner organizations and 4000+ students"[1]. Link Me Up focuses on students' skills development for employability and on improving companies' services/products and it will be addressed fully in another publication.

Focusing specifically on the teacher training programme in Portugal, it is important to refer that it is directed not only at the teaching staff working in HEI, but also the ones working in vocational schools, in an attempt to create an ecosystem that increases the percentage of vocational education graduates continuing their studies in HE. Therefore, in each edition, each of the thirteen Polytechnic Institutes guarantees the participation of two vocational schoolteachers from the surrounding areas to take part in training sessions together with eight other HE lecturers, the only exceptions being Coimbra and Leiria, as they always have two teams, so doubling the number of participants. But who trains these teachers?

Demola Global is a Finnish company that was created in 2008, within the "Creative Tampere 2006-2011" programme and, after experiencing great success at regional level, primarily due to the support of the Nokia Research Centre and Hermia Group, but also aided by the Council of Tampere Region and three Universities located in the same city, it soon expanded across the world (Catalá-Perez et al., 2020).

2.1 A glimpse of the Demola methodology and tools

Demola makes use of a standardised model to engage the participants in reflective practice and dialogue with their peers to adopt a focus on problem-solving, innovation and creativity in a structured and systematised way. Using MsTeams, Demola trainers bring together a group of teachers from different Portuguese Polytechnic Institutes and from multiple knowledge domains on Mondays and another on Tuesdays so that they are prepared to facilitate the implementation of tools for a comprehensive view on trends and megatrends that will shape the future and for ensuring enriched interaction during co-creation processes. Whether in a single online room or in breakout rooms and boot camps, teachers share experiences and resources, rely on feedback to design assumptions, improve ideas and prototypes over multiple iterations, have the opportunity to integrate a community of experts, inspire and lead their team of talents, beyond textbooks, on field trips to companies and research centres.

In such intensive online training course, in a total of 344 hours, teachers start by contacting different organisations to design a challenge based on societally relevant phenomena. Meanwhile, they interact using Demola Chat, explore Atlas (https://atlas.demola.net) to manage different tasks associated with the challenges they identified, and they are introduced to Miro, a visual collaboration platform, where they test hypotheses and strategic frameworks such as the PESTLE analysis, beforehand, so that they can later guide students more effectively into thinking about the phenomenon through political, economic, social, technological, legal and environmental factors.

In their weekly training, they learn about co-creative facilitation tools, namely personal mind maps; stakeholder/user group identification maps; design research, preparing students to collect qualitative data through observations and interviews; affinity diagrams to organise, compare and make connections between ideas, contrast and draw inferences from their findings; megatrend selection and future persona profiles to attempt to look ahead making predictions; ideation, and, among others, low and high-fidelity prototyping. Students follow the process submitting all those tasks on Demola Portal, some completed individually and discussed in groups afterwards, and many others in co-creation, in an eight-week period.

In the next few pages, we will look at the Demola training course at IPV, by bringing forward the teachers' own needs, and their experience resulting from their participation in this pedagogical innovation programme and mentoring activities.

[1] Quoted from https://portugal.demola.net/teachertraining

3. Pedagogical innovation and co-creation at the Polytechnic of Viseu through the Demola programme

To understand and assess the needs, levels of satisfaction, and implications on the future practices of the IPV participants in the first edition of the Demola training programme (Jan.-Jun. 2021), it is now time to analyse the questionnaires applied prior to the beginning of the course, in the middle-end, and at the end, and conclude using some thoughts shared in their final reports. Methodologically speaking, then, this study relies upon mixed methods' data analysis, in which, according to Johnson et al., there is a combination of "elements of qualitative and quantitative research approaches" (2007, p. 123). In other words, through the questionnaires and excerpts from the trainees' reports, we intend to find out their perception of the effectiveness of the training programme towards their mission as facilitators of innovation, co-creation among the several stakeholders, and regional development.

Starting with the analysis of the first questionnaire, a preliminary one to assess the teachers' needs, we realise that all those who took part in the first edition of the training course at IPV were female (90%), except for one participant (10%). However, rather than confirming that HEI in Portugal are female dominated, which is actually not accurate as, throughout the years, there has always been a higher number of men than women in Portuguese academia according to pordata.com[2], it may allow us to infer that women are generally more concerned with their teaching practices or probably they feel they need to invest more in upskilling than men.

From these ten teachers, two work at a vocational school in Viseu, Escola Profissional Mariana Seixas, and eight work at IPV: three of the trainees work at the School of Education (30%), two at the School of Technology and Management in Viseu (20%) and one in Lamego (10%), one at the School of Health (10%) and one at the Agrarian School (10%). All of them had permanent employment contracts, except for the two vocational schoolteachers and one IPV teacher who had fixed-term contracts. Besides that, the most predominant age group of the participants was between 40 and 49 years (70%), followed by teachers in-between 50 and 59 (20%), and the remaining 10% were over 60 years old. This leads us to infer that pedagogical innovation is correlated with age and job stability, that is, it depends on the teachers' availability which is directly related to maturity, job satisfaction and organisational commitment. However, their approaching retirement age may also be an obstacle that hinders investment in innovative pedagogical practices.

Regarding the teachers' qualifications, seven hold a PhD (70%), two a master's degree (20%) and one a licentiate degree (10%). Their teaching areas are diverse, ranging from the Humanities, particularly language teaching (20%), to Communication Sciences (10%), Psychology (20%), Natural (10%) and Agronomic Sciences (10%), Mathematics (10%) and ICT (20%). All participants acknowledge the need to develop skills related to innovation, co-creation, (social) entrepreneurship and they value lifelong learning, as one would expect, because they had to apply to be part of the course. For them, pedagogical innovation is not a novelty, as 70% of the respondents claimed that they had previously attended actions (over three hours) aimed at improving teaching, learning and evaluation processes in educational models in the last two years.

Closer to the end of the process, Demola trainers asked the participants to answer a questionnaire, but because some of the questions are similar to the ones that were part of the questionnaire developed by the consortium and applied in July 2021, we decided to focus on the ZedGraph below only:

Figure 1: ZedGraph created by Demola Global, before the end of the training course

All the questions regarding facilitation hovered around 80%. Later, in July, when asked about the extent to which the training course met their expectations, we realise that the respondents' overall satisfaction with the training course was quite positive, as, in a 7-point Likert scale, all the answers were 4, that is neutral, with 20%, or above,

[2] https://www.pordata.pt/Portugal/Docentes+do+ensino+superior+total+e+por+sexo-666

with 30% of trainees being satisfied, 40% very satisfied and 10% completely satisfied. Diving deeper into their reasoning for choosing these options, we could understand that, generally speaking, they believe that the course objectives were clearly met: 20% strongly agree with the assertion (7 points), 40% agree with it (6 p.), 20% somewhat agree (5 p.) and the remaining 20% are neutral (4 p.).

Interestingly, despite the very positive answers to the previous questions, 10% of the respondents were not that much satisfied (3 p.) with the way the course was structured, 10% seem to be neutral (4 p.), again 10% agree with its organisation (6 p.), and 70% of the respondents say they somewhat agree (5 p.) with it. Regarding the appropriateness of the blended-learning model, there was no consensus, as 20% strongly agreed with it, 30% agreed with the model, 20% felt somewhat satisfied with it, 20% neither agreed nor disagreed with it, and 10% considered it was somehow not efficient. Maybe this lack of consensus is justified by the fact that, with the spread of COVID-19, and in the context of lockdown and working from home, face-to-face interaction was (almost) non-existent, and the only moment when it occurred, in case it did not happen virtually instead, was during implementation when the facilitators visited the partner company with their teams. Congruent with the above, when asked the extent to which they agreed that the teaching methodologies were innovative, we once again found that 20% strongly agreed with it, 30% agreed with the assertion, 40% somewhat agreed with it, and 10% were undecided or neutral on the matter. We believe that these percentages were quite high bearing in mind that 70% of the participants had already attended actions whose purpose was to improve teaching practice, as mentioned.

Focusing on the tools (e.g., miro, canva, problem tree, …), it was found to be at a high level, with 40% of respondents strongly agreeing with its effectiveness, 10% agreeing with it, 40% somewhat satisfied with getting acquainted with it, and 10% neutral or undecided. The use of platforms (e.g., Atlas, Demola Chat) was also viewed very positively, as 30% strongly agreed that they were helpful, 30% agreed with it, again 30% somewhat felt them as useful, and 10% remained neutral.

The consortium questionnaires also revealed that the training programme helps develop different skills, such as communication, group work, creativity, and the ability to think critically, so important to co-work and facilitate innovation, as the following graphs show:

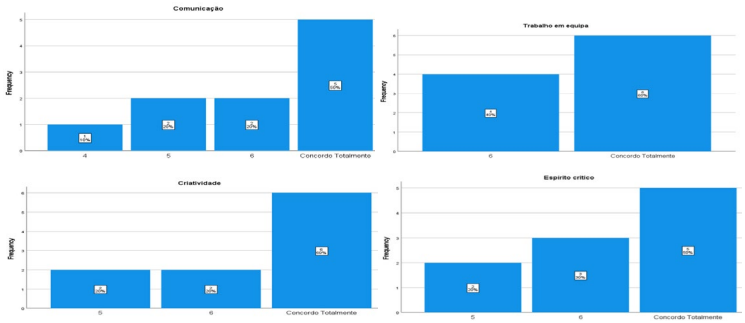


Figure 2: Graph 1, above left, refers to communication skills; on its right, teamwork; below left, creativity, and, on its right, critical thinking

The same is felt regarding other skills equally important, such as leadership, entrepreneurship, ability to work with the team of students, and to collaborate with the partner organisations. It is worth mentioning that entrepreneurship and the ability to work with partner organisations received the same ranking of 7, 'strongly agree', by 60% of the participants, whereas 20% agree that they are important skills that the training course was meant to impart, and 20% say they somewhat agree with it. There is also little doubt that the training course provided the teachers with the opportunity to work with their team of students, as 40% strongly agree with it, followed by 40% who say they agree, and 20% who somewhat agree with it. Leadership failed to garner that much consensus, even if 40% strongly agreed it is a skill developed by Demola in its training course. 20% of the respondents agree with it, and some other 20% somewhat agree with it, but 10% are neutral or undecided and the remaining 10% are not very confident about it, awarding it 3 points only.

Maybe because digitalisation has been playing an important role in today's ever-changing and globally connected world, when asked about the importance of the development of digital competencies and the course's contribution to unlocking opportunities for internationalisation, 20% of the respondents strongly agreed with it, 60% agreed the training course fulfilled their expectations and the remaining 20% somewhat

agreed with it. Research, data collection and analysis, as well as collaboration and networking among facilitators were also highlighted as very positive aspects of the training, as we observe below.

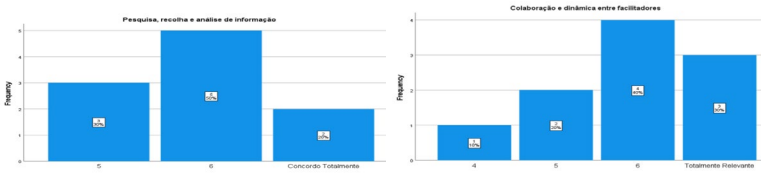


Figure 3: Research, data collection and analysis, on the left, and collaboration and networking among facilitators, on the right, assessed as highly positive

Focusing on the last questions, when asked if they thought it would be possible to implement co-creation projects at IPV, their answers were favourable: 30% believe they can do it within the next 12 months, 60% within 12-24 months, and 10% answered it seems hard to implement co-creation projects at all. In line with the needs analysis conducted at the beginning of the project, results show that 80% of the respondents see this course as incremental innovation, whereas 20% see it as disruptive innovation. Finally, when asked whether they would recommend the training programme to other colleagues, 90% answered positively, which is crucial to assess the success of this initiative that aims to forge academia-industry partnerships.

4. Conclusion: Looking back and moving forward

"Learning based on co-creation processes," a project that has been substantiated via the training course presented above, designed and led by Demola Global, offered pedagogical innovation and was highly valued by the participants at IPV. In one of the final reports, we could read that…

It was the first time I worked in a co-creation process, so personally it was enriching. I learned new platforms (Miro Board) and tools that I can apply in the future in my professional life and in the classroom context. The team that I facilitated does not see us as the teacher to whom they have to obey, but as someone who guides them to achieve a goal… (H.E.C., 1st batch, June 2021)

By participating in the project, IPV teachers became trainees and facilitators, and they claim they are more open to use innovative tools and platforms; to collaborate within and outside the academia; to acknowledge the need to accept and manage uncertainty and to facilitate societal challenges in multidisciplinary teams of (inter/)national students. In brief, they are better equipped to explore the potential of learning environments based on co-creation processes and to be closer to the Bologna objectives mentioned above. The opinion of another teacher, also stated in her final report, confirms the above findings:

We want teaching methodologies to be more centered on the student, but our practices show a tradition focused on the passive role of the student, placing the teacher as a specialist. In this course, teachers were students too. And the students proved to be experts in the challenge explored, in the technologies and tools used, in their relationships with others. (…)[S]tudents found (…) a new partner, people who are in the labor market, (…) and who allowed them to transfer to the real world academic learning that is usually kept in the higher education institution, between classroom walls (which in this project were replaced by the windows of the online platforms) or between pages of academic works. (R.F., 1st batch, June 2021)

Much more could be said about the teachers' reflections upon the training programme, but word limits prevent a fuller examination of this training that attempted to engage so many stakeholders around concepts such as co-creation and innovation, trends and megatrends. Together, they have looked ahead exploring new teaching methods; new possibilities; exciting, new directions, tracing new paths not just in a classroom, but locally, regionally, nationally and ultimately internationally, because the world is globally connected.

References

Amante, S., Antunes, M.J., Dygala, M. and Gökce, I. (2021a). "Stepping up to Global Challenges (SGC): Empowering Students across the World". Psychology of Language and Communication, 25(1), 217-239.

Amante, S., Antunes, M.J., Dygala, M. and Gökce, I. (2021b). "Um Olhar sobre 'Stepping Up to Global Challenges (SGC) 2: learning English while fighting COVID-19'". In B. Silva et al. (Eds.), Atas do XVI Congresso Internacional Galego-Português de Psicopedagogia. Universidade do Minho, Braga, pp. 1915-1928.

Bologna Declaration. (1999). "The Bologna Declaration of 19 June 1999". Joint Declaration of the European Ministers of Education, Bologna.

Catalá-Perez, D., Rask, M. and Miguel-Molina, M. (2020). "The Demola model as a public tool boosting collaboration in innovation: a comparative study between Finland and Spain". Technology in Society 63, 101358.

Davies, D., Jindal-Snape, D., Collier, C., Digby, R., Hay, P… (2013). Creative learning environments in education—A systematic literature review. Thinking Skills and Creativity, 8, pp. 80-91.

European Commission, Directorate-General for Education, Youth, Sport and Culture. (2018). Study on Supporting School Innovation Across Europe: Final Report to DG Education and Culture of the European Commission. Luxembourg: Publications Office of the European Union. Retrieved from https://data.europa.eu/doi/10.2766/466312

Heitor, M. (2015). "How university global partnerships may facilitate a new era of international affairs and foster political and economic relations". Technological Forecasting & Soc. Change, 95, pp. 276-293.

Johnson, R., Onwuegbuzie, A. and Turner, L. (2007). "Toward a definition of mixed methods research". Journal of Mixed Methods Research, 1(2), pp. 112–133.

Lis, M. (2021). "Higher Education Institutions as Partners in Growing Innovation of Local Economy". Social Sciences, 10 (8), 316, pp. 1-20.

Noorda, S. (2018). "Autonomy: A Practice Serving a Purpose". In A. Heijnen & R. van der Vaart (eds.). Places of Engagement: Reflections on Higher Education in 2040 – a Global Approach. Amsterdam University Press, Amsterdam, pp. 23-29.

O'Dwyer, M., Filieri, R. & O'Malley, L. (2022). Establishing successful university–industry collaborations: barriers and enablers deconstructed. The Journal of Technology Transfer. https://doi.org/10.1007/s10961-022-09932-2

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., ... (2013). "Academic engagement and commercialisation: a review of the literature on university–industry relations". Research Policy 42(2), pp. 423–442.

Pinheiro, R., Langa, P. and Pausits, A. (2015). "One and two equals three? The third mission of higher education institutions". European Journal of Higher Education 5(3), pp. 233–249.

Pocol, C., Stanca, L., Dabija, D., Pop, I., and Miscoiu, S. (2022). Knowledge co-creation and sustainable education in the labor market-driven university-business environment. Frontiers in Environmental Science. https://doi.org/10.3389/fenvs.2022.781075

Ramos, A., Afonso, P., Cruchinho, A., Delgado, F., Ramos, G. and Sapeta, A. (2013). "Pedagogical changes towards the implementation of the Bologna Process. Indicators' structure of measurement". Journal of Further and Higher Education, 39(1), pp. 67-84.

Rybnicek R., and Königsgruber R. (2019). "What makes industry -university collaboration succeed? A systematic review of the literature". Journal of Business Economics, 89, pp. 221–250.

Scarborough, N., and Cornwall, J. (2018). "Preface". In N. Scarborough and J. Cornwall (Eds.), Essentials of entrepreneurship and small business management, 9th ed. Pearson Global Editions, Harlow, pp. 15-24.

Shore, C., and McLauchlan, L. (2012). "'Third mission' activities, commercialisation and academic entrepreneurs". Social Anthropology, 20(3), pp. 267–286.

Factors Enabling Student Start-ups to Commercialise Scientific Research for Demonstrating Social Impact

Dwitya Amry, Ali Ahmad and Dawei Lu
WMG, University of Warwick, Coventry, UK
d.amry@warwick.ac.uk
ali.ahmad@warwick.ac.uk
d.lu@warwick.ac.uk

Abstract: This research highlights contributions of student actors' research commercialisation efforts within the academic entrepreneurship (AE) landscape. Our review of the AE literature shows that the potential inherent in campus-based student enterprise activity has not been fully acknowledged within the AE literature. We argue that student start-ups are a viable means for demonstrating the social impact of scientific research. In this research, the aim is to map the student-led enterprise emergence and development mechanism as a vehicle for facilitating university technology transfer. Through a longitudinal case study design, the focal student enterprise's enacted process to commercialize university generated scientific research is investigated. It is shown how new technology stemming from university research was able to enhance the livelihoods of local fish farmers through the agency of student entrepreneurs. Light is shed on the enabling factors and wider university level arrangements that triggered and subsequently facilitated the case entrepreneurial endeavour. We find that an interplay of both micro- and meso-level factors enabled the case enterprise to achieve both commercial success and demonstrate social impact.

Keywords: student start-ups, academic entrepreneurship, social impact, frugal innovation, social innovation, case study, Indonesia

1. Introduction

There is growing interest in universities' third mission and the socio-economic impact that these institutions could deliver through academic entrepreneurship (AE). Based within this premise, we investigate a mechanism within technology transfer theory that is designed to leverage on universities' knowledge capital for promoting *socio-economic development*. We have previously argued that there is a need to extend the concept of 'academic' within the *AE* discourse to also include 'students' not just academic members of staff (Amry, Ahmad, Lu, 2021). Within this novel broader view, there is an urgent need for research which unpacks the best models and support mechanisms to enhance student entrepreneurship as a part of the AE landscape (Wright, Siegel and Mustar, 2017).

As universities gain traction in the entrepreneurship education arena, students in ever greater numbers are becoming equipped for *entrepreneuring* (Steyaert, 2007). As a result, there has been a gradual rise in the numbers of student start-ups (SSUs) initiated whilst at university or a few years after graduation.

Therefore, to contribute to the question of 'how best can universities demonstrate social impact under their third mission', our aim in this paper is 'to explain how student-led academic entrepreneurialism delivered social impact through university technology-linked venturing activity'. Using Vohora, Wright and Lockett's (2004) 'critical junctures in development of university spin-out companies' as our theoretical lens, we operationalise our aim via the following research question: 'What are the enabling factors that trigger students to commercialise university research output for social impact?'.

The above aim was achieved by undertaking in-depth longitudinal and qualitative case study research which charted the process of a 'student start-up' (SSU) that commercialised university scientific output. We captured both historical data on the focal SSU through archival documents from 2016 onwards and followed the student founders' lived experiences in action for a period of 8 months (between June 2021 – February 2022). Findings shed light on the myriad eco-system actors and arrangements needed to support student-led entrepreneurialism to specifically drive universities' third mission agenda. We offer pathways for augmenting AE theory reliant on a refreshed understanding of how best to demonstrate social impact through student+university+academic-industry partner triads. From a practical standpoint, we provide guidance on students' managerial and resource arrangements for initiating the venturing process that aims to commercialise university research for social impact.

The paper is structured as follows; we start by evaluating research on technology transfer, AE and entrepreneurship education. Next, we explain our methodology and analytical methods. Findings are then presented informed by Vohora, Wright and Lockett's (2004) model of critical junctures followed by a discussion on the main contributions of the research. We conclude by suggesting future research directions along with laying out our limitations.

2. Literature review

2.1 University technology transfer, research commercialisation and academic entrepreneurship for socio-economic development

University technology transfer mechanisms are put in place to facilitate the commercialisation of scientific inventions. In formal technology transfer, a legal aspect of ownership through intellectual property rights (IPR), such as patents, trademarks and trade secrets must exist. However, the process of legally formalising ownership of any technology requires following rigid and strict rules. Which means that there might exist some technology that is 'innovative' but is not qualified for patenting (Abreu and Grinevich, 2013; Belitski, Aginskaja and Marozau, 2019). For example, specific know-how or technical skills, which the owner of such knowledge can leverage for joint or contractual research or consultancy (Abreu and Grinevich, 2013).

Formal technology transfer leading to commercialisation requires an intense multi-stakeholder effort (Carayannis *et al.*, 2018). From a process perspective, considerable resources are required and the presence of supporting mechanisms (institutionalised practices and a particular kind of ecosystem) are essential for universities to execute formal technology transfer. For example, a pre-requisite would be to attract top quality academic faculty (Perkmann *et al.*, 2013) that generates patent-able research outputs, access to research funding (Cunningham *et al.*, 2014; Gosens *et al.*, 2018) and the availability of an entrepreneurial university ecosystem (Autio *et al.*, 2014). Although it is suggested that the potential financial returns from formal technology transfer could be immense (Vinig and Lips, 2015), overall all the required preconditions are unattainable for many universities (Carayannis *et al.*, 2018; Lehmann and Menter, 2018). This is especially the case where universities are geographically located in regions with nascent innovation and entrepreneurial ecosystems, earmarked by institutional voids. These hinder the ability of ecosystem actors to harness knowledge capital from universities (Arocena, Goransson and Sutz, 2018).

In light of the above, debates have emerged on the role of universities in socio-economic development (Arocena, Goransson and Sutz, 2018). A strong focus on the formal routes of technology transfer can stall the creation of new academic outputs targeted towards solving particular societal problems (Guindalini, Verreynne and Kastelle, 2021; Cinar and Benneworth, 2020).

Brundenius, Göransson and Carvalho De Mello (2016) highlight a growing interest amongst economists to measure economic growth that can capture *real* progress. They argue that GDP as an indicator of economic growth discounts important other non-economic indicators such as people's wellbeing and environmental sustainability. Contemporary measures for 'growth', such as the United Nation's Sustainable Development Goals, accentuate universities' role in socio-economic development and raise questions on how universities ought to be showcasing impact.

In the past, a university's role in teaching and research was assumed to contribute to economic growth through the supply of human capital that would ultimately increase economic productivity leading to higher GDP. However, owing to the shift in the 'development' paradigm, how universities ought to contribute to society is also being reconceptualized – especially in light of universities' new 'third mission' (Bölling and Eriksson, 2016; Marzocchi, Kitagawa and Sánchez-Barrioluengo, 2019). This shift requires universities to reframe 'academic entrepreneurship' and related activities to become wider-scoped and beyond formal technology transfer, and to include activities that can contribute to newer non-GDP based development paradigms (Amry, Ahmad and Lu, 2021).

2.2 Entrepreneurship education and student entrepreneurship

A growing number of researchers now call for paying more attention to entrepreneurship education owing to its impact on increasing SSUs and how such start-ups are embedded within the wider AE landscape (Wright, Siegel and Mustar, 2017). Such researchers emphasise the need to factor-in entrepreneurship education's

impact when we assess universities' overall contributions to society (Morris and Kuratko, 2014; Edokpolor and Somorin, 2017). For example, entrepreneurship education in developing countries such as Indonesia is encouraged by policy interventions as a way to address the demographic bonus and as a solution to the potential increase in unemployment (Wiratno, 2012). Such interventions are based on the perceived effectiveness of entrepreneurship education to enhance the likelihood of university students transitioning into entrepreneurship, and as a result adding value to the overall economy.

Although studies have shown that there is a significant relationship between entrepreneurship education and entrepreneurship outcomes (Cui and Bell, 2022; Martin, McNally and Kay, 2013), under more careful observation, outcomes vary and 'success' depends on teaching pedagogy and the context within which it is embedded (Rauch and Hulsink, 2015). A study based on US data found that graduate SSU founders, interestingly, do not possess any formal entrepreneurship education attainment such as an MBA or other business degrees. Instead, the campus 'environment' and its ecosystem are the main enablers for new venturing activity (Åstebro, Bazzazian and Braguinsky, 2012). A part of 'campus culture', for example, would be having peers that are collectively primed for entrepreneurship, which positively predisposes students to pursue entrepreneurship (Lerner and Malmendier 2013). Since the influencing and contributing factors to entrepreneurship education provision and 'success' are nuanced (Hayter, Lubynsky and Maroulis, 2017), there are calls for contextualising its delivery to fit-in with the context in which it is embedded and to generate the sort of opportunities that are likely to be pursued (Adekiya and Ibrahim, 2016).

Studies looking into the phenomenon of student entrepreneurship as a body of literature within AE research, have emphasised that entrepreneurship support policies, programmes and empirical research should no longer just focus on faculty (Siegel and Wright, 2015; Hayter, Lubynsky and Maroulis, 2017). Consequently, leading to the assertion that universities' mission in economic development should not be limited to intellectual property commercialisation. As student entrepreneurship rates continue to rise, more empirical work is need for understanding how these new academic entrepreneur actors create ventures, and in what ways are they able to contribute to a university's third mission agenda.

3. Research methodology and theoretical framework

Our study seeks to explain how student-led academic entrepreneurialism delivers social impact through university technology-linked venturing activity. A unique aspect in this research is our real-time tracking of the venture creation process enacted by student entrepreneurs. To guide our inductive inquiry, we adopt the following research question: "What are the enabling factors that trigger students to commercialise university research output for social impact?"

Using the above guiding question, we focus our attention to the focal case's *entrepreneuring* activity – a termed coined by Steyaert (2007); effectively, the process of 'becoming' instead of seeking to explain entrepreneurship in its stable state of being. This will allow the research to "follow a logic of recursivity" (Steyeart, 2007, p. 471) which will enable us to understand the entrepreneurial process situated in the experience of the actors as they are living within it. To answer our research question, we chose an 'extreme' case study (Yin, 2018) that demonstrated the context and the process through which an invention (developed by faculty) was transferred and subsequently commercialised by student entrepreneurs with the explicit goal of socio-economic development. Our case selection rationale meant that we strove to identify a non-traditional case of AE, where students (instead of faculty) were the main actors of research commercialisation, who were embedded with a 'non-mature entrepreneurial ecosystem'. A non-mature entrepreneurial ecosystem is characterised as an environment where innovation intermediaries (such as 'technology transfer offices' and other supporting mechanisms) are weakly connected or non-existent which results in lack of coordination and an inefficient use of resources (Schaeffer and Matt, 2016).

In collecting data, our goal was both to understand the *entrepreneuring* experience and to situate this in a particular context, achieving a contextual explanation of the phenomenon under study (Welch *et al*, 2011). Therefore, not only the actors accounts are needed, but also a rich understanding of the context in which the actor's experience is embedded in must be achieved. We map out the *entrepreneuring* process to uncover how venture creation occurs by asking 'what are the activities you actually have to engage overtime to produce it' (Gehman *et al.*, 2018, pg. 289). By adopting this methodology, we were able to analyse the enabling factors, ongoing challenges recursively and in real-time.

Our fieldwork with the SSU commenced in mid-2021. During this period, the start-up was in the final stages of testing their prototype. Our archival data on the SSU, however, dates to 2016 allowing us to chart changes and processual dynamics longitudinally. The limitation of a single case was addressed by performing a longitudinal study, mapping both historical along with real-time events. As a part of our data collection effort occurred during the lockdown owing to the COVID-19 pandemic, primary data was mainly collected through recommended online methods (Salmons, 2016). Our approach followed Pink et al's (2016, p. 3) concept of digital ethnography where "we are often in mediated contact with participants rather than in direct presence".

For data analysis, we converted all digital recordings into textual data. Data was collected via interviews, extant text archives (such as social media captions) and through the creation of memos on non-textual data which included videos, pictures, and virtual meeting observations (Salmons, 2016). Creating a textual database was imperative as it allowed for data coding. Coding was essential for drawing out concepts, properties, and dimensions of emerging categorical themes. Through the principles of constructive grounded theory analysis as outlined by Charmaz (2006), we undertook the recommended three-steps of coding – (a) initial coding, (b) axial coding, and (c) theoretical coding while going back and forth to the literature, anchoring it to our theoretical framework drawn from Vohora, Wright and Lockett's (2004) 'critical junctures in development of university spin-out companies'.

3.1 Case organisation

The case chosen was an aquaculture technology-based start-up founded in 2017 and was formally registered as a limited company in 2019 under its current name. The product commercialised was based on Microbubble Generator (MBG) technology invented by a faculty member of a public university in Indonesia. Although the technology was invented by faculty, the initial idea of commercialisation came from a group of undergraduate students who were a part of the research team led by the faculty-inventor. These students subsequently mobilised resources to form a start-up, targeting small-holder fish farmers as potential users without directly involving faculty in the start-up creation process. This start-up has undergone several iterations in terms of team composition, technology, product, and design developments since 2017 to 2020 to achieve product-market fit (see figure 1). In the first quarter of 2021 their official product was launched and sold to its intended target users.

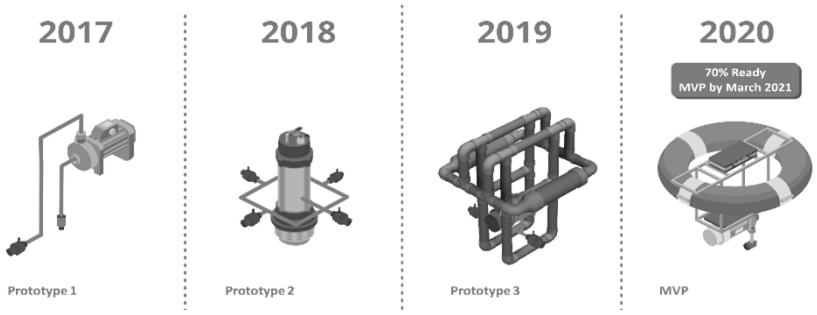


Figure 1: MBG Design Iteration (author's archive provided by the case organisation)

3.2 Theoretical framework: Critical venture creation junctures

Findings are presented using Vohora, Wright and Lockett's (2004) model of 'critical junctures' (p. 150) – which emerged from research on university-based spin-out companies. Their conceptual model is well aligned with the ethos of our study as they hold the view of non-linearity in the venture creation process. The model focusses on the critical moments that are either contributing or challenging the *entrepreneuring* process during venture creation. The critical junctures model creates a starting analytical lens to understand SSUs as a research commercialisation mechanism.

According to their framework (see Figure 2), the phases that an academic spin-off would go through consist of (1) opportunity framing; (2) pre-organisation; (3) re-orientation; and (4) sustainable returns. These different phases consist of various actions enabling the crossing of *critical junctures* leading to the subsequent phases. These junctures are: (1) Opportunity recognition, (2) Entrepreneurial Commitment (3) Threshold of Credibility and (4) Threshold of Sustainability.

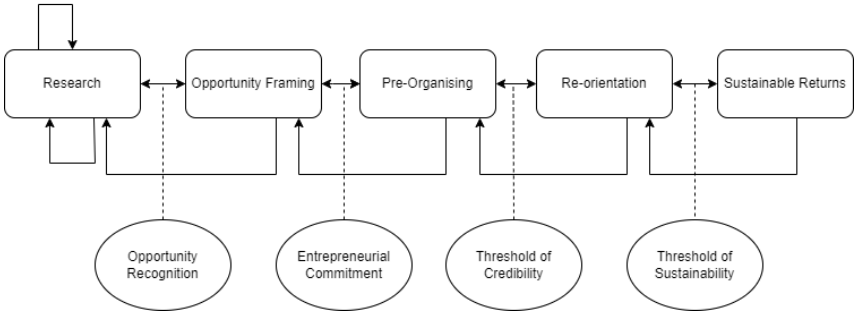


Figure 2: Critical Junctures by Vohora, Wright and Lockett (2004)

4. Findings and analysis

4.1 Universitas Gadjah Mada – A pro-social and developmental university culture

Universitas Gadjah Mada (UGM) is one of the 4,621 higher education institutions (HEI) in Indonesia (PDDIKTI, 2019). UGM's mission is to carry out education, research, and community service as well as the preservation and development of beneficial knowledge for the community.

UGM frames their identity around the notion of 'development' and encourages their students and staff to uphold pro-social values. This is evident by (1) their student induction programme to ensure that new students understand UGM's developmental agenda and their role in society; and, (2) the curriculum is designed to encourage students to actively engage in services to the community through especially allocated government funding for research that generates community service-type activities. UGM delivers university-wide programmes that facilitate direct student interaction with underserved or marginalized communities spread across Indonesia. Some of their programmes embody the spirit of development and are classed as a form of 'community service'.

UGM's community service ethos differs markedly from the concept of 'community engagement' as is known and practiced in the developed world. Community service entails 'giving back', instead of 'extracting from' communities for the purpose of socio-economic development. It is recognised that the university as an institution has a privileged status that can socially and economically uplift and empower communities through their services and activities.

4.2 The critical junctures

In this section, the *entrepreneuring* process of the aquaculture technology start-up will be outlined. This start-up was formally launched in 2019 by undergraduate student founders. This section is presented to follow the student team's '*entrepreneuring*' attempts. The sub-sections below present the outcomes of this process mapping exercise using the vocabulary and conventions of Vohora, Wright and Lockett's (2004) critical junctures framework.

4.2.1 Availability and access to research output

A member of staff and their research team from the Centre of Energy Studies at UGM invented a technology labelled the 'Microbubble Generator' (MBG). Through an aerator, the MBG improved oxygen saturation levels using tiny bubbles, enhancing water quality and, thereby, improving aquatic life's growth. The initial application of the technology was for industrial water waste treatment, funded by the Ministry of Higher Education, Research and Technology (at the time) under the Appropriate Technology scheme. Nevertheless, the technology was not intended for commercialisation and instead was seen as a 'community service' application for showcasing research impact.

During the initial stage, to identify the technology's use case, the academic inventor collaborated with academics from the Faculty of Agriculture and became involved in a company CSR (Corporate Social Responsibility) project. In this project, they sought to investigate whether the MBG could be used to solve a problem that agriculture researchers had previously identified: low levels of fish harvest yield and its link to poor pond water quality. The data generated through this funded project fed into the problem validation phase. However, as the intended

research objectives were achieved, after the project's termination, the MBG apparatus and equipment were shelved, without any further commercialisation attempts.

4.2.2 1st Juncture: Opportunity recognition to opportunity framing

During the above CSR-funded project, the academics involved included several undergraduates, hiring them as research interns and analysts. This followed a cultural norm where the intention was to provide a learning opportunity so students could gain skills and experience through a real-life project outside of their normal curriculum. It was a non-institutionalised rule but was understood by all faculty members at UGM. Students too understood that to be chosen by faculty to take part in such projects was a matter of privilege, whilst being perfectly aware that their involvement would not be a part of any structured assessment or included in their credit points.

This 'culture' within UGM cultivated a certain kind of attitude that led students being pump primed to actively engage in external projects with their tutors. This unwritten rule became key for the opportunity recognition juncture for the commercialisation of the MBG technology. The students involved in the project showcased enterprising behaviours that lead to the framing of both a 'commercial opportunity' and an ability to generate 'social impact'. Student interns and research assistants spotted a market gap for a technology for small-holder fish farmers that would uplift their livelihood. Hence, UGM's pro-social ethos, unwritten rules about student engagement in real world projects and students' own enterprising behaviours triggered the start of the *identification* and *framing* of both the 'commercial' and the 'social upliftment' opportunity that the focal technology presented.

4.2.3 2nd Juncture: Entrepreneurial commitment to pre-organization

After the student founders identified the commercial opportunity as part of their work experience in the CSR-funded project, they needed to seek permission to further develop the technology for commercial use. During this phase, the academic inventor bypassed the university's TTO as the student team did not pay any licensing fees under an agreement to modify or use the MBG technology. As the student founders had built a good relational foundation with the inventor, within an education-for-the-sake-of-education mindset, they were allowed to continue further research and development without any formal contractual arrangement. Despite though, the academic inventor continued to provide mentoring support. Once commitment was achieved, the process moved on to the next phase where resource mobilization needed to occur.

4.2.4 3rd Juncture: Threshold of credibility to re-orientation

To pass this juncture, mobilising knowledge and capabilities are required as pathways to venture creation for research commercialisation. In the focal case, founders needed to form a sub-team to validate their idea. Founders comprised a group of friends that were previously involved in an SSU competition, where they pitched the MBG's potential for aquaculture. Our evidence showed that competitions of various types became key in mobilising resources in terms of formulising not only the viability of the technology, but also teams' capabilities.

The case analysis shows that for SSUs to commercialise university research, student business competitions are relevant not just to validate particular value propositions (Stolz, 2020), but also as a way to mobilise resource capabilities to pass the juncture of 'threshold of credibility'. This then allowed the student founders to start the re-orientation phase of research commercialisation in terms of capability needs, further validation and anticipating future resource requirements and mobilisation needs.

4.2.5 4th Juncture: Threshold of sustainability to sustainable returns

Testing the commercial viability of the technology was crucial for ensuring a steady demand for the end-product. Four iterations were required for the main technology to reach a level of commercial 'maturity' from the initial research undertaken by the lead inventor (see Figure 1). Tests as a part of these iterations were conducted in the field through the cooperation of local fish farmers.

In this phase, the SSU required a close co-creative working partnership with the target beneficiaries. As the founders had a specific customer group in mind, there was a need to precisely understand how and in what way the technology might be used by target end-users. This was only possible because channels of communication were opened much earlier with the target fish farmer community through relationship building measures

initiated during the earlier CSR-funded stage. Further governmental funding created opportunities to validate the technology's value proposition. As the target users experienced the benefits of the technology first-hand, an incentive in the form of government subsidies became fundamental in securing access to their ponds. These were to be used as 'living labs' to constantly test and monitor the prototype.

The above co-creation process resulted in a product that utilized affordable materials which were easily available locally, and in alignment with frugal innovation concepts (Weyrauch and Herstatt, 2017). It was also important that the device's cost was kept at a level that fell within the end users' willingness-to-pay (Ali, Acton and Bhatt, 2019). These aspects led to an overall value proposition that could meet the threshold of the venture's dual-purpose sustainability criteria, where both commercial returns were achieved alongside the delivery of social impact.

5. Discussion

Based on our findings, it can be determined that several pre-conditions are essential for students to become focal actors in commercialising university scientific output and transferring technology to societal actors/communities. We found that exposure to socio-economic development concepts and community-motivated research is a foundational basis for the recognition of potential commercialisation opportunities that generate affirmative student action. We also found that student entrepreneurs would be much more likely to take part in a research commercialisation project if they were first actively engaged with their tutors in extra-curricular and related research projects. Such projects lead to experiential learning, which increases students' level of confidence and imparts essential intangible enterprise skills augmenting their competence in *entrepreneuring*. Although, past research has suggested that student project-based and experiential learning is a major factor in enhancing entrepreneurship behaviour (Sukavejworakit, 2018), we find that an element of action-oriented pedagogy that facilitates direct involvement with grassroot communities is also imperative for igniting student pro-social behaviour. Such behaviour is a precursor for framing opportunities to solve societal problems.

Past empirical research in entrepreneurship education area has identified the value of student competitions, arguing that these positively influence student *entrepreneuring* capabilities by augmenting their enterprising behaviours (Stolz, 2020). Student competitions are a way for students to iterate a value proposition leading to a viable business model. However, in this research it was found that students use competitions to not only test and iterate their value propositions, but also to attract and mobilize team members that share similar characteristics and long-term goals. Thus, competitions serve as a critical juncture to evaluate student teams' entrepreneurial commitment.

Additionally, to ensure social impact, the process of co-creation with identified end-users early on is key for determining commercial viability leading to dual mission success. Findings show that the outcome of any end-user co-creation process must lead to 'frugal innovation'. Specifically, the target technology and value proposition need to be affordable with materials readily available to ensure product-market fit to improve adoption levels with target beneficiaries.

Through passing the critical factors highlighted in Figure 3, the case SSU has demonstrated how it can achieve both commercial success alongside delivering social impact. The necessary pre-conditions that led the target SSU to mobilize would be useful for other universities to create within their own campus-based entrepreneurial eco-systems to showcase progress on their third missions, in other words, a focus on education for its own sake (Wright, 2014). Such showcasing of social impact can also potentially solve the tension generated by the question on whether or not universities should profit from publicly-funded research (Tyler, 2013; Bölling and Eriksson, 2016; Cinar and Benneworth, 2020). Additionally, social impact showcasing could also potentially resolve the identity tension between academics as academics and academic entrepreneurs (Jain, George and Maltarich, 2009) that has been cited as a major inhibitor of research commercialisation.

Therefore, by pump priming students and using the correct formulation of pedagogy, it is likely that research commercialisation and technology transfer's focal actors could be student entrepreneurs, working to solve the academic – entrepreneur identity dilemma and somewhat alleviating the responsibility solely lying with academics to commercialise their research outputs.

We found that the existence of an effective working TTO was not necessarily a major contributing factor in successful commercialising of university scientific outputs. Hence, universities that are in non-mature entrepreneurial ecosystems with institutional voids with an absent or redundant TTO can still showcase progress on their third missions through commercialising research outputs for societal change. Here, even though the university might not reap financial rewards as a result of commercialisation success, they will still be able to augment their reputation, leading to indirect benefits such as increases in student intake and amount of research funding that can be captured (Abreu *et al.*, 2016).

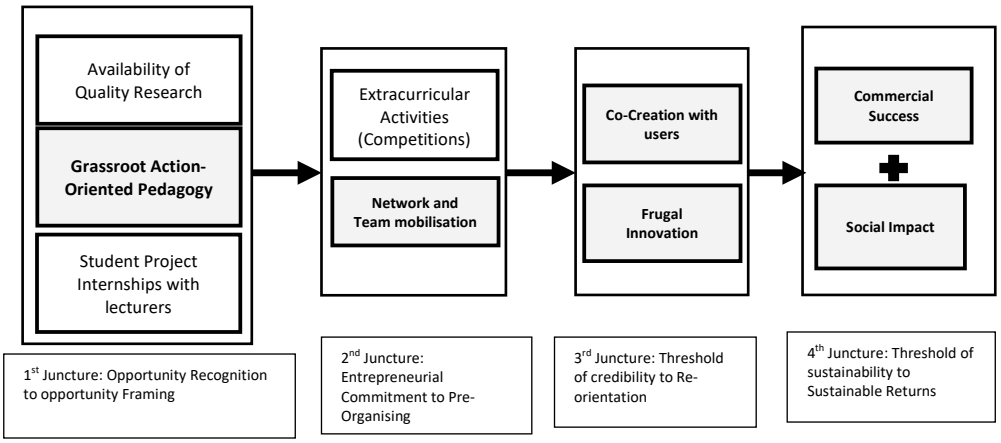


Figure 3: Enabling factors and critical junctures of SSU for research commercialisation

6. Conclusion

Our research endeavour started by an enquiry on how student entrepreneurship fits within the AE landscape. We followed an SSU's venture creation process as they commercialized a university research output outside of, and unimpacted by, conventional 'technology transfer' support mechanisms and enabling factors found in research universities embedded in mature ecosystems. Our contributions are both theoretical and practical. Theoretically, we contribute to the AE literature by extending the number of recognised actors involved in research commercializing, thereby, providing agency to students as focal research commercialisation agents, especially for social impact. Using critical junctures as a theoretical framework, we uncover some of essential enabling 'pre-conditions' for the success of student-led research commercialisation.

Practical implications point to the need for an action-oriented pedagogy that has been shown to be a major contributing factor for facilitating student entrepreneurship targeted to solving societal problems. Overall, we provide an initial framework on how best to encourage student-led research commercialisation activities that can achieve both commercial and social impact.

Nevertheless, the study has several limitations. As all qualitative research, it is not our intention to provide analytical generalisations, but instead to shed light on an emerging phenomenon within the AE landscape. Given the nature of our single case study, further research would be needed to arrive at robust theoretical generalisations.

Future research should investigate other SSU processes that aim to commercialise university scientific output in different contexts. Another interesting avenue is to look more closely at the action-based pedagogy in entrepreneurship education. We found that for students to internalize key intangible enterprise skills, there is a need to go beyond the classroom and even outside the boundaries of host universities. It would be useful to study whether simulation-based pedagogy and role play by exposing students with real-life scenarios might deliver the same impact as action-oriented pedagogy (fieldwork-based).

References

Abreu, M. *et al.* (2016) 'Entrepreneurial practices in research-intensive and teaching-led universities', *Small Business Economics*, 47(3), pp. 695–717.

Abreu, M. and Grinevich, V. (2013) 'The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities', *Research Policy*., 42(2), pp. 408–422.

Adekiya, A. A. and Ibrahim, F. (2016) 'Entrepreneurship intention among students. The antecedent role of culture and entrepreneurship training and development', *International Journal of Management Education*. 14(2), pp. 116–132.

Ahmad, A., Acton, I. and Bhatt, P. (2019). *Entrepreneurship in Developing and Emerging Economies.* Sage Publications. India.

Amry, D., Ahmad, A. and Lu, D. (2021) 'The new inclusive role of university technology transfer: Setting an agenda for further research', *International Journal of Innovation Studie*s, 5 (1), pp. 9-22.

Arocena, R., Goransson, B. and Sutz, J. (2018) *Developmental Universities In Inclusive Innovation Systems: Alternatives for Knowledge Democratization in the Global South*. Switzerland: Palgrave Macmillan.

Åstebro, T., Bazzazian, N. and Braguinsky, S. (2012) 'Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy', *Research Policy*, 41(4), pp. 663–677.

Autio, E. *et al.* (2014) 'Entrepreneurial innovation: The importance of context', *Research Policy*. 43(7), pp. 1097–1108.

Belitski, M., Aginskaja, A. and Marozau, R. (2019) 'Commercializing university research in transition economies: Technology transfer offices or direct industrial funding?', *Research Policy*. 48(3), pp. 601–615.

Bölling, M. and Eriksson, Y. (2016) 'Collaboration with society: The future role of universities? Identifying challenges for evaluation', *Research Evaluation*, 25(2), pp. 209–218.

Brundenius, C. (2016) 'Challenges of Rising Inequalities and the Quest for Inclusive and Sustainable Development' in Göransson, B. and Carvalho De Mello, J. M. *Universities, inclusive development and social innovation: An international perspective*, *Universities, Inclusive Development and Social Innovation: An International Perspective*.

Carayannis, E. G. *et al.* (2018) 'The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models', *R and D Management*, 48(1), pp. 148–162.

Cinar, R. and Benneworth, | Paul (2020) 'Why do universities have little systemic impact with social innovation? An institutional logics perspective', *Growth and Change*, 00, pp. 1–19.

Cui, J. and Bell, R. (2022) 'Behavioural entrepreneurial mindset: How entrepreneurial education activity impacts entrepreneurial intention and behaviour', The International Journal of Management Education, 20(2), pp. 1 - 16

Cunningham, J. *et al.* (2014) 'The inhibiting factors that principal investigators experience in leading publicly funded research', *Journal of Technology Transfer*, 39(1), pp. 93–110.

Edokpolor, J. E. and Somorin, K. (2017) 'Entrepreneurship Education Programme and its influcence in developing Entrepreneurship Key Competencies among Undergraduate Students', *Problems of Education in the 21st Century*, 75(2), pp. 144–156.

Gehman, J. *et al.* (2018) 'Finding Theory–Method Fit: A Comparison of Three Qualitative Approaches to Theory Building', *Journal of Management Inquiry*, 27(3), pp. 284–300.

Goel, R. K. and Göktepe-Hultén, D. (2018) 'What drives academic patentees to bypass TTOs? Evidence from a large public research organisation', *Journal of Technology Transfer*.

Gosens, J. *et al.* (2018) 'The limits of academic entrepreneurship: Conflicting expectations about commercialisation and innovation in China's nascent sector for advanced bio-energy technologies', *Energy Research and Social Science*, 37(September 2017), pp. 1–11.

Guindalini, C., Verreyne, M.and Kastelle, T. (2021). 'Taking scientific inventions to market: Mapping the academic entrepreneurship ecosystem', Technological Forecasting and Social Change, 173, pp. 1-12

Hayter, C. S., Lubynsky, R. and Maroulis, S. (2017) 'Who is the academic entrepreneur? The role of graduate students in the development of university spinoffs', *Journal of Technology Transfer*. Springer US, 42(6), pp. 1237–1254.

Jain, S., George, G. and Maltarich, M. (2009) 'Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialisation activity', *Research Policy*, 38(6), pp. 922–935.

Lehmann, E. E. and Menter, M. (2018) 'Public cluster policy and performance', *Journal of Technology Transfer*. Springer US, 43(3), pp. 558–592.

Lerner, J. and Malmendier, U. (2013) 'With a little help from my (random) friends: Success and failure in post-business school entrepreneurship', *Review of Financial Studies*, 26(10), pp. 2411–2452.

Marzocchi, C., Kitagawa, F. and Sánchez-Barrioluengo, M. (2019) 'Evolving missions and university entrepreneurship: academic spin-offs and graduate start-ups in the entrepreneurial society', *Journal of Technology Transfer*, 44(1), pp. 167–188.

Morris, M. H. and Kuratko, D. F. (2014) *Building University 21st Century Entrepreneurship Programs that Empower and Transform*, *Advances in the Study of Entrepreneurship, Innovation & Economic Growth*. Emerald Group Publishing Limited.

PPDIKTI. (2020). Statistik Pendidikan Tinggi di Indonesia. Jakarta, Indonesia: Kementrian Pendidikan Tinggi dan Kebudayaan. Available at https://pddikti.kemdikbud.go.id/asset/data/publikasi/Statistik%20Pendidikan%20Tinggi%20Indonesia%202019.pdf (Accessed 17 June 2020)

Perkmann, M. *et al.* (2013) 'Academic engagement and commercialisation: A review of the literature on university-industry relations', *Research Policy*. 42(2), pp. 423–442.

Rauch, A. and Hulsink, W. (2015) 'Putting Entrepreneurship Education where the Intention to Act lies: An investigation into the Impact of Entrepreneurship Education on Entrepreneurial Behavior', *Academy of Management Learning and Education*, 14(2), pp. 187–204..

Schaeffer, V. and Matt, M. (2016) 'Development of academic entrepreneurship in a non-mature context: the role of the university as a hub-organisation', *Entrepreneurship and Regional Development*. 28(9–10), pp. 724–745..

Siegel, D. S. and Wright, M. (2015) 'Academic Entrepreneurship: Time for a Rethink?', *British Journal of Management*, 26(4), pp. 582–595.

Steyaert, C. (2007) '"*Entrepreneuring*" as a conceptual attractor? A review of process theories in 20 years of entrepreneurship studies', *Entrepreneurship and Regional Development*, 19(6), pp. 453–477.

Stolz, L. (2020) 'Startup competitions and their role in entrepreneurial ecosystems: A conceptual attempt', *Zeitschrift fur Wirtschaftsgeographie*, 64(4), pp. 233–246.

Sukavejworakit, K. (2018) 'Oetel : an Innovative Teaching Model for Entrepreneurship Education', *Journal of Entrepreneurship Education,* 21(2), pp. 1–11.

Tyler, J. E. (2013) 'Redeploying Bayh-Dole: Beyond Merely doing good to optimizing the potential in results of taxpayer-funded research', *Journal of Technology Transfer*, 38(6), pp. 911–929.

Vinig, T. and Lips, D. (2015) 'Measuring the performance of university technology transfer using meta data approach: the case of Dutch universities', *Journal of Technology Transfer*. 40(6), pp. 1034–1049. d

Vohora, A., Wright, M. and Lockett, A. (2004) ' Critical junctures in the developmet of university high-tech spinout companies', *Research Policy,* 33 (1), pp. 147-175

Welch, C. *et al* (2011) 'Theorising from case studies: Towards a pluralist future for international business research', *Journal of International Business Studies,* 42, pp. 740-762.

Weyrauch, T. and Herstatt, C. (2017) 'What is frugal innovation? Three defining criteria', *Journal of Frugal Innovation*. Journal of Frugal Innovation, 2(1), pp. 1–18.

Wiratno, S. (2012) 'Pelaksanaan Pendidikan Kewirausahaan Di Pendidikan Tinggi', *Jurnal Pendidikan dan Kebudayaan*, 19(4), pp. 453–466.

Wright, M. (2014) 'Academic entrepreneurship, technology transfer and society: Where next?', *Journal of Technology Transfer*, 39(3), pp. 322–334.

Wright, M., Siegel, D. S. and Mustar, P. (2017) 'An emerging ecosystem for student start-ups', *Journal of Technology Transfer*, 42(4), pp. 909–922.

Yin, R. (2018) *Case Study Research and Applications: Design and Methods*. 6th Ed. Sage Publications. London

Health Digitalisation and Innovative Entrepreneurship Status. A Qualitative Exploration of Private Sector in Greece and Synthesis of Main Issues

Sotiris Apostolopoulos[1,2], Ilias Makris[1] and Stravros Stavroyiannis[1]
[1]Department of Accounting and Finance, University of the Peloponnese, Kalamata, Greece
[2]Department of Economics and Business, Neapolis University Pafos, Pafos, Cyprus
s.apostolopoulos@go.uop.gr
i.makris@uop.gr
s.stavrogiannis@uop.gr

Abstract: This primary research aims to examine to what extent Greek health entrepreneurs, as they looking for options to grow their businesses, have realized the opportunities offered to them by the new technologies. Furthermore, to which level they have implemented innovative practices, based on the potential of digitalisation, to improve the operation of their entrepreneurial activities in providing treatment services to the citizens as well as to cooperate with other structures and other organisations. The research explores the views of the entrepreneurs on using digital practices at their services and their impact regards to the reduction of operating costs, the control of materials and the change of the patient-doctor cooperation grid. A qualitative study was conducted with semi-structured interviews in twelve healthcare companies from various regions of Greece. The selection of the sample was made with the Convenience Sampling strategy. The interviews were conducted in Greek with the owners or managers of these healthcare units and the duration was 45 minutes. The content of the semi-structured interviews was classified into three thematic categories. The first section dealt with innovative digital interventions in relation to suppliers, materials, wares, supplies and payments. The second section is concerned with innovative digital interventions compared to the public services and self-administrative authorities, insurance funds and public health structures. The third section is concerned with the innovative digital interventions in relation to the quality care of the patient, his treatment and upgrading the offered health services. The research showed that there were discrepancies in the development of innovative digital activities among the examined companies. Innovative digital interventions were developed by health enterprises, especially in the field of their internal operation and in the service of their patients. On the contrary, many digital interventions could not be completed since there has been an incompatibility with public services and public health structures where the digital transition has not progressed in the same level. Entrepreneurs who preferred traditional forms of operating and offering services to their patients, they did so by fearing that innovative digital activities required more financial capitals and new qualified staff that would surely increase their operating costs.

Keywords: healthcare enterprises, digitalisation, innovation, entrepreneurship

1. Introduction

Research interest in digital transformation of the health sector and how business models are affected has increased in recent years (Parviainen et al, 2017). Digital applications support the emergence of new types of innovation processes in healthcare (Morande et al.2020; Omachonu & Einspruch, 2010) and contribute to the upgrading and interaction among health services (Pillay, 2019). New innovative technologies can be developed through health structures while emerging new business opportunities (Belolipetskaya et al, 2020). Digital health technology also significantly improves the experience of health professionals (Wulfovich & Meyers, 2020) and transforms the offered health services (Rivas, 2020). Digital innovations in health improve the effectiveness of medical and diagnostic interventions, increase the quality of services and reduce costs (Lupton, 2013). New business models based on health digitalisation require a re-approach by those who operating in the field in relation to their existing mode of operation. The health system is characterized by the opportunities arising from increasing digitalisation (Glauner et al, 2021). When a need turns into an entrepreneurial opportunity, designing the right business model should be pursued with a persistent and open mindset (Zajicek & Meyers, 2018) while the digital transformation is a tool for the renewal of business models that helps them to increase their competitiveness (Bumann & Peter, 2019). However, there are many barriers for health enterprises as far as the implementation of innovative plans and succeeding through innovation to finally achieve their goals in the healthcare market. This is clearly changing from country to country. The factors that negatively affect the implementation of the potential of digital practices and how they will be addressed are crucial elements that the research lens must focus on. It should be traced what could be changed to improve conditions and make them friendly to digitalisation. An obstacle to entrepreneurship in the field of digital health and innovation is the complex institutional and legal framework that exists in many countries (Zajicek & Meyers, 2018) and the non-completion of the digital transition as far as other public structures and insurance organisations (Apostolopoulos

et al, 2022). Managers need to develop business strategies compatible with the current digital trends (Reis et al, 2018). Nowadays, health entrepreneurs are facing the challenge of taking advantage of the business opportunities that arise in the digital era to change the way their businesses operate until now (Van Velthoven et al, 2019). Similar challenges are faced by start-up health companies in the context of digital healthcare since the customer experience is a key goal (Wulfovich & Meyers, 2019).

In Greece, due to public health problems and reducement in funding, there is a deterioration in the provided services (Apostolopoulos et al, 2021; Liaropoulos et al, 2008; Tountas et al, 2005). This gap has been filled by the booming of private health sector, which is constantly investing in new technologies (Kondilis et al, 2011; Souliotis, 2000). The present research seeks to examine the views of health entrepreneurs on digitalisation and the implemented innovative interventions since these aspects have not been researched in Greece. It also examines the context of operation and development of innovative digital interventions and the obstacles that entrepreneurs face in the digital transformation of their entrepreneurial activities. Exploring the perspectives of experts in healthcare industry helps to gain knowledge in exactly which activity areas are modern digital technologies best applied. (Apostolopoulos et al, 2022; Ross et al, 2018)

2. Literature review

In recent years many studies have focused on the digitization of health sector with the vast majority of them referring to the public health sector (Iyamu et al, 2021; Azzopardi-Muscat et al, 2019). They focus on the complexity of digitalisation in public health (Ricciardi et al, 2019), on the service delivery model they offer (Fitzpatrick et al, 2020), the use and preservation of personal data (Mohamed, 2020; Karampela et al, 2019) and to the needs of users (van Poelgeest et al, 2019; Steinhubl & Topol, 2015). Other researches refer to the views and experiences of health professionals on digitization in public health structures (Sprenger et al, 2017; Ålander & Scandurra, 2015). Finally, some surveys highlight the obstacles and barriers that make it difficult to establish innovative digital practices in health services such as the legal framework of patient data files as well as the functions of the financial departments of health units. (Kulkov et al. 2021; Zajicek & Meyers, 2018; Devlin et al., 2015).

In the private health sector, research on digital innovation focuses on the development and implementation of new health information systems, digital user networks, digital health services, and the creation of modern ecosystems in the field of care that help reducing operating costs and improving the services provided (Schiavone et al, 2021; Botti & Mondi, 2020; Hwang & Christensen, 2008). There is also more research interest on the evolution of innovative digital practices in relation to health care market issues such as competition, healthcare area conditions, prevailing existed challenges, and business prospects through digitalisation (Joensuu-Salo et al, 2021; Van Velthoven et al, 2019; Pferzinger & Rammerstorfer, 2017). In Greece, research on digital innovation is still in its infancy. The research of Makris & Apostolopoulos (2021) that examined active health companies found that entrepreneurs who implemented innovative practices that included the digitalisation of services had positive results. In their research, Giannopoulou et al, (2020) documented the benefits of developing and implementing new innovative care delivery models based on process digitalisation. In this regard, economic support has been provided through the European Structural Funds for financing, among other enterprises, health companies too (Makris et al, 2021). In addition, Bogdanos et el, (2008) who examined digitization and care determined that the modern models should be developed in the health services market based on both corporate and human goals. The digitalisation of health services in the vaccination programs for protection against the Covid-19 pandemic (Odone et al, 2021) also provided a huge significant benefit.

3. Methodology

This study adopted a qualitative approach with semi-structured interviews (Modgil et al, 2022). Qualitative research contributes positively to the diversity of entrepreneurship issues (Creswell & Poth, 2016; Pringle et al, 2011). Using qualitative methods offered us the opportunity to identify the experiences and beliefs of health entrepreneurs on the development of digitalisation in the health sector as well as on the innovative practices that can be applied (Kyllingstad et al, 2021, Janssen & Moors, 2013). By this methodological progress we traced the key aspects of the new entrepreneurial activities that could be developed according to the views of owners and managers in healthcare industry (Mehrabi et al, 2019). We conducted 12 interviews of 45 duration minutes with each one individual. The interviews commenced in August 2021 and ended in November 2021. This qualitative interview-based study features primary data from a sample of active entrepreneurs in private healthcare sector (Makris & Apostolopoulos, 2021).

Table 1: Characteristics of the selected companies

ENTERPRISE	YEAR OF ESTABLISHMENT	NUMBER OF EMPLOYEES	TYPE OF ENTERPRISE
R1	2010	120	Rehabilitation & Recovery Center
R2	2005	47	Hymodialysis Center
R3	2012	11	Diagnostic Center
R4	2012	176	Rehabilitation & Recovery Center
R5	2014	13	Phyciatric Clinic
R6	2007	18	Diagnostic Center
R7	2019	41	General Clinic
R8	2012	85	Rehabilitation & Recovery Center
R9	2011	210	Rehabilitation & Recovery Center
R10	2008	190	Rehabilitation & Recovery Center
R11	2014	32	Phyciatric Clinic
R12	2017	14	Diagnostic Center

We used in-depth interviews to capture entrepreneurs' perspectives on the implementation of digital practices as well as possible obstacles (Schiavone et al, 2021; Gastaldi et al, 2018). We chose Convenience Sampling technique which is among the most adequate strategies in qualitative research to identify the sample in healthcare area. We have harmonized with the literature's knowledge on qualitative research methodology which suggests that the collected sample size should be small in order to keep subjective and individual characteristics (Moser & Korstjens, 2017). The sample consists of medical surgery clinics, diagnostic centres, hemodialysis services, psychiatric care, rehabilitation-recovery centres located in various small towns in Greece's regions. In order to highlight the impact of digitalisation progress on health companies, we focused on innovative digital interventions in relation with specific factors such as the suppliers, materials, wares, supplies and payments, the public services and local self-administrative authorities, insurance funds and public health structures as well as the quality care of the patient, his treatment and upgrading the offered health services.

4. Data analysis

In order to capture the topics and subthemes (Gioia et al, 2013) the semi-structured interviews were examined individually using an inductive approach before proceeding further in any comparisons between them (Thomas, 2006; Creswell, 2005). The coding was exclusive and independent (Krippendorf, 2018) and there was a percentage weighting of agreement or non-agreement between the research team coding (Hayes & Krippendorff, 2007; Strauss & Corbin, 1990).

Table 2: Emerging topics και sub-themes

Emerging topics	Sub-themes	Summary
Innovative digital interventions in relation to suppliers, materials, wares, supplies and payments	Digital supplies of materials	Most of the supplies are now made using digital technology Technology solved problems in the supply chain in a fast and efficient way
	Digital commission payments	All payments for the supply of materials are now made electronically
	Digital transactions with financial institutions	Electronic transactions with financial institutions are mostly digital. Very few transactions are made in person
Innovative digital interventions compared to the public services and self-administrative authorities, insurance funds and public health structures.	Digital services with public health structures	The digital transformation of public health structures is not complete, and this makes it difficult to do business with them. There are also system incompatibilities in some cases
	Digital transactions with self-administrative authorities and other public services	A large part of the transactions with the local government continues to be done with a physical presence

Emerging topics	Sub-themes	Summary
	Digital transactions with insurance organisations	Despite the progress made in recent years, there is still a problem with digital transactions
Innovative digital interventions in relation to the quality care of the patient, his treatment and upgrading the offered health services.	Digital interventions to serve patients	Innovative digital projects were implemented to serve citizens with positive results
	Digital interventions for better internal operation and upgrading of the services provided	Innovative projects were implemented that facilitated and accelerated the internal operation of health enterprises

5. Findings

Ten entrepreneurs of the twelve individuals who participated in this study, stated that they have implemented digital innovations in their enterprises. Two entrepreneurs among interviewers said they were hesitant to develop large-scale digital innovations fearing that innovative digital activities would require a large amount of financial capital and new skilled staff that would increase their operating costs. The structure of the findings as far as the entrepreneurs who developed digital innovations was carried out based on the emerging thematic topics: Innovative digital interventions in relation to suppliers, materials, wares, supplies and payments. Innovative digital interventions compared to the public services and self-administrative authorities, insurance funds and public health structures. Innovative digital interventions in relation to the quality care of the patient, his treatment and upgrading the offered health services.

- Innovative digital interventions in relation to suppliers, materials, wares, supplies and payments

In relation to the supply of materials concerning the entrepreneurs participating in the research, it was detected that they have digitised the supply chain and this fact has created positive outcomes for their enterprise.

> *"Technology has solved dozens of problems we have had with our supply chain operation. Everything is now done quickly and efficiently. We are able to have direct information and we can easily compare product specifications and prices."*

In relation to the payment system from the purchase of materials and products, survey found that entrepreneurs have developed the electronic payment system and are satisfied with its use.

> *"All our transactions as far as the payment invoices from suppliers are now done electronically. This has solved dozens of problems for us. It reduced costs and facilitated transactions. Everything is done instantly and quickly."*

It was found that most of the transactions with financial institutions are now done electronically and only a few require physical presence.

> *"All our transactions that are relevant to the banks are carried out electronically. Only for a few transactions we have to go to the bank ourselves. This fact offered a whole new dynamic in our performance. The lost working hours in the banks ceased to exist "*

- Innovative digital interventions compared to public services and self-administrative authorities, insurance funds and public health structures

In relation to digital transactions with the public sector, it was detected that they are problematic since the digital transition of public services has not yet been completed.

> *"There's a negative reflection in our transactions with the public services since the public sector has not completed its digital transition. In many cases the transactions are made in the old traditional ways "*

In the present research it was detected that there are also problems in the transactions of health enterprises with the self-administrative services since the digital transition has not been completed in the local government.

> *"Our transactions with the self-administrative authorities are mostly done in traditional ways since the digital transition has not been completed and system incompatibilities prevail''*

Through the reports of the health entrepreneurs, it was found that despite the digitalisation steps that have been developed in the public insurance organisations, they continue to make transactions in the traditional way.

> *"Both public insurance organisations and public services have not completed their digital transition. This progress greatly complicates the expanded use of our own innovative digital designs."*

- Innovative digital interventions in relation to the quality care of the patient, his treatment and upgrading the offered health services.

The individual's in-depth interviews revealed that the private health sector, taking advantage of the weaknesses of the public sector, invested in innovative digital projects and has gained a comparative advantage in the health system, both in serving the citizens and in its dynamic operation. Due to the investments in high level technology, these enterprises forced the public sector and the insurance organisations to become the biggest consumers of their healthcare services.

> *"Our comparative advantage is the investment in high level technology that delivers reliable services to our patients. For us, serving the citizens is our primary aim. These are the differences between us and the public sector."*

The entrepreneurs who participated in the present research believe that investing in innovative digital designs solved problems in their internal operation and gave them a strong dynamic. Due to the investments in high level technology, they forced the public sector and the insurance organisations to become the biggest consumers of their services.

> *"Investing in innovative practices in our medical facilities has solved our operational problems and made us credible to patients."*

6. Discussion

This study captured that health entrepreneurs have proceeded to innovative digital projects and only a small percentage of them continue to operate in traditional ways. Those entrepreneurs who have invested in digital innovations consider that the outcomes had positive effects both in terms of their internal operation and in terms of their dealings with suppliers and financial institutions. They contributed to the better service of the citizens and to the quality improvement of the provided services. However, the research identified obstacles in the development of digital transactions of these enterprises with public healthcare services, insurance organisations, self-administrative authorities, and some other public services. Entrepreneurs have attributed them issues to the fact that these public structures have not completed the digital transformation of their services. The above findings are consistent with other research findings which are showing that digital innovations contribute positively to the interaction with health consumers (Pillay, 2019) and improve their experience linking with healthcare professionals (Wulfovich & Meyers, 2020). Digital innovations improve patient outcomes, increase the quality of the offered services and reduce internal costs (Lupton, 2013). They create business opportunities in the health sector (Belolipetskaya et al, 2020) and improve the quality of citizens' life (Iyawa et al, 2016). They increase the competitiveness of enterprises and contribute to the transformation of services (Bumann & Peter, 2019).

At the same time, these digital intervations enable enterprises to reduce the waste use of certain resources and enhance the entrepreneurial activities (Yousaf et al, 2021). In this survey, a small percentage of entrepreneurs (2/12) were reluctant to invest in digital innovation practices by fearing that innovative digital activities would require more financial capitals and new qualified staff which surely increase the operating costs. This view and perception of the entrepreneurs, contrasts with many researches showing that implement digital innovation practices reduces performance and service delivery costs and combats the waste as far as the expenditures (Yousaf et al, 2021). In their research Moro Visconti & Morea, (2020) point out that traditional technologies often increase the cost of investment while digital applications are cheaper and may allow for its timely reduction. The research of Simpson et al (2006), which examined the positive and negative aspects of innovative projects among the negative elements reflected the fear of rising the overall cost of procedures. There are also studies that found that the ways of controlling the overall costs which usually incurred in investing in digitizing processes and implementing innovative digital practices of health companies need to be further expanded (Kraus et al, 2021). Barriers in the collaboration with central government and local self-admistrative services that have not yet completed the digital transition are also identified in other researches (Makris & Apostolopoulos, 2021). Katehakis et al (2018) argues that for modern health systems to function, effective cooperation between

stakeholders such as insurance organizations and the public sector is needed, and the interoperability is a prerequisite as far as the information and communication technology systems

7. Conclusions

Digital innovation projects are a challenge for the private health sector as well, and where such projects have been implemented the results have been succeful. They reduced the operating costs of enterprises, upgraded the offered healthcare services, and facilitated the service of patients. They provide private health companies with a comparative advantage over public medical services. The non-completion of the digital transformation of the public sector, local self-administrative services and insurance organisations were highlighted in the research as an obstacle to the digital innovation plans of the private health sector. The results of this research provide a useful tool to the health policymakers but also to the investors. It is also a useful quide for the EU institutions that develop and implement Member States' health programs. As this article provides insights into how the digital transformation in private healthcare enterprises can contribute positively in entrepreneurship issues, further in-depth investigation could combine the findings of this paper with the views of local administrative authorities and other health professionals as well as it could expanded in rural areas. Of course many other issues as far as the economic environment which is very tough for most of the companies that are activated in Greece but also variable, needs to keep in close monitoring for further influence.

8. Limitations and future research

This survey has identified the views of health entrepreneurs on digital innovation practices without reflecting the views of the workforce in private health units as well as the patients themselves, which is a fact that future research should include.

References

Alander, T. and Scandurra, I. (2015) “Experiences of Healthcare Professionals to the Introduction in Sweden of a Public eHealth Service: Patients' Online Access to their Electronic Health Records’’, *MedInfo,* pp 153-157.

Apostolopoulos, N., Apostolopoulos, S., Makris, I., and Stavroyiannis, S. (2021) “Rural Healthcare Enterprises in the Vortex of COVID-19: The Impact of Public Policies on the Internal and External Environment’’, *Administrative Sciences*, Vol 11, No. 3, 82

Apostolopoulos, N., Liargovas, P., Sklias, P., Makris, I. and Apostolopoulos, S. (2022) “Private healthcare entrepreneurship in a free-access public health system: what was the impact of COVID-19 public policies in Greece?”, *Journal of Entrepreneurship and Public Policy*, Vol 11, No. 1, pp. 23-39.

Apostolopoulos, S., Makris, I., and Stravroyiannis, S. (2022) “Healthcare Innovation in Greece: The Views of Private Health Entrepreneurs on Implementing Innovative Plans”, *Journal of Open Innovation: Technology, Market, and Complexity*, Vol 8, No. 2, 78.

Azzopardi-Muscat, N., Ricciardi, W., Odone, A., Buttigieg, S. and Paget, D. Z. (2019) “Digitalization: potentials and pitfalls from a public health perspective”, *The European Journal of Public Health*, Vol 29, No. 3, 1.

Belolipetskaya, A. E., Golovina, T. A. and Polyanin, A. V. (2020) “Digital transformation of healthcare: a competency-based approach”, *Problems of Social Hygiene, Public Health and History of Medicine*, Vol 28, pp. 694-700.

Bogdanos, C., Lagouros, M. and Ekonomou, L. (2008) “Healthcare information systems in Greece: system and human integration”, *Communication & Information Technology*, pp. 196-200.

Botti, A., & Monda, A. (2020) “Sustainable value co-creation and digital health: The case of trentino eHealth ecosystem”, *Sustainability*, Vol 12, No. 13, 5263.

Bumann, J. and Peter, M. K. (2019) “Action fields of digital transformation–a review and comparative analysis of digital transformation maturity models and frameworks. Digitalisierung und andere Innovationsformen im Management”, *Innovation und Unternehmertum*, Vol 2, pp. 13-40.

Creswell, J. (2005) *Research design: Qualitative, quantitative, and mixed methods approaches,* Newbury Park: Sage Publications.

Creswell, J. W. and Poth, C. N. (2016) *Qualitative inquiry and research design: Choosing among five approaches*, Sage publications.

Devlin, A. M., McGee-Lennon, M., O'Donnell, C. A., Bouamrane, M. M., Agbakoba, R., O'Connor, S., Grieve, E., Finch, T., Wyke, S., Watson, N., Browne, S. and Mair, F.S. (2015) “Delivering digital health and well-being at scale: lessons learned during the implementation of the dallas program in the United Kingdom”, *Journal of the American Medical Informatics Association*, Vol 23, No. 1, pp. 48-59.

Fitzpatrick, F., Doherty, A. and Lacey, G. (2020) “Using artificial intelligence in infection prevention”, *Current treatment options in infectious diseases*, Vol 12, No. 2, pp. 135-144.

Gastaldi, L., Appio, F. P., Corso, M. and Pistorio, A. (2018) “Managing the exploration-exploitation paradox in healthcare: three complementary paths to leverage on the digital transformation”, *Business Process Management Journal*. Vol 24, No. 5, pp. 1200-1234

Giannopoulou, I. and Tsobanoglou, G. (2020) "COVID-19 pandemic: Challenges and opportunities for the Greek health care system", *Irish Journal of Psychological Medicine*, Vol 37, No. 3,pp. 226-230.

Gioia, D. A., Corley, K. G. and Hamilton, A. L. (2013) "Seeking qualitative rigor in inductive research: Notes on the Gioia methodology", *Organizational research methods*, Vol 16 No. 1, pp. 15-31.

Glauner, P., Plugmann, P. and Lerzynski, G. (2021) *Digitalization in Healthcare*. Springer International Publishing.

Hayes, A. F. and Krippendorff, K. (2007) ''Answering the call for a standard reliability measure for coding data. *Communication methods and measures''*, Vol 1, No. 1, pp. 77-89.

Hwang, J. and Christensen, C. M. (2008) "Disruptive innovation in health care delivery: a framework for business-model innovation", *Health affairs*,Vol 27, No. 5,pp. 1329-1335.

Iyamu, I., Xu, A. X., Gómez-Ramírez, O., Ablona, A., Chang, H. J., Mckee, G., & Gilbert, M. (2021). Defining Digital Public Health and the Role of Digitization, Digitalization, and Digital Transformation: Scoping Review. *JMIR public health and surveillance*, *7*(11)

Iyawa, G. E., Herselman, M., & Botha, A. (2016). Digital health innovation ecosystems: From systematic literature review to conceptual framework. *Procedia Computer Science*, *100*, pp. 244-252.

Janssen, M., & Moors, E. H. (2013) "Caring for healthcare entrepreneurs—Towards successful entrepreneurial strategies for sustainable innovations in Dutch healthcare", *Technological Forecasting and Social Change*, Vol 80 No 7, pp. 1360-1374.

Joensuu-Salo, S., Kangas, E. and Mäkipelkola, J. (2021) "Service Innovation Capability in Social and Health Care SMEs: The Impact of Market Orientation and Technology Orientation", *Journal of Enterprising Culture*, Vol 29, No 3, pp. 183-206.

Karampela, M., Ouhbi, S. and Isomursu, M. (2019) "Connected health user willingness to share personal health data: questionnaire study", *Journal of medical Internet research*, Vol 21, No. 11.

Katehakis, D. G., Kouroubali, A. and Fundulaki, I. (2018) "Towards the Development of a National eHealth Interoperability Framework to Address Public Health Challenges in Greece", In *SWH@ ISWC*.

Kondilis, E., Gavana, M., Giannakopoulos, S., Smyrnakis, E., Dombros, N. and Benos, A. (2011) "Payments and quality of care in private for-profit and public hospitals in Greece. *BMC health services research*", Vol *11,* No.1, 234.

Kraus, S., Schiavone, F., Pluzhnikova, A. & Invernizzi, A. C. (2021) "Digital transformation in healthcare: Analyzing the current state-of-research", *Journal of Business Research*, Vol. *123*, pp. 557-567.

Krippendorff, K. (2018) *Content analysis: An introduction to its methodology. Sage publications.*University of Pennylvania

Kyllingstad, N., Rypestøl, J. O., Schulze-Krogh, A. C. and Tønnessen, M. (2021) "Asset modification for regional industrial restructuring: digitalization of the culture and experience industry and the healthcare sector", Regional Studies, Vol 55, No. 10-11, pp. 1764-1774.

Liaropoulos L, Siskou O, Kaitelidou D, Theodorou M and Katostaras T. (2008) "Informal payments in public hospitals in Greece". *Health Policy*, Vol 87 No. 1, pp. 72– 81.

Lupton, D. (2013) "The digitally engaged patient: Self-monitoring and self-care in the digital health era". *Social Theory & Health,* Vol. 11, No. 3, pp. 256-270.

Makris, I. and Apostolopoulos S. (2021) "Investing in healthcare enterprises in the non-metropolitan areas: Incentives, reflections, and innovative ideas", *Proceedings of the European Conference on Innovation and Entrepreneurship*, ECIE, pp. 1160–1166

Mehrabi, R., Yadolahi Farsi, J. and Talebi, K. (2019) "Phenomenological interpretation of the nature of entrepreneurial opportunities based on lived experiences of entrepreneurs in healthcare business context", *Transformation Management Journal*, Vol 11 No. 1,pp. 1-26.

Modgil, S., Dwivedi, Y. K., Rana, N. P., Gupta, S. and Kamble, S. (2022) "Has Covid-19 accelerated opportunities for digital entrepreneurship? An Indian perspective", *Technological Forecasting and Social Change*, Vol 175, 121415.

Mohamed, H. (2020) ''Digitizing Medical Records And Healthcare Management'', *World Scientific Book Chapters*, pp.105-119.

Morande, S., Del Vacchio, E. and Ranieri, A. (2020) "Digital Innovations in Healthcare Startups: Transforming Service Ecosystem", *Journal of Business and Management Studies*, Vol 2, No. 1, pp. 26-39.

Moro Visconti, R. and Morea, D. (2020) "Healthcare digitalization and pay-for-performance incentives in smart hospital project financing", *International journal of environmental research and public health*, Vol 17 No. 7, 2318.

Moser & Korstjens, (2017) "Series: Practical guidance to qualitative research. Part 1: Introduction. *European Journal General Practice"*, Vol 23, No.1 , pp. 271–73.

Odone A, Gianfredi V, Sorbello S, Capraro M, Frascella B, Vigezzi GP and Signorelli C. (2021) "The Use of Digital Technologies to Support Vaccination Programmes in Europe: State of the Art and Best Practices from Experts' Interviews", *Vaccines*, Vol. 9 No. 10, 1126.

Omachonu, V. K. and Einspruch, N. G. (2010) "Innovation in healthcare delivery systems: A conceptual framework". *Innovation Journal*, Vol. 15 No 1, pp. 1-20.

Parviainen, P., Tihinen, M., Kääriäinen, J. and Teppola, S. (2017). "Tackling the digitalization challenge: how to benefit from digitalization in practice", *International journal of information systems and project management*, Vol. 5 No 1, pp. 63-77.

Pferzinger M., Rammerstorfer P. (2017) "Design Thinking Based Digital Transformation in Healthcare", In: Pfannstiel M., Da-Cruz P., Mehlich H. (eds) Digital Transformation of Healthcare Services II. Springer Gabler, Wiesbaden.

Pillay, R. (2020) *Digital Health Trends. In Digital Health Entrepreneurship*, pp. 207-213, Springer, Cham.

Pringle, J., Hendry, C. and McLafferty, E. (2011) "Phenomenological approaches: Challenges and choices", *Nurse researcher*, Vol 18, No 2.

Reis, J., Amorim, M., Melão, N. and Matos, P. (2018) "Digital transformation: a literature review and guidelines for future research", In World conference on information systems and technologies , pp. 411-421, Springer, Cham.

Ricciardi, W., Pita Barros, P., Bourek, A., Brouwer, W., Kelsey, T. and Lehtonen, L. (2019) "How to govern the digital transformation of health services", *European journal of public health*, Vol 29, No. 3, pp. 7-12.

Rivas H. (2020) Future Entrepreneurship in Digital Health. In: Wulfovich S., Meyers A. (eds) Digital Health Entrepreneurship. Health Informatics. Springer, Cham.

Ross, J., Stevenson, F., Dack, C., Pal, K., May, C., Michie, S., Barnard,M. and Murray, E. (2018) "Developing an implementation strategy for a digital health intervention: an example in routine healthcare", BMC health services research, Vol 18 No. 1, 1-13.

Schiavone, F., Mancini, D., Leone, D. and Lavorato, D. (2021) "Digital business models and ridesharing for value co-creation in healthcare: A multi-stakeholder ecosystem analysis. Technological Forecasting and Social Change", Vol 166, 120647.

Simpson P., Siguaw J. and Enz C. (2006) "Innovation orientation outcomes: The good and the bad", *Journal of Business Research,* Vol. 59, pp. 1133-1141.

Souliotis, K. (2000). *The role of the private sector in the Greek health care system*. *Athens Greece: Papazisis*. (in Greek)

Sprenger, M., Mettler, T. and Osma, J. (2017) "Health professionals' perspective on the promotion of e-mental health apps in the context of maternal depression", *PloS one*, Vol. *12* No. 7.

Steinhubl, S. R. and Topol, E. J. (2015) "Moving from digitalization to digitization in cardiovascular care: why is it important, and what could it mean for patients and providers?" , *Journal of the American College of Cardiology*, Vol 66, No. 13, pp. 1489-1496.

Strauss, A and Corbin, J. (1990) "Basics of qualitative research: Theory procedures and Techniques*", Sage Publications.*

Thomas, D. R. (2006) "A general inductive approach for analyzing qualitative evaluation data", *American journal of evaluation*, Vol. 27 No. 2, pp. 237-246.

Tountas, Y., Karnaki, P., Pavi, E. and Souliotis, K. (2005) "The "unexpected" growth of the private health sector in Greece", *Health policy*, Vol 74 No. 2, pp. 167-180.

van Poelgeest, R., van Groningen, J. T., Daniels, J. H., Roes, K. C., Wiggers, T., Wouters, M. W. and Schrijvers, G. (2017) "Level of digitization in Dutch hospitals and the lengths of stay of patients with colorectal cancer", *Journal of medical systems*, Vol 41 No. 5, pp. 1-7.

Van Velthoven, M. H., Cordon, C. and Challagalla, G. (2019) "Digitization of healthcare organizations: The digital health landscape and information theory", *International journal of medical informatics*, Vol. 124, pp. 49-57

Wulfovich, S. and Meyers, A. (2019) Introduction to Digital Health Entrepreneurship. In Digital Health Entrepreneurship ,pp. 1-6, Springer, Cham

Wulfovich, S. and Meyers, A. D. (Eds.). (2020) *Digital health entrepreneurship,* Springer, New York

Yousaf, Z., Radulescu, M., Sinisi, C. I., Serbanescu, L. and Păunescu, L. M. (2021) "Towards sustainable digital innovation of SMEs from the developing countries in the context of the digital economy and frugal environment" *Sustainability*, Vol. 13 No. 10, 5715.

Zajicek, H. and Meyers, A. (2018).*Digital Health Entrepreneurship. Digital Health*, pp.271–287. Springer, Cham.

The Inevitable but Altered Roles of Universities Within an Innovation Ecosystem

Linde Baaijens, Maria Freidel, Denice Groenen, Antonios Matzakos Chorianopoulos, Jordan Vasseur, Matthijs Zwemmer, Emőke Takács and Toon Abcouwer
University of Amsterdam, Netherlands
a.w.abcouwer@uva.nl

Abstract: It is evident that for an organisation, the most successful way for operating is being part of business ecosystems and creating more value than on its own. Universities play a specific role in this field. We undertook this research to verify the universities' role in an innovation ecosystem where they work together with businesses to create and share new cutting-edge knowledge. Our theory-based research offers scientifically underpinned suggestions for innovators and entrepreneurs in developing innovation ecosystems with a specific focus on the altered role of universities. The article focuses on the roles of universities to discovers how it can become more resilient to adapt to the ever-changing demands of an innovation ecosystem. How can it provide professional knowledge sharing on an equal base within the ecosystem whilst remaining its leading role in innovation and knowledge development? This approach breaks with the traditional view of universities as the primary source of knowledge in society. Universities take several roles in a business ecosystem, which we conclude in this paper. To let universities stay strong in innovation, they must adapt their traditional role to suit to the ever-changing demands presented by the ecosystem. They need to focus on knowledge sharing instead of knowledge delivery to achieve a sustainable growth. The changing approach fits better the innovation and entrepreneurship by working within a knowledge ecosystem. Additionally, organisations must stay proactive by evaluating partners better, building meaningful relationships, and adopting a business-like mentality. Organising such a knowledge ecosystem will stimulate innovation and facilitate entrepreneurs in searching for new markets in an increasingly sustainable and circular world.

Keywords: innovation, business ecosystem, resilience, partnership, IT

1. Introduction

This paper offers solutions for higher education institutions to overcome the challenge of adapting to new circumstances and requirements to establish and manifest the role of a knowledge-sharing entity. According to Cai et al. (2020), the traditional roles of universities, such as education and research, need to evolve with strengthening the knowledge transfer role to become a more relevant but also profitable player in the innovation ecosystem of education.

This article looks for answers to the questions of *how to adapt the traditional roles within a university to enable improving knowledge sharing and whether an innovation ecosystem supports the implementation.*

Given the fact that organisations operate in a highly dynamic environment, they are challenged to adapt and innovate quickly. However, sometimes it is not crystal-clear which route to choose. We have found that properties such as high level adaptivity, resilience, defining the right links and finding partners may help overcoming the imposed uncertainty and the uncomfortable status-quo when forced to innovate. We aim to answer our main research question along with three sub-questions and set knowledge transfer into the centre, building a hub between universities and industry or policy. During our research we were able to identify and discuss the bottlenecks and the opportunities for universities to achieve the task of improving their knowledge sharing capacity. Our sub-questions explore the needs for and the results of change. The first two revolve around restructuring the role of universities within the innovation ecosystem. With a focus on the demands and knowledge sharing, our main question is about the unavoidable adaptation to the new situation. The last sub-question focuses on the results and gains from the transitions. In sum, the sub-questions are:

- How can a university become more resilient to adapt to the ever-changing demands of innovation?
- How to provide knowledge sharing with professional ecosystems whilst remaining an innovation ecosystem?
- What insights can be obtained by sharing knowledge with other partners within the ecosystem?

2. Literary background

Universities have to be adaptive to cope with the fast-changing environment and the rapidly changing world. The challenge to adapt to changes highlights some key aspects, like innovation ecosystem, ecosystem resilience, partners and the role of IT.

2.1 Innovation ecosystem

An innovation ecosystem is a self-organising, self-regulating, self-developing and open ecosystem that enables innovation through cross-border multidisciplinary collaboration and resource utilization by partners within an ecosystem (Jucevičius&Grumadaitė, 2014; Znyiak et al., 2020; Cai et al., 2020; Al-Kurdi et al., 2018). Jucevičius&Grumadaitė (2014), also state that innovation ecosystems can be called smart systems because of their interaction with the environment, emergence, adaptability, tolerance, and flexibility. This means that the true nature of the innovation ecosystem is found in its elements, which continuously adapt to dynamic environments, forging a highly resilient system.

Etzkowitz et al. (2000) discusses the development of universities into entrepreneurial entities and how this comes about. The paper explains internal and external reasons associated with the emergence of 'knowledge-based innovation'. There are two reasons for the entrepreneurial activities of universities: Improve regional or national economic performance and generate funding for the university itself. These dynamics are explained with the help of two models: The 'Triple Helix' (university-industry-governments) and the entrepreneurial academic paradigm. The Triple Helix wants to account for the new constitution of institutional forces that rise within innovation systems, which can lead to either the decline of the Status Quo or the manifestation of a new insular entity. The second model, the entrepreneurial academic paradigm, is a normative but also analytical approach to assess the role of universities in innovation systems. If universities want to function as innovation agents, they must undergo 'academic revolutions' to sharpen their mission in research and claim their role in economic development through extensions in their research and teaching missions.

Cai et al. (2020), identified four different roles that higher educational institutions (HEI) can take on in an innovation ecosystem. The first two are strictly for education and research purposes where they provide human capital for innovation and where they extract information and generate knowledge. The other two are more applicable for an innovation ecosystem. They are the roles of knowledge exchange and strategic information. Knowledge exchange is the most important in the ecosystem since it enables knowledge to be shared outside the walls of the university to ensure the synergy in the ecosystem. Additionally, strategic information is needed to implement the innovations.

However, the emergence of entrepreneurial and socially embedded innovation systems is a subtle process that can hardly be achieved with direct policy measures and incentives. Specifically, researchers and knowledge creators might not be in a position to exchange knowledge or information. Al-Kurdi et al. (2018), identified four possible reasons why researchers might be hesitant to share knowledge such as: individual factors, organizational factors, technological factors, and cultural factors.

This is where creating the right ecological conditions becomes crucial. Establishing an actively cultivated knowledge-sharing environment is essential for knowledge management and exchange across an innovation ecosystem (Al-Kurdi et al., 2018). Therefore, one should define the main agents, relationships, and outcomes resulting from this interaction in every subsystem. Then, one should identify the weakest parts in the system having the greatest impact (Jucevičius&Grumadaitė, 2014). Jucevičius&Grumadaitė suggest four categories to tackle the bottlenecks of information exchange. The four categories are: strategy, agents, links, and resilience. The strategic category aims to set a clear strategy for the system to work as a whole and generate synergy. The agent category involves selecting and attracting the right partners for the ecosystem. The links category encourages innovation ecosystems to cluster links and relationships that are vital and remove the links that do not work. Resilience, the last category, encourages ecosystems to create and maintain the disequilibrium state to keep innovating.

2.2 Resilience

Resilience is a key aspect of an ecosystem. When an ecosystem is considered resilient, it can recover from external perturbations and is able to build adaptive capacity (Ensor, 2011). This may vary depending on which ecosystem is examined.

According to Datta&Adesola (2020), university knowledge transfer or the third stream is now arguably a catch-all to describe the activity of universities engaging with external stakeholders, for various reasons other than teaching and academic research. The scope of the third stream may have appeared to broaden over time. However, this agenda continues to be associated with innovation and/or positive outcomes of economic and social benefits. There is a need in both policy and research for an overarching approach, but one that effectively incorporates the inherent heterogeneity of the domain. Therefore, accommodating newer areas involved in innovation without excluding older ones. Gianiodis and Meek (2020) build on Etzkowitz's model and discuss in detail how the knowledge sharing activities must be embedded. For instance, politicians, governments, and university trustees, as well as local communities, alumni foundations, and university donors need to be committed to partnering with and integrating entrepreneurial initiatives into the regional ecosystem with a long-term time frame in mind.

2.3 Partners

It is not always entirely clear what each partner adds to the ecosystem and what to get out of it (Beelen et al., 2022). So, the evaluation of partners requires a good selection method of partners to optimise the value you gain from the ecosystem. It mentions six categories that are the most important: partner's characteristics, partner's capabilities, partner's product, partner's knowledge assets, partner's sales capabilities, and the orchestrator perspective. Each category has a selection of attributes that are viewed as the most significant. The selection of these attributes was done by performing several case studies to find out what industry leaders' value most in their partners. These categories facilitate the start-up of a new ecosystem, the shift in an existing ecosystem, or the evaluation of the current ecosystem. The categories allow for a more objective view of the partners that are present and new partners that might enter the ecosystem.

Lastly, we discuss the role of IT in the ecosystem of a university. When IT manages and controls interorganizational relationships within a business ecosystem, it becomes a valuable and reusable resource. Additionally, it can enhance robustness in a high velocity environment and support creative work (Kim, Lee & Han, 2010). Furthermore, it assists businesses in lowering costs and establishing new contacts in a generally stable corporate climate. IT also provides for consistent communication between different organizations and aids in the business networking.

Second, IT enables business ecosystems to be more resilient and dependable (Moore, 1999). With the support of IT, organizations can monitor the status of other organizations within the ecosystem and act when something is going wrong. Third, value creation allows organizations to stand out from its competitors while also allowing it to form ties with customers (Kim et al., 2010). Finally, overall productivity has the potential to benefit all ecosystem members substantially (Iansiti and Levien, 2004).

3. Methods

The innovation ecosystem (see figure 1) was composed of findings from the discussed literature. As mentioned, an innovation ecosystem can encounter several bottlenecks that can complicate knowledge sharing and the implementation thereof. By placing the identified mechanisms onto strategic points in the ecosystem, the bottlenecks can be minimised or dissolved. This has an influence on how universities and the industry cooperate with each other. The agent mechanism is all about selecting the right partners from the industry to share knowledge with. The links mechanism explains the interaction with selected partners. Resilience was defined as the encapsulating mechanism that involves every part of the innovation ecosystem, by making sure it remains in an innovative state of disequilibrium.

Even though an innovation ecosystem consists of the three entities university, industry and the government which are interacting with each other, this framework only focuses on the cooperation between universities and the industry. We acknowledge that the government does play an important role indeed. However, the scope of this study was limited to the collaboration of universities and industries. With that said, there is a possibility to

exchange the industry with the government or with society in this framework and work through more findings at a later stage.

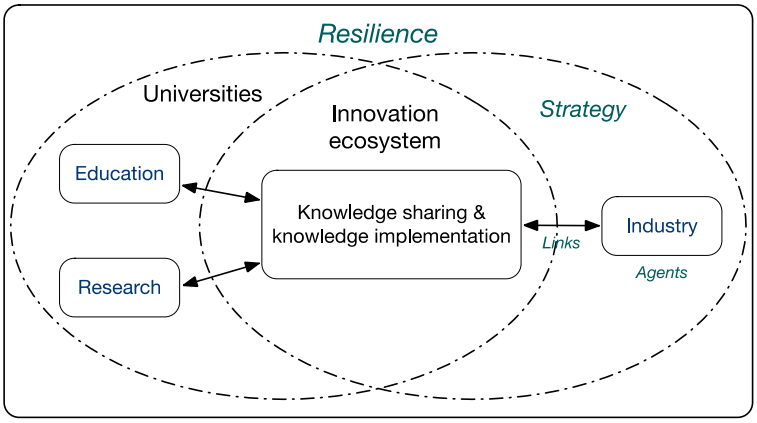


Figure 1: Innovation ecosystem

4. Results

4.1 Knowledge sharing

Essentially, Michels (2020) describes the 'third stream' as a catch-all to describe any activity of universities that partner or engage with external stakeholders. A broad body of research that Michels (2020) provides delivers a deep analysis of what policy implications and recommendations are imminent, in order to create vehicles to make knowledge transfer accessible.

A few examples (2020, p.72) are:

- Difficulty in finding partners/accessibility
- Degree of formality
- Cross/beyond-boundary perspective/attitude
- Strategic (institutional/sector) objectives/valorization/clarity
- Effort/negotiation/politics
- Restrictive contracts/ownership issues/bureaucracy
- Flexibility
- Leadership, management

One of the outcomes and conclusions of Michels is that knowledge and knowledge transfer is valuable but needs to be differentiated into three categories: Individual and disciplinary based approaches, organization- based approaches and case study approaches. In summary, individual- based approaches take individual identity into account when assessing linkages between the knowledge owned and valued by the academic and their engagement when participating in knowledge transfer.

Disciplinary-based knowledge transfer is based on motives that disciplines might have. This approach is considered very heterogeneous, and disciplinary differences may be one element in a complex context. Organization- or institutional approaches see the university as a meaningful unit for academia but also policy. Some research incorporates all organizational parties in the knowledge equation but fails to conclude meaningfully for all. There seems to be a tendency for research to focus on one organizational party: firm/university, recipient/creator (Agrawal, 2001). Results about one stakeholder category may not apply to another. "Firm–firm interactions" are not necessarily relevant for "university–firm" interactions (Agrawal, 2001). Insights from industry may not help support academia and vice versa. Lastly, case-study approaches apply a cross-stakeholder attitude. The notion of a partnership concept that takes into consideration both, common ground and differences, an aim for consensus and vision to dissolve dissensus between stakeholders will lead to an integration of knowledge. The variation of perspectives that aim to integrate commonality and accept' multiple tension' (or hidden agendas). Resulting on the categorization above, we suggest a few strategic

knowledge sharing activities that may leverage the roles of education and research. They move foremost in the organizational and case study approach because we cannot make any assumptions on the individual and disciplinary level when it comes to the introspection and perception of the actors. The reason is that with cross-sectoral stakeholders, many layers of feasibility need to be met to make this work. So either organizations such as companies need to adapt internal processes in the long term or if they focus on a case study approach, they work out possible tensions ad hoc. Also, we aimed to fit the ideas into Eskowitz' Triple- Helix (2000) model where university, industry and government are involved equally if possible.

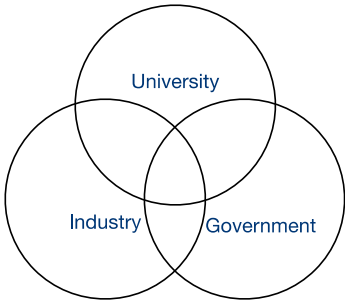


Figure 2: Triple Helix configuration

4.2 Leveraging the research role

Here, the suggestions shall contribute to an expansion of the already existing infrastructure that universities have. Declining funds from traditional sources have forced universities to seek alternative revenue streams, and one opportunity can be the increase of funded, contracted research. Here, industry clients who seek knowledge, innovation and insight from academia can partner with researchers from a discipline and follow through a common research project. Tammi (2009) stated in her results, that such an entrepreneurial approach within the research realm gave universities internal autonomy in important matters and strengthened the quasi-market steering of universities as well as the move towards defining specific performance targets for teachers and researchers. We want to remark at this point that the initiator research team must have a clear picture and vision about the purpose and goal of this project because of course, research and results should not be sold to the highest bidder but should serve a higher purpose to gain knowledge and to share it accordingly.

4.3 Leverage of education role

The role of education can evolve on many levels and can involve many actors, serving Etzkowitz' Triple Helix in various ways. Bespoke executive education as we see it in many Anglo-Saxon universities holds a lot of potential to stay connected and build links to society and the industry. Professional requirements change, and professionals who want to stay on top of their knowledge base can seek knowledge leverage at universities without committing to abandon their career to educate themselves. Here, the university also has opportunities to build reputation and can create a channel to market itself. Lifelong learning tailored to market needs and professional evolution is according to Child et al. (2021) one of the strongest drivers to increase the revenue streams for universities. At this point, the opportunity is used to introduce two more ways how society and even the government can be creatively involved to establish and forge links between universities and their emerging innovation ecosystem. Canada has the Student Work Placement Program (SWPP) which means that a variety of funding opportunities are available for employers to hire students for the purposes of experiential learning. We expect that this can encourage businesses who might reconsider hiring a postgraduate with little experience but fresh academic expertise and knowledge. This funding is being administered by Employment and Social Development Canada (ESDC) through various delivery partners. The Knowledge Transfer Partnership Scheme (KTP's) is another way how the government, industry and universities can work together. KTP are trying to connect businesses that have an innovation idea with the expertise to help deliver it, for example with postgraduates. This example is from the UK as a countrywide program that has been helping businesses for the past 40 years to improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK knowledge base. A Knowledge Transfer Partnership serves to meet a core strategic need and to identify innovative solutions to help that business grow. KTP often delivers significantly increased profitability for business partners as a direct result of the partnership through improved quality and operations, increased sales and access to new markets. In sum, with the above-mentioned activities, a university could possibly establish stronger ties to research and educational spheres but also kick-start the strategic transformation into a more entrepreneurial organization.

4.4 Knowledge sharing bottlenecks & resolving mechanisms

A university needs to be more open to knowledge sharing with external partners in an innovation ecosystem. Knowledge sharing is essential as it enables businesses to enhance innovation performance (Scarbrough, 2003). Knowledge sharing has several potential bottlenecks in four different categories. First, the individual factors. Knowledge sharing is performed by people, and therefore behavioural factors play an important role. Trust is one of the most critical aspects. A lack of trust can be one of the key barriers in knowledge sharing. Other individual factors are personal attitude, motivation, commitment, norms, personal expectations and the relationship between knowledge and power. Furthermore, there are the technological factors. Knowledge sharing needs a sort of IT infrastructure to be executed. When the systems of a university and the partner cannot cooperate, it will be difficult to share information. Additionally, IT literacy is also a possible barrier for knowledge sharing. Next there are the organizational factors. This includes the organizational culture and climate. If these do not align within a university and the business, then it is hard for a good knowledge sharing environment to be set up. The fourth category contains the cultural factors where a difference in local, national, or international culture can form a bottleneck for information sharing since trust in between cultures can be negative (Al-Kurdi et. al., 2018).

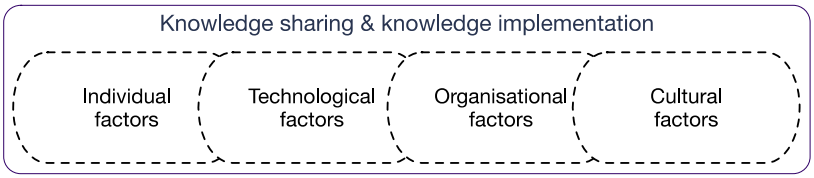


Figure 3: Knowledge sharing factors / bottlenecks

However, these bottlenecks can be countered using resolving mechanisms. Eleven of these mechanisms are identified and grouped in four categories. The first category is strategic mechanisms, where it is important for partners in an innovation ecosystem to set a clear strategy for the system to work as a whole and create a synergy. The second category is about creating the right links between the right partners. Clustering links and relationships that are vital and removing links that do not work to optimise collaboration, is what is needed to make sure that knowledge sharing can be successful. The third category contains mechanisms to make the ecosystem more resilient. This is done by implementing strategies to encourage ecosystems to create and maintain a disequilibrium to keep innovating. The fourth and final category focuses on agents. This category is about the importance of well-functioning mechanisms to select the right partners for the ecosystem. Implementing these mechanisms in the right manner will make sure that a university can remain resilient for the future of knowledge sharing.

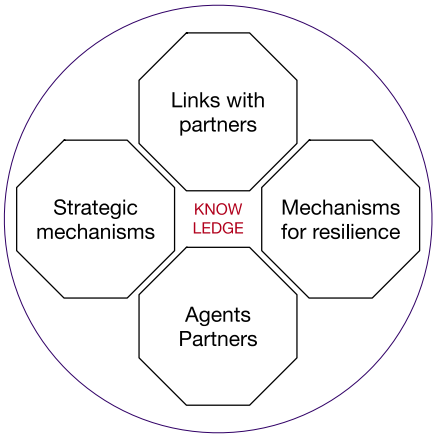


Figure 4: Resolving mechanisms

5. Discussion

Within an innovation ecosystem it is important to have a clear strategy. In that way, every actor in the ecosystem knows which direction the collaboration is headed. This way it is possible to create a synergy that allows the ecosystem to flourish. For universities, this would mean to setup and implement a clear plan to further the coloration within the ecosystem that has clear time frames for each phase of the plan. This would allow a

university to find clear points in time to re-evaluate their position within the ecosystem. Furthermore, evaluating implemented phases halfway through could help with the strategy since it could aid in keeping a good overview.

A very important factor is the strategic evaluation of partners that a university should make to create and maintain valuable links. Creating links is a time-consuming process that requires a lot of money and effort. So, our suggestion is for universities to re-evaluate existing relationships with companies, improve the most crucial links by exploiting further the University-industry relation and thus find the most essential partners and strengthen that link by creating a win-win situation. Moreover, we suggest that it is important to not only ameliorate one aspect of learning, but rather create an environment where students can actually have an opinion on the forming of certain partnerships. This evaluation process should be an ongoing process, because in dynamic environment relationships change and there are possibilities that an existing link might need to be cut. This is not supposed to be an immediate act, but rather a methodised process that would be implemented through certain stages, because a link with a partner cannot just cease to exist. That is why we would strongly recommend that this continuous procedure should be planned and realised carefully so that all existing links with partners are constantly optimal.

When we are referring to partners it is important to get a good understanding of the value that partners have and how to develop a clear and concise strategic evaluation plan. This evaluation can be a very complex task as it is not obvious how much each partner can contribute to the ecosystem. Our suggestion is to select partners based on certain criteria and qualities. Most essential are the characteristics of a partner. More specifically, qualities such as *trustworthiness*, which means that a partner can be trusted to fulfil his obligations, *transparency* in his methods and intentions and the reputation, *credibility*, and *loyalty*, which are key indicators for the formation of prosperous partnerships. Also, the objectives should be aligned for the partnership to work. Moreover, the selection should rely on a partner's capabilities and pose questions, such as “what are the unique competencies that differentiate him from the rest?”, “Do they demonstrate a continuous focus on innovation and development?” and “What management capabilities do they possess?”.

Furthermore, when an ecosystem is considered resilient it means that it can recover from external disturbances that can cause irregularities. Also, it shows that a system can develop adaptive capacity. So, in our perspective resilience in an educational context can be achieved in the following ways. Universities should make room for new learning modes, such as lifelong learning or hybrid flexible learning that brings the online approach closer to an in-person experience. Use the partnerships for case-based learning and thus reduce the gap of academia approach and real-life problems. Use the university as a knowledge point for paid collaboration. Moreover, another option is to diversify education with collaborative international projects which eventually can lead to the formation of international contacts and cultural appreciation. So, all this eventually creates a feedback loop which can benefit the education ecosystem.

A university should deal with knowledge sharing within a modern innovation ecosystem based on the proposed framework which tackles possible bottlenecks with mechanisms to counter the bottlenecks. The applications of the mechanisms are what this article proposes as the best practices for a strong position in a successful innovation ecosystem. These mechanisms allow exchange between partners and the co-creation of new knowledge. Doing so would increase the resilience of the ecosystem, but also increase the quality of research and education. Research is much more connected to the real world, where new findings can be tested and valorised. Education would benefit since it would be more entangled in the industry, meaning that students would receive relevant and up-to-date knowledge.

Within an innovation ecosystem, the university is the most important partner. Without the innovation that a university provides, the ecosystem would be a regular one. But with society changing, it is the question whether universities should remain in their traditional role of delivering knowledge. The answer this article provides is the fact that knowledge delivery should change in knowledge sharing. And this role can be achieved by altering the way that research is done, and education is given in the university. By shortening the paths from these two roles to the industry via knowledge sharing and implementation, a university could provide and obtain much more than from knowledge delivery. When universities take a predominant role in an innovation ecosystem, it could operate with a more hands-on approach to integrate education and research more in the industry.

When looking at the future of this proposal, the economic feasibility of our views on the solution should be further explored. This is because in our views the partner connection and relationships are more integrated, and this will cost time and resources to complete. Also, the act of severing a relationship could become costly. By researching the hidden and visible costs of this would prove to be worth it as it allows everyone involved to understand the costs that are present in these types of situations.

6. Conclusion

Our main research question was: how the traditional roles within a university must adapt to enable universities to improve their knowledge sharing and how to implement this within the innovation ecosystem?

To answer this question, we explored many facets of the situation and thus we concluded that the education system as a whole should move more towards a project-based system where industry and education can meet to better understand each other and provide valuable insights into the overall views of the industry. The research part of a university should engage in a feedback loop with the industry for validation and implementation. This will result in the capabilities of universities to improve, regarding knowledge sharing within the innovation ecosystem.

References

Academics. Knowledge Transfer Partnerships. Retrieved December 7, 2021, from https://www.ktp-uk.org/academics/

Adner, R. (2006). Match your innovation strategy to your innovation ecosystem. Harvard Business Review 84, 4. 98-107.

Agrawal, Ajay. 2001. University to Industry Knowledge Transfer: Literature Review and Unanswered Questions. International Journal of Management Reviews 3 (4): 285–302.

Al-Kurdi, O., El-Haddadeh, R., & Eldabi, T. (2018). Knowledge sharing in higher education institutions: a systematic review. Journal of Enterprise Information Management.

Beelen, L., Jansen, S., & Overbeek, S. (2022). Are you of value to me? A partner selection reference method for software ecosystem orchestrators. Science of Computer Programming, 214, 102733

Bianchi, S. I., Sousa, D. R., & Pereira, R. (2021). Information Technology Governance for Higher Education Institutions: A Multi-Country Study. Informatics, 8(2), 26. https://doi.org/10.3390/informatics8020026

Cai, Y., Ma, J., & Chen, Q. (2020). Higher education in innovation ecosystems.

Child, F., Frank, M., Lef, M., & Sarakatsannis, J. (2021, November 11). Setting a new bar for online higher education. McKinsey &Company. Retrieved December 5, 2021, from https://www.mckinsey.com/industries/education/our-insights/setting-a-new-bar-for-online-higher-education

Datta, S., & Adesola, S. (2020). Entrepreneurial universities: creating institutional innovation in times of turbulence (1st ed. 2020.). Cham, Switzerland: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-48013-4

Etzkowitz, Henry et al. The Future of the University and the University of the Future: Evolution of Ivory Tower to Entrepreneurial Paradigm. Research policy 29.2 (2000): 313–330.

Ghildyal, A., & Chang, E. (2017). IT Governance, IT/Business Alignment and Organization Performance for Public Sectors. Journal of Economics, Business and Management, 5(6), 255–260. https://doi.org/10.18178/joebm.2017.5.6.522

Gianiodis, P. T., & Meek, W. R. (2019). Entrepreneurial education for the entrepreneurial university: a stakeholder perspective. The Journal of Technology Transfer, 45(4), 1167–1195. https://doi.org/10.1007/s10961-019-09742-z

Iansiti, M. and Levien, R. (2004). Strategy as ecology. Harvard Business Review 82, 3. 68-78.

Jucevičius, G., & Grumadaitė, K. (2014). Smart development of innovation ecosystem. Procedia-social and behavioral sciences, 156, 125-129.

Kim, H., Lee, J. N., & Han, J. (2010). The role of IT in business ecosystems. Communications of the ACM, 53(5), 151–156. https://doi.org/10.1145/1735223.1735260

Michels N. (2020) Research, Policy, and Practice in Knowledge Transfer: Towards an All-inclusive Approach. In: Adesola S., Datta S. (eds) Entrepreneurial Universities. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-48013-4_4

Moore, J. (1999). Predators and Prey: A New Ecology of Competition. Harvard business review. 71. 75-86.

Scarbrough, H. (2003). Knowledge management, HRM and the innovation process. International journal of manpower.

Student Work Place Program (SWPP) | Wage Subsidy Program. (2021). HIRE Waterloo. Retrieved December 7, 2021, from https://uwaterloo.ca/hire/funding-opportunities/student-work-placement-program

Tammi, T. The competitive funding of university research: the case of Finnish science universities. High Educ 57, 657–679 (2009). https://doi.org/10.1007/s10734-008-9169-6

Zmiyak, S. S., Ugnich, E. A., & Taranov, P. M. (2020). Development of a regional innovation ecosystem: the role of a pillar university. In Growth poles of the global economy: Emergence, changes and future perspectives (pp. 567-576). Springer, Cham.

Innovation as a Challenge for Peripheral Regions: An Israeli Case

Raphael Bar-El, Sharon Hadad, Liran Maymoni, Ran Ben-Malka and Reut Megidish
Sapir Academic College, Hof Ashkelon, Israel
rbarel@bgu.ac.il
sharonh@sapir.ac.il
liran.maymoni@gmail.com
ranben78@sapir.ac.il
reutmeg@gmail.com

Abstract: Peripheral regions are now confronted with the worldwide prominence of innovation and high technology driving economic growth. It is crucial that they integrate the new trends for their economic sustainability and for the narrowing of social gaps. Research has focused on factors influencing the concentration of technology in metropolitan areas. Other analyses have highlighted the advantages for peripheral or rural regions if they integrate into this process. In our article, we aim to contribute to the discourse by suggesting a unique approach, testing it empirically with a peripheral region in Israel. Our approach contains the following elements: First, instead of considering innovation as knowledge creation or practical implementation (as generally considered), we prefer the indicator of a knowledge-based economy, as a better proxy for advanced economic growth. Second, we make a distinction between the changes in the economy of the periphery as indicated by prevailing types of occupations, and the changes in the economy of the resident's workers as indicated by their actual occupations, working in or out of the region (as in the distinction between GDP and GNP). Using time series for the last two decades, we compare the southern region of Israel and its main central region, using a classification of occupation types into three levels. The results showed a positive response of the peripheral region to the technological trend challenge. They improved skills and reacted to public policy measures. The economic structure of the periphery improved, providing occupations at higher wage levels. However, such improvement did not sufficiently respond to the improvement in labor supply by resident workers, leading to an increase in dependence on employment of high-level workers from other regions. We also detected an increase of internal gaps within the periphery.

Keywords: innovation, region, knowledge, periphery, core-periphery gaps, labor market

1. Introduction

The contribution of technological innovation to economic growth is well established in economic literature (Wong et al. 2005), and it is often found to be one of the fundamental drivers of both economic development and human progress (Sheehan et al. 2014). These innovation trends include the introduction of new products and services and the demise of old ones, which often leads to an increase in demand for skilled workers (Bosetti et al. 2015) and changes in economic structures (Bar-El and Maymoni 2022). Due to this, innovation differs significantly for different regions, depending on their abilities to adapt and absorb such intense transformation in their economic environment (Agrawal et al. 2014). In this article, we offer empirical evidence on the integration of the Israeli periphery into the national innovation trend. We further suggest a government policy to distribute the innovation process to the peripheral areas reducing the core-periphery gaps.

It has been well-documented that poorer regions' lower level of technology adoption is a rational response of firms to a range of challenges, such as weaker infrastructures, lower skills and low managerial capabilities (Varsakelis 2006; Filippetti and Peyrache 2011). Accordingly, wealthier regions provide a fertile ground for innovative activities since they embody innovative firms capable of a high level of adaption and resilience.

In spatial terms, metropolitan regions are often considered to have higher innovation potential in comparison to peripheral areas. This is mainly due to geographical proximity, which offers a variety of benefits such as exchange of goods or work (Krugman 1991), transfer of knowledge (Feldman and Massard 2012), as well as psychological or sociological reasons, motivated by a desire for social interaction (Ota and Fujita 1993). As a result, the core-periphery social gaps have threatened to widen, emphasizing the need for the oversight of an effective government policy.

This article aims to identify and analyze the process of the integration of the periphery into the innovation-led economic growth. We use the example of Israel for an empirical analysis. It has experienced significant technological growth in the last two decades, affecting labor market structure and employment opportunities both in the core metropolitan and peripheral regions. We use secondary data obtained from Israeli Central

Bureau of Statistics (CBS) to construct and compare regional trendline regressions of relevant variables in these two regions.

2. Literature review

The location trends of innovation activity: spatial concentration

The relevant literature assumes that the tendency to innovate is very geographically oriented and unevenly distributed between regions. This is partly due to industry clustering, social capital networks and knowledge spillover. Porter (1998) defines clusters as a geographical concentration of specialized suppliers and service providers, organizations like universities and commercial unions, as well as interconnected enterprises. These compete with each other and only collaborate in particular and related industries. Geographical proximity causes easier communication and value creation through networks (Mercan and Goktas 2011), as well as the tendency of funding and research support to be directed into areas where there have already been innovation success stories (Morgan 2007).

Main factors influencing the location of innovation activities: national and regional ecosystem factors

Literature mentions that one of the most critical factors driving firms to enter into clusters, is the need for talented employees. Their skills, capabilities, and productivity are closely related to available human capital (Justman and Teubal 1991; Breschi et al. 2010). The proportion of the population with post-secondary education is a good indicator of the qualities of human capital (Hollanders et al., 2014). Ciccone and Papaioannou (2009) argued that there is a positive relationship between education and structural change in knowledge-intensive activity. Knowledge-intensive activities or services based on the knowledge inherent in people is critical for transferring or exchanging knowledge and information in the innovation process.

The region's scientific and technological resources (universities, technology centers, etc.) are another key factor for regional innovation. They provide direct services to companies and facilitate interaction and collaboration between local actors and external knowledge networks (Inkinen and Suorsa 2010).

Another factor mentioned in the literature is the public subsidy for research and development (R&D), which stimulates innovation activities at the firm level (Herrera et al. 2008). Many governments provide public funding for R&D projects with the potential to generate externalities. Almus and Czarnitzki (2003) suggested that the level of R&D investment of companies receiving government support is significantly higher compared to companies not receiving government support. However, Wallsten (2000) claims that subsidies do not increase investment in R&D, but rather act as substitutes for those that are firm-financed.

Culture is a major factor in the explanation of innovation advance, although it is hardly measurable (Mercan and Goktas 2011; Turbiner, Schwartz and Bar-El 2016).

Periphery in the context of innovation

Innovation in the periphery is an issue that still receives relatively little attention compared to innovation in the core areas. However, recently there has been many theoretical developments and much empirical work on issues related to the innovation potential of remote regions (Eder 2019). Some studies point to the potential benefits of the periphery from innovation activities (Grabher 2018; Simmie 2012; Bar-El and Felsenstein 1990). Innovation in the periphery can be a major component of growth, as these firms provide employment for highly skilled workers, and even attract other highly qualified workers from outside the region (Meili and Shearmur 2019).
An empirical study conducted in southern Norway showed that firms in the periphery could overcome difficulties and innovate by establishing regional centers and strong ties to international-innovative networks (Fitjar and Rodríguez-Pose 2011).

3. An alternative approach

While the literature is quite clear on the factors that influence the innovation process both at a national and at a regional level—the issue of balance between core and peripheral regions remains inexplicit. For our analysis

of the integration of the periphery into the innovation process, we interrogate the three main approaches that prevail.

First we question whether the variety of definitions used for innovation are appropriate for the analysis of innovation in a peripheral context. Indicators such as knowledge creation (such as R&D activity or patents creation), or practical implementation (such as manufacturing of high-tech products) may not be the most valid indicators. We propose the use of the knowledge-based indicator as a more appropriate proxy for the level of integration of the periphery into the innovation process (Cooke and Schwartz 2008; Bar-El and Felsenstein 1989). The concept of the knowledge-based economy focuses on the level of skills required in various occupations, as evaluated by education or wage levels.

Second, we do not prioritize consider our objective function as the optimization of the innovation level in the periphery. We rather consider the objective of diminution of the core-periphery gap. This is in terms of the relative increase of higher levels of knowledge-based activities (with higher wage levels in the periphery).

Third, we do not consider the periphery as a single issue; we make a distinction between the economy of the periphery (in terms of the occupations in the economic activities installed there), and the economy of the resident workers of the periphery (in terms of their occupations, either in the periphery or in other regions). This may be considered as the balance between labor supply and labor demand. Labor supply for any given occupation is evaluated as the number of resident labor force in each region employed in this occupation, in the same region or outside the region (with some bias caused by the exclusion of unemployed labor force, for which there is no viable statistical data about the desired occupation). Labor demand is evaluated as the number of workers in each occupation with each given region. To some extent, labor supply may be considered as a parallel to gross national product (GNP), while labor demand may be considered as a parallel to gross domestic product (GDP). Therefore labor supply is used as a proxy for the economic level of the labor force in a given region, while labor demand is more a proxy of the level of the economy of a given region.

4. Hypotheses

- Both the local labor force and the business sector respond positively to the challenges of the innovation trend (with the support of public policy), with the integration into higher knowledge-based activities and higher wages.
- The improvements in peripheral supply (of improved labor force, improved local ecosystem factors) are not met by sufficiently appropriate demand of knowledge-based activity.

5. Methodology

We use Israel as a case study, and compare two regions: a core region defined as the metropolitan region of Tel-Aviv (including the district of Tel Aviv and the central district, and the peripheral region defined as the southern district). We used data from the Central Bureau of Statistics on the percentages of employed persons by occupations from 2003 to 2019. Occupations were classified into 3 levels of knowledge-based activities, based on wage levels of detailed occupations:

LO—Low-level occupations: unskilled, services, and sales workers.
MO—Mid-level occupations: skilled, clerical workers, engineers.
HO—High-level occupations: academics and managers.

We compared the relative weight of each occupational level in the periphery and in the core, when the demand (the ‘‘region”) side is the share of each occupational level out of total employment within the periphery (or core), when variable:

LOD(p), LOD(c): the share of workers in low level occupations out of total employment within the periphery (p) and within the core (c),
MOD(p), MOD(c): the parallel share of workers in medium level occupations,
HOD(p), HOD(c): the parallel share of workers in high level occupations.

The supply (the ‘‘people”) side is the share of each occupational level out of total employment of the resident labor force of the periphery (or core):

Using those variables, we define the relative share of each occupation level in the periphery in relation to the core:

Eq 1:$LOD(p/c) = \frac{LOD(p)}{LOD(c)}$: the percent of labor demand for low level occupations out of total labor demand in the periphery, divided by the same percent in the center.
Eq 2: $MOD(p/c) = \frac{MOD(p)}{MOD(c)}$: as above for labor demand for medium level occupations.
Eq 3: $HOD(p/c) = \frac{HOD(p)}{HOD(c)}$: as above for labor demand for high level occupations.
Eq 4: $LOS(p/c) = \frac{LOS(p)}{LOS(c)}$: the percent of labor supply for low level occupations out of total labor supply in the periphery, divided by the same percent in the center.
Eq 5: $MOS(p/c) = \frac{MOS(p)}{MOS(c)}$: as above for labor supply for medium level occupations.
Eq 6: $HOS(p/c) = \frac{HOS(p)}{HOS(c)}$: as above for labor supply for high level occupations.

We performed an analysis of time series changes in the economic structure, in the periphery and the center. This was in terms and occupational levels, using estimation of regression trendline, using a ‘‘best fit” regression procedure. On the supply side, we identify the trends of adaptation of the local labor force to improved occupational levels, and on the demand side, we identify trends of change in the structure of the economy in the periphery.

6. Findings

Labor supply:

The relative changes of labor supply at the three levels of occupations in Table 1 demonstrate a clear increase of the share of workers employed on high level occupations, both in the core region and in the peripheral region. The sudden increase in 2012 is attributed to the changing classification of occupations by the Israeli Central Bureau of Statistics (CBS). This technical distortion is attenuated by the calculation of the ratio of the share of peripheral labor force and of core labor force residents (HOS(p/c)). A most interesting finding is the quite continuous increase of this indicator (after a decrease at the beginning of the period), testifying to an adaptation of the residents of the periphery to innovation changes, at a higher share that that of the core residents (who were apparently already better prepared at the beginning of the period).

The decrease of the share of labor force residents in middle level and low level occupations is met by a higher decrease amongst the core labor force residents.

Table 1: Share of occupation levels by regions of residence, 2003–2019: Labor Supply

year	Core			Periphery			Share Periphery/Core		
	LOS	MOS	HOS	LOS	MOS	HOS	Low supply	Middle supply	High supply
							LOS(p/c)	MOS(p/c)	HOS(p/c)
2003	27%	50%	23%	30%	55%	15%	1.15	1.09	0.64
2004	28%	49%	23%	30%	56%	14%	1.11	1.13	0.60
2005	28%	49%	23%	32%	56%	13%	1.13	1.13	0.56
2006	28%	49%	23%	31%	55%	13%	1.13	1.12	0.58
2007	27%	49%	24%	31%	55%	14%	1.14	1.13	0.58
2008	27%	48%	25%	31%	55%	14%	1.16	1.13	0.57
2009	27%	49%	25%	32%	54%	14%	1.20	1.11	0.57

year	Core			Periphery			Share Periphery/Core		
	LOS	MOS	HOS	LOS	MOS	HOS	Low supply	Middle supply	High supply
							LOS(p/c)	MOS(p/c)	HOS(p/c)
2010	27%	47%	26%	32%	52%	15%	1.20	1.11	0.59
2011	27%	48%	26%	33%	51%	16%	1.23	1.08	0.61
2012	24%	36%	40%	30%	41%	28%	1.26	1.14	0.71
2013	25%	36%	39%	30%	42%	28%	1.23	1.15	0.72
2014	24%	36%	40%	31%	39%	30%	1.28	1.10	0.75
2015	23%	35%	42%	30%	40%	30%	1.28	1.15	0.73
2016	23%	34%	43%	29%	40%	31%	1.27	1.17	0.72
2017	24%	34%	43%	28%	41%	31%	1.20	1.21	0.72
2018	23%	33%	44%	29%	40%	31%	1.25	1.19	0.72
2019	23%	34%	43%	29%	41%	30%	1.28	1.18	0.70

Source: Calculated on the basis of data from the labor force surveys of the CBS

Labor demand:

The changing structure of the economy of the core and of the periphery regions (labor demand) shows an increasing adaptation to the innovation national trend: in both regions we identify an increase (in spite of changing classifications by the CBS) of the share of high level occupations. However, the share of low level occupations in the periphery is quite stable, against its diminution in the core region.

Table 2: Share of occupation levels by regions of work, 2003–2019: Labor Demand

	Core			Periphery			Share Periphery/Core		
	LOD	MOD	HOD	LOD	MOD	HOD	Low demand	Middle demand	High demand
							LOD(p/c)	MOD(p/c)	HOD(p/c)
2003	27%	50%	23%	30%	54%	16%	1.14	1.07	0.69
2004	28%	50%	22%	31%	54%	15%	1.10	1.09	0.67
2005	28%	50%	22%	32%	54%	15%	1.11	1.07	0.68
2006	28%	50%	22%	31%	54%	15%	1.12	1.07	0.70
2007	27%	49%	23%	31%	54%	15%	1.12	1.10	0.64
2008	27%	49%	24%	32%	53%	16%	1.16	1.09	0.64
2009	27%	49%	24%	32%	52%	16%	1.17	1.06	0.68
2010	27%	48%	25%	33%	51%	17%	1.19	1.06	0.67
2011	27%	48%	25%	33%	50%	17%	1.20	1.04	0.70
2012	25%	37%	38%	31%	41%	28%	1.24	1.12	0.73

	Core			Periphery			Share Periphery/Core		
	LOD	MOD	HOD	LOD	MOD	HOD	Low demand	Middle demand	High demand
							LOD(p/c)	MOD(p/c)	HOD(p/c)
2013	25%	37%	38%	31%	41%	28%	1.25	1.11	0.74
2014	24%	36%	40%	31%	39%	30%	1.26	1.07	0.77
2015	24%	35%	41%	30%	39%	31%	1.25	1.10	0.76
2016	23%	35%	42%	30%	39%	31%	1.28	1.12	0.74
2017	24%	34%	42%	29%	40%	31%	1.23	1.17	0.73
2018	23%	34%	43%	30%	39%	32%	1.27	1.14	0.74
2019	23%	35%	42%	30%	41%	30%	1.32	1.15	0.70

Source: Calculated on the basis of data from the labor force surveys of the CBS

7. Analysis: Demand vs. supply

We use best fitted trendlines of the ratio of the share of periphery and of the core regions for the three levels of occupations, for demand (HOD (p/c), MOD(p/c), LOD (p/c)) and for supply (HOS(p/c), MOS(p/c), LOS(p/c)).

The regression estimation for high level occupations is best fitted using a 3 level polynomial estimation:

$$HOD(p/c) = 2058616 - 3071.09Year + 1.5272Year^2 - 0.0003Year^3, \quad R^2 = 0.805^{***}$$
$$HOS(p/c) = 3162792 - 4717.67Year + 2.3456Year^2 - 0.0004Year^3, \quad R^2 = 0.877^{***}$$

*** p<0.01

As shown in Figure 1, regarding the supply, there is a lower share of high-level occupations in the periphery, but a decreasing gap with the center after a short increase. Regarding the demand of local activities, we see a decreasing periphery/core gap, but at a slower intensity; the increasing relative supply of high-level workers of the periphery is not met by a sufficient response of local activities.

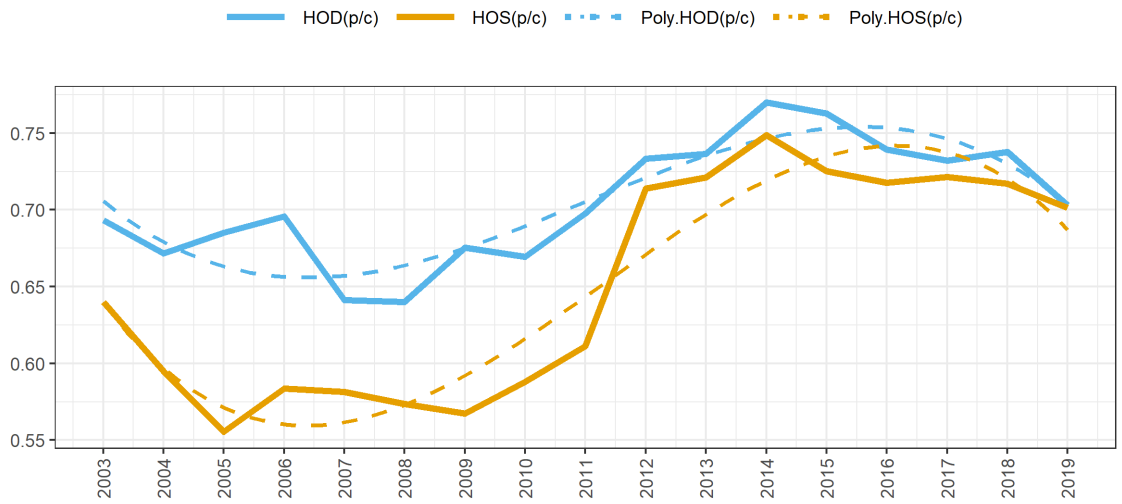


Figure 1: High level occupations: trends of the periphery/core gap of supply and demand

The consequence regarding the ability of high-level labor force to find occupations in the periphery is shown by the following indicator:

HOB(d/s)- high occupational level balance in the periphery=
workers employed in high level occupations in the periphery/
workers resident in the periphery employed in high level occupations
The trend of the balance is presented in Figure 2, and estimated by the following regression:
$HOB(D/S) = 19.6283 - 0.0093Year, R^2 = 572^{***}$
*** p<0.01

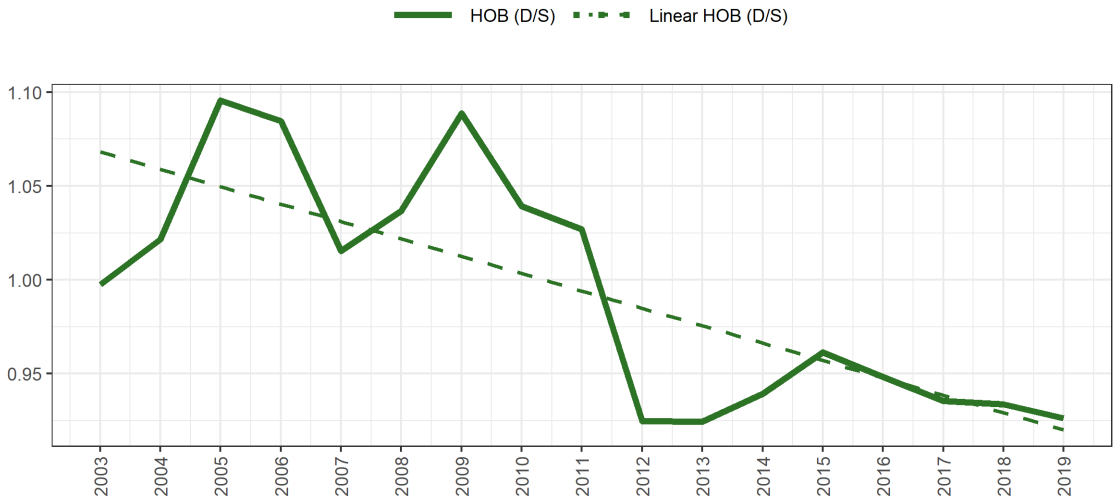


Figure 2: High level occupations balance

We find a clear decreasing demand/supply balance: the increasing supply of high-level workers in the periphery is not met by a parallel increasing demand.

The parallel results for low level occupations are shown in the following regressions results and graphs:

$LOD(p/c) = -410.14 + 0.396Year - 0.0001Year^2, \quad R^2 = 0.893^{***}$

$LOS(p/c) = -2131.29 + 2.110Year - 0.0005Year^2, \quad R^2 = 0.817^{***}$

$LOB(D/S) = -0.743 + 0.0008Year, R^2 = 0.175^{*},$

**** p<0.01 * p<0.10*

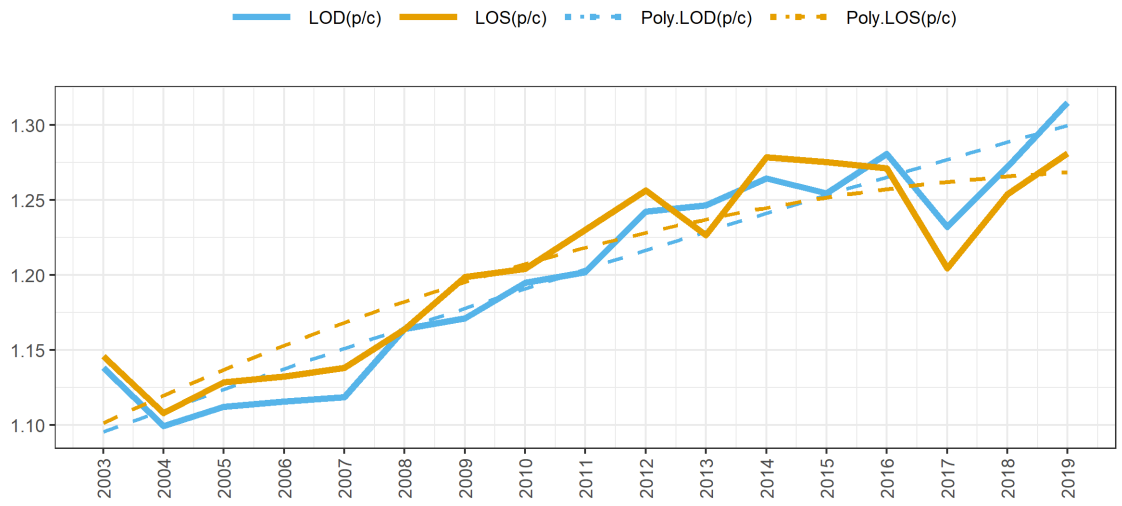


Figure 3: Low level occupations: trends of the periphery/core gap of supply and demand

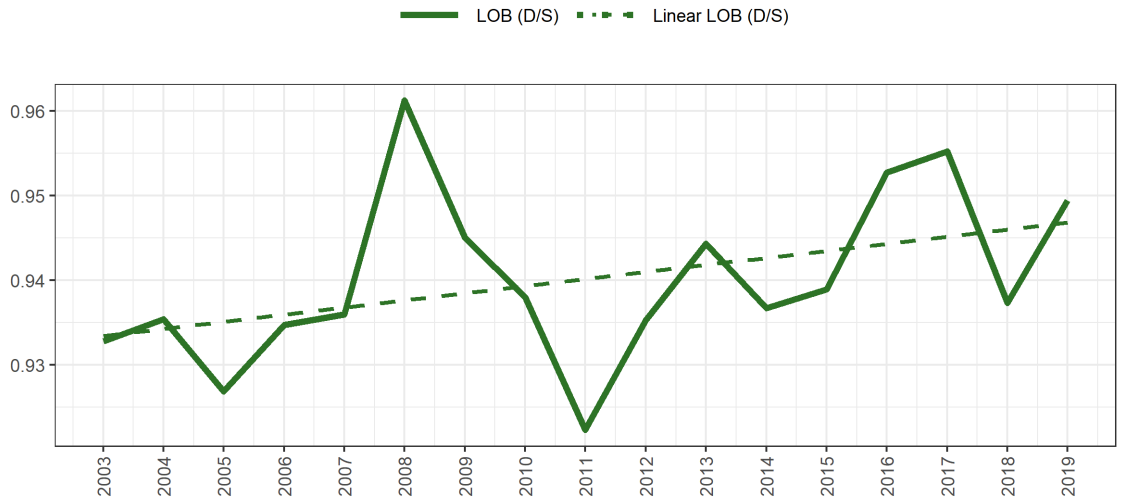


Figure 4: Low level occupations balance

On the supply side, the share of low-level occupations of local workers in the periphery is quite constant (about 30%), but that of the core decreases over the time period. This increase of the relative frequency of low-level workers leads to a decrease of the relative attractiveness of the periphery (Figure 3).

This is met on the demand side of local activities with an increasing periphery/core gap, adapting to the relatively higher frequency of low-level workers in the periphery.

Consequently, we identify in Figure 4 an increasing excess of low-level job opportunities in the periphery (yet not statistically significant).

8. Conclusion

We found that advances in innovation and high-tech activities do actually impact the regional system. This article focused on the impact on the economic balances between a core region and a peripheral region, from the aspect of the labor market. Prevailing literature related to the regional issue in the context of innovation, but the conclusions were not explicit. This is due to a large extent to the fact that there is no real agreement about the definition of innovation and its measures, and to the fact that core and periphery or remote regions may have varying facets.

We chose to consider the integration of innovation by peripheral areas in terms of absorption of knowledge-based activities with higher wage levels (instead of knowledge creation or production of innovative products). We considered improved occupation types with higher income levels to be a better indicator of the objective function of the peripheral area.

Using the Israeli case, we found that the innovation process impacts the economic situation of the labor force population in the periphery, and to a lesser extent the economic situation of the periphery itself. In a sense, the gap between the peripheral labor force and that of the core region is reduced, but not the gap between the economic structure of both regions. This may be attributed to the lower response flexibility of a region's economy, that depends mainly on more rigid factors, such as infrastructures or agglomeration.

The adaptation of the labor force of the periphery to the innovation trends is also expressed by a decrease of the share of workers in low level occupations. However, the decrease of such workers in the core region was even higher, which can be attributed to a higher advance of the innovation process there. This imbalance naturally leads to a higher relative attractivity of low-level occupations to the periphery.

The bottom line is a better adaptation of local labor force of the periphery (supply) to the innovation national process than that of the local economy (demand). This increasing gap between supply and demand may lead to increased commuting of skilled labor force, or to emigration to core regions.

The findings of this study should be considered under a few heavy limitations, and therefore can be used as a base for much further research. One important limitation is the validity of the measures of the knowledge base level of each occupation: the wage level provides an important and quite reliable measure, but other variables should be considered, such as the educational level. A second important limitation is the time series of two decades: much more interesting results may be achieved with longer time series (which could not be done here because of heavy technical limitations, changing definitions, and changing classifications of occupations).

Further research is also required to identify the implications of these results in terms of welfare and spatial structures, and for the introduction of appropriate policy measures.

References

Agrawal, A., Cockburn, I., Galasso, A., & Oettl, A. (2014). Why are Some Regions More Innovative than Others? The Role of Small Firms in the Presence of Large Labs. *Journal of Urban Economics*, *81*, 149-165.

Almus, M., & Czarnitzki, D. (2003). The effects of public R&D subsidies on firms' innovation activities: the case of Eastern Germany. *Journal of Business & Economic Statistics*, *21*(2), 226-236.

Bar-El, R., & Felsenstein, D. (1989). Technological Profile and Industrial Structure: Implications for the Development of Sophisticated Industry in Peripheral Areas. *Regional Studies*, *23*(3), 253-266.

Bar-El, R., & Felsenstein, D. (1990). Entrepreneurship and Rural Industrialization: Comparing Urban and Rural Patterns of Locational Choice in Israel. *World Development*, *18*(2), 257-267.

Bar-El, R., & Maymoni, L. (2022). Peripheral Implications of National Innovation: Insights from the Israeli Experience. Working Paper.

Bosetti, V., Cattaneo, C., & Verdolini, E. (2015). Migration of Skilled Workers and Innovation: A European Perspective. *Journal of International Economics*, *96*(2), 311-322.

Breschi, S., Lenzi, C., Lissoni, F., & Vezzulli, A. (2010). The Geography of Knowledge Spillovers: the Role of Inventors' Mobility Across Firms and in Space. *The Handbook of Evolutionary Economic Geography, Cheltenham: Edward Elgar*, 353-369.

Ciccone, A., & Papaioannou, E. (2009). Human Capital, the Structure of Production, and Growth. *The review of economics and statistics*, *91*(1), 66-82.

Cooke, P., & Schwartz, D. (2008). Regional Knowledge Economies: An EU-UK and Israel perspective. *Tijdschrift Voor Economische en Sociale Geografie*, *99*(2), 178-192.

Eder, J. (2019). Innovation in the Periphery: A Critical Survey and Research Agenda. *International Regional Science Review*, *42*(2), 119-146.

Filippetti, A., & Peyrache, A. (2011). The Patterns of Technological Capabilities of Countries: a Dual Approach Using Composite Indicators and Data Envelopment Analysis. *World Development*, *39*(7), 1108-1121.

Fitjar, R. D., & Rodríguez-Pose, A. (2011). Innovating in the Periphery: Firms, Values and Innovation in Southwest Norway. *European Planning Studies*, *19*(4), 555-574.

Grabher, G. (2018). Marginality as Strategy: Leveraging Peripherality for Creativity. *Environment and Planning A: Economy and Space*, *50*(8), 1785-1794.

Herrera, L., & Nieto, M. (2008). The National Innovation Policy Effect According to Firm Location. *Technovation*, *28*(8), 540-550.

Hollanders, H., Es-Sadki, N., Buligescu, B., Léon, L. R., Griniece, E., & Roman, L. (2014). Regional Innovation Scoreboard 2014. *Enterprise and Industry, European Commission*.

Inkinen, T., & Suorsa, K. (2010). Intermediaries in Regional Innovation Systems: High-technology Enterprise Survey from Northern Finland. *European Planning Studies*, *18*(2), 169-187.

Justman, M., & Teubal, M. (1991). A Structuralist Perspective on the Role of Technology in Economic Growth and Development. *World Development*, *19*(9), 1167-1183.

Meili, R., & Shearmur, R. (2019). Diverse Diversities—Open Innovation in Small Towns and Rural areas. *Growth and Change*, *50*(2), 492-514.

Mercan, B., & Goktas, D. (2011). Components of Innovation Ecosystems: a Cross-country Study. *International Research Journal of Finance and Economics*, *76*(16), 102-112.

Morgan, K. (2007). The Learning Region: Institutions, Innovation and Regional Renewal. *Regional studies*, *41*(S1), S147-S159.

Porter, M. E. (1998). Clusters and the New Economics of Competition. *Harvard Business Review, 76* (6),77-90.

Schwartz, D. (2006). The Regional Location of Knowledge-based Economy Activities in Israel. *The Journal of Technology Transfer*, *31*(1), 31-44.

Sheehan, M., Garavan, T. N., & Carbery, R. (2014). Innovation and Human Resource Development (HRD). *European Journal of Training and Development*.

Simmie, J. (2012). Path Dependence and New Technological Path Creation in the Danish Wind Power Industry. *European Planning Studies*, *20*(5), 753-772.

Turbiner, Y., Schwartz, D. & Bar-El, R. (2016). Innovation Ecosystems: Practice vs. Prevailing Perceptions. *International Journal of Innovation and Scientific Research, 22*(2), 444-455.

Varsakelis, N. C. (2006). Education, Political Institutions and Innovative Activity: A Cross-country Empirical Investigation. *Research policy*, *35*(7), 1083-1090.

Wallsten, S. J. (2000). The Effects of Government-Industry R&D Programs on Private R&D: the Case of the Small Business Innovation Research program. *The RAND Journal of Economics*, 82-100.

Wong, P. K., Ho, Y. P., & Autio, E. (2005). Entrepreneurship, Innovation and Economic Growth: Evidence from GEM Data. *Small Business Economics*, *24*(3), 335-350.

Innovation in the Circular Economy

Lukáš Blažek
VSFS University of Finance and Administration, Czech Republic, Prague
blazek.lukas@mail.vsfs.cz

Abstract: The circular economy (CE) is an area that is increasingly resonating across different sectors. This is one of the principles of the sustainability strategy. CE deals with ways to improve the quality of the environment and human life by increasing production efficiency. In the future, it is intended to replace the linear economy, in which a large percentage of products, in the first place, end up unnecessarily after consumption in landfills or incinerators. It is necessary to deal with the observance of the principles of the circular economy, mainly for the sake of nature protection in connection with the visibly changing climate and stocks of raw materials. In the context of global trends, sustainability strategies are a necessity for more and more companies. It is therefore a presentation of the concept of environmentally sustainable economy, technology and production chain in today's globally burdened environment. Accessing CE in terms of cost, material and energy savings can be a great motivation for companies. Companies are trying to reduce costs associated with production and waste management and are looking for new business models. As part of the transition from linear to CE principles, procedures and opportunities for a step improvement compared to the existing competition in the form of the implementation of innovative proposals can be recommended. There are not only ecological but also economic arguments in favor of CE. The economy requires resources to produce goods and services and ultimately to create value for society. Unless companies radically use recyclable materials more often and adhere to CE principles, they will face a shortage of resources that will complicate their operations in the medium to long term. In order for companies to become part of the circular economy, they must carry out a complete overhaul of their business models. Based on analyzes of the economic and social environment, the presented article provides an overview of the possibilities of innovation and eco-innovation within CE. The subject was to determine the development of the implementation of innovations in CE in today's society, as one of the latest approaches to the production, consumption and subsequent processing of waste.

Keywords: circular economy, shared economy, digital technologies, innovation, sustainability, ecodesign, European Union, green deal, life cycle assessment

1. Introduction

The aim of the presented text is to state a more detailed characteristic of CE, including an outline of the concept, principles, advantages and disadvantages. Furthermore, determining the possibilities of innovation in CE. Information for the processing of the submitted text was drawn from secondary sources, mainly from printed professional Czech and foreign literature, professional articles and Internet sources. Circular economics is a current concept today, not only in a societal context, but across all disciplines that affect us all ethically and in principle, not only as individuals. Therefore, this area is important because it represents the concept of an environmentally sustainable economy, technology and production chain in today's globally burdened and destroyed environment. There has long been talk about the current method of production, which is, however, environmentally unsustainable. It is estimated that in 2050, production from the three planets would not be enough to cover all global consumer demand. Consumption is enormous and current resources are no longer enough. The solution can be just CE (found.cz, 2020). Companies are expected to behave innovatively. This means using natural resources wisely, minimizing waste generation, supporting each other on the path to sustainability, and requesting services or raw materials from partners who have already implemented circular and sustainable principles in their products. In fact, the CE is primarily about tangible results, sensible use of resources and, above all, cooperation between entities. Without cooperation, one company would not be able to turn the rest of the company's material into a completely new source. CE is primarily about closing material cycles and minimizing waste. Products that have reached the end of their useful life can be disassembled and used as a raw material for further production. Companies already understand that it also pays off economically, especially in the current shortage of plastics, wood or metals. For this system to work, however, we need to think about the whole operation of the business in an innovative way - to address product design, financing and the supply chain. Partnerships help companies innovate, invent and move. This is the CE principle. Combining an idea and an implementer, often a smaller entity, with a major player in the market. However, a good example is the connection of the academic community where the proposal of innovation can take on completely new dimensions and move business thinking forward.

2. Literature review

The content of the article deals with the topic "Innovation in the circular economy". In the field of circular economics, you can find mainly professional articles and studies at the level of the European Commission - EU Environmental Management and Audit Scheme (EMAS), Green Public Procurement (GPP), Life Cycle Costs, etc .. among the authors are Morlet, A., Sherratt, A., Brkljac, M., Sudarevic, T .. It should be noted that there is not yet a large number of professional publications focused directly on this particular issue. Especially in relation to the researched issues (combination of the importance of innovation and CE). On the other hand, there is enough professional literature in the field of innovation theory. Among them are well-known personalities such as Schumpeter,J.A, Valenta, F. and Drucker,P.F.. A detailed overview of the used literature and authors is given at the end of the article.

3. Methodology, goal and purpose of research

The stated goal of the paper was achieved by implementing the following scientific methods and organizational principles. Information for the processing of the submitted text was drawn from secondary sources, mainly from printed professional Czech and foreign literature, professional articles and Internet sources. To achieve the output, a search of available relevant literature and studies dealing with issues of innovation, concept and principles of CE and Life Cycle Assessment was performed. Furthermore, a meta-analysis was performed, which summarizes data from several partial independent studies. Extensive documents prepared by the European Commission were also used. The aim is to make recommendations to companies that will want to move from linear to circular operation and, as part of this change, to improve dramatically through innovation. Specific areas of innovation are defined in the text. This article is the initial output of research conducted at the University of Finance and Administration (Prague, Czech Republic). The name of the project is "Innovation in the circular economy", where the main goal is to estimate the possible use of innovation in CE. CE is one of the basic pillars of sustainable development, as it helps the market to function better, raises awareness of prices and quality of services, but also gives everyone better access to the market. It is necessary to monitor, research, analyze and focus on identifying positive and negative impacts. It follows from the above that in the areas mentioned in this paper, both in theory and in practice, there is great potential for the corporate sector and for future research. Now the author presents the first output within the researched issues.

4. Circular economics - definition, model

The term CE can be characterized as intentionally renewable management, the aim of which is to maintain products, materials and other components for the life of the highest potential for use. CE aims to streamline the flow of material, information, labor and energy in such a way that social and natural potential can be restored (Morlet, 2016). CE is a concept of closing material loops in order to preserve and preserve products, materials and parts and strive to extract their maximum utility value. The idea of replacing secondary production with a lower environmental impact with intensive primary production gives the circular economy a strong environmental appeal (Zink, Geyer, 2017). According to Jonášová, director of the Institute of Circular Economics for the Czech Republic (jit.cz, 2018), this is a system in which we behave respectfully to nature and at the same time generate profit thanks to the reuse of valuable materials that are kept in circulation for as long as possible.

Assumptions of circular economics

According to (Sherratt, 2013), there are six key approaches and principles:

- **industrial symbiosis** - waste of one can be the source of the other (eg use of waste heat)
- **shared economy** - in case of occasional use, the possibility of using rent instead of buying (eg
- sharing cars or production machines),
- **3R = reduce, recycle, reuse** - methods of re-inclusion of end-of-life products in the system (eg take-
- back of cans by the manufacturer),
- **ecodesign** - product design to minimize the negative impact on the environment (eg use of
- degradable materials),

- **Cradle to Cradle** - product design with absolute respect for natural cycles, when at the end of its life
- it is fully recycled or returned to nature in the form of safe and non-toxic substances
- **biomimicry** - inspiration for the emergence of new solutions sought in nature (eg buildings in desert
- areas with a construction inspired by cacti).

As follows, the shared economy is part of the CE and can be defined as: "an economic system based on the sharing of underused assets or services, free of charge or for a fee" (Brkljac, Sudarevic, 2018). Or, as Blažek states, “a modern shared economy can generally be defined as prioritizing access to durable goods and factors of production through digital platforms without personal ownership of these assets. It is a free online market that helps to make more efficient use of currently free production factors with economic, ecological and social benefits ”(Blazek, 2020).

5. Principles and model of circular economy

According to Stahel (2016), there are two models of circular economics:

- A model that supports re-use, where life is extended through upgrades, repairs or refurbishments,
- A model that transforms old goods into new ones through material recycling.

Although the main goal of CE is considered to be economic prosperity and environmental quality, none of the characteristics mention the impact on future generations and social justice (Kirchherr, Reike, Hekkert, 2017).

The CE concept is based on the effort to replace the direct current that prevails in the current economic system (Moldan, 2021). In 2017, global plastics production reached almost 350 million tons. Some estimates suggest that plastics and waste generation could double by 2035 (Walker, 2020). According to Schulz (2016), the introduction of the principles of the circular economy for individual states would mean not only social but also environmental benefits and, of course, the ability to generate significant savings, savings of primary resources and a positive impact on employment.

Circular economics uses this principle (Morseletto, 2018):

recovery - recycling - reuse - refurbishment - renovation - repair - reuse - re-evaluation – disposal

Circular economics requires:

- cooperation of the whole spectrum of various fields,
- perception of waste as a valuable resource,
- the use of eco-design in the production of new products,
- use of renewable resources,
- inclusion of modern digital technologies,
- preserving the value of manufactured products, including extending their life cycle,
- change of business models (Rifkin, 2022)

Circular principles should in any case take into account the life cycle analysis in terms of production and environmental impacts. It is important to define the advantages and disadvantages of CE.

Table 1: Advantages and disadvantages of the circular economy

Advantages	Disadvantages
almost zero waste production, supply chain elimination, separation of economic growth from raw material extraction, less burden on the environment, saving resources and energy, reduction of material and raw material costs, preventing the loss of biodiversity and conserving natural resources,	relatively complex feasibility, lack of legislation in most countries, the need to think about the product from the very beginning, product design change,

Advantages	Disadvantages
lower price fluctuations in global markets, new job opportunities, new business opportunities, efficient production method	

Source: Adjusted by found.cz (2020) and Rifkin (2022)

6. Innovations and their importance

The concept of innovation has become very popular in recent years. A pioneer in the field of innovation is Josef A. Schumpeter, who is considered the founder of the modern theory of innovation. Schumpeter (Schumpeter and Elliot, 2011) describes innovation: "the creation and commercial or industrial application of something new — a new product, process or method of production; a new market or source of inputs; a new way of managing an organization, business or financial management. " We can mention Professor F. Valenta, an economist and academic, who defines innovation somewhat more broadly as: "any change in the internal structure of a production organism" (Valenta, 1969). For the definition of innovation, we can also use the Oslo Manual of OECD (2005), which characterizes innovation as follows: "Innovation means the implementation of a new or significantly improved product (goods or services) or process, new marketing methods or new organizational structures." method in business practice, workplace organization or external relations'. All definitions have one thing in common, and that is the idea of something new. However, this is what causes high risk, an unclear outcome and a very vague approach to successful innovation.

7. Innovation in the circular economy and the support of the European Union in practice

Many companies have already made a public commitment to resource management. For example, IKEA wants to use only certified wood and promote the quality and repairability of its products. The clothing company H&M would like to be completely circular by 2030. Already in 2017, Philips accounted for 60% of total revenues in the circular economy (jic.cz, 2018).

The European Union (EU) supports the strategic plan for the transition to a circular economy through specific instruments. In addition to support in the form of, for example, eco-labeling of products and services, new tools are emerging in response to the increased interest in CE. Based on the type of support, these instruments can be divided into financial and non-financial.

Under the **financial support of CE**, which is provided as part of the EU's cohesion policy, EUR 150 billion was allocated in the budget period 2014-2020. This appropriation was intended to support CE in the areas of waste management, strengthening the bioeconomy, new ecodesign solutions, low-carbon investments and resource efficiency. The water reuse project was also supported. Several regions in the EU already recycle wastewater to irrigate parks, clean the streets, or replenish groundwater supplies. In addition to cohesion policy, Horizon 2020, LIFE and COSME (ec.europa.eu, 2021) also provide financial support.

Specifically, for example, LIFE funds a wide range of **eco-innovation** projects and implementations, which are becoming the most important driver of a competitive economy based on sustainable progress. It helps fund nature and landscape, environment and climate protection projects across the EU. Since 1992, it has supported the implementation of 5,000 top projects worth more than EUR 5 billion. In addition, the budget was increased to EUR 5.4 billion for the new programming period (2021-2027). The program aims to contribute to the transition to a sustainable, circular, energy-efficient economy based on renewable energy, climate change neutral and resilient. Another of the program's goals is to improve the quality of the environment, its protection and restoration, and last but not least, to support biodiversity. The program funds eco-innovation projects involving science, industry and public administration, but also supports environmental management and information and awareness-raising campaigns.

The program is divided into 4 sub-programs, within which individual projects are implemented. Specifically, these are sub-programs:

- Nature and biodiversity
- Circulating economy and quality of life
- Climate change mitigation and adaptation

- Switch to clean energy

In addition, the program also offers financial instruments for environmental investors to show that environmental investments can be repayable (ec.europa.eu, 2021).

In 2017, the European Commission announced the launch of the CE Financial Support Platform. The platform aims to strengthen the links between existing financial instruments or, where appropriate, to create new ones. The purpose is to connect investors with innovators and find a suitable solution for financing CE projects. The platform will be composed of representatives of the European Commission, the EIB, national banks, Member State Ministries, investors, NGOs and other key CE stakeholders. The platform contains three pillars, consisting of coordination and awareness-raising on CE, consultancy and funding (ec.europa.eu, 2021).

Support for innovation in CE is the possibility of obtaining funding at the level of the European Union (EU). The specific conditions of individual programs are being adjusted on an ongoing basis, but it will be possible to obtain subsidies, for example, for:

- research, development and innovation,
- Industry 4.0, increasing digitization and automation,
- energy savings, renewable resources,
- reconstruction of real estate and brownfields,
- introduction of a circular economy and new circular solutions,
- eco-innovation, use of secondary raw materials, waste minimization,
- avoidance of water waste,
- building high-speed internet networks.

Non-financial instruments of EU support consist in setting criteria for assessing the environmental impact. These tools help organizations define their strategies and also aim to improve public awareness. One of the tools is the so-called Level (s), which focuses on the field of construction. It focuses on building and renovating in an energy and resource efficient way based on the Green Deal policy. It further emphasizes the importance of greening the construction sector, reducing material and energy consumption and increasing resource learning while maintaining affordability (ec.europa.eu, 2020). Another tool is EMAS, which was developed for companies and other organizations to evaluate and improve their environmental impact. It covers all economic sectors and is applicable worldwide. The aim is to reduce environmental impact, strengthen compliance while saving resources and money (ec.europa.eu, 2021).

Consumption is an important area for CE, and especially for waste reduction. According to the EU Commission, one of the problems at this stage of the product life cycle is too many labels and environmental claims, which are difficult for consumers to find and which do not always meet legal requirements. For this reason, the EU Commission has committed itself to ensuring better enforcement in the fight against unfair commercial practices, and a method has been developed to determine the Environmental Product Footprint (PEF) and the Organization's Environmental Footprint (OEF). The Product Environmental Footprint (PEF) and Organization Environmental Footprint (OEF) tools monitor the environmental impact of products and organizations over the entire life cycle (LCA). In this way, they contribute both to better public awareness and to organizations with the definition of circular strategies. An equally important tool is the concept of GPP (Green Public Procurement), which deals with public procurement. The concept is based on clear, verifiable and ambitious environmental criteria, for products and services based on the LCA approach (ec.europa.eu, 2021).

When creating a comprehensive CE model tool, it is necessary to deal with the entire life cycle from design, through production and subsequent consumption to waste management.

Although ecodesign is constantly evolving, its main principles, first published in the American magazine Innovation in 1992, remain the same. It is about:

- 1. **Promoting safe products and services** - These are products and services that are safe for human health and at the same time have the least possible negative impact on the environment.

- 2. **Biosphere protection** - There is a need to significantly reduce the release of any substances that could harm the air, water or soil.
- 3. **Sustainable use of natural resources** - Must strive for the sustainable use of renewable natural resources and for the protection of vegetation, native nature, undeveloped areas and wildlife.
- 4. **Reducing waste and increasing recycling** - This is an effort to minimize waste. To this end, the product design must pay attention to durability, adaptability, repairability and the possibility of recycling. These criteria must also be part of the contracts and technical conditions.
- 5. **Wise energy use** - Environmentally safe energy sources must be selected and energy-saving means put in place.
- 6. **Risk reduction** - Ecodesigners must find a way to eliminate the health risk of both their employees and customers.
- 7. **Information transfer** - There is a need to share information that can help in the selection of the most suitable material and production processes (Remtová, 2003).

The concept of LCA (Life Cycle Assessment), or life cycle assessment, is closely linked to ecodesign. The LCA method is a tool that allows you to assess the environmental impact of a product or service in terms of the entire life cycle. The aim is to identify and quantify all the environmental impacts associated with a product from the extraction of raw materials, its production, consumer use to the end of the product's life and subsequent recycling. This approach is also known as "Cradle to grave".

LCA can be defined as the collection and evaluation of inputs, outputs and potential environmental impacts of a product system, throughout the life cycle. LCA works with data that allow us to assess the use of resources and the amount of pollution, such as solid waste and emissions (Krečmerová, Kovaříková, 2006).

The most commonly used LCA tools include:

LCI - **Life Cycle Inventory** - this is the collection and analysis of data on environmental interventions (eg air emissions, waste production, resource consumption), which are associated with the product from the extraction of raw materials through its production and use to final disposal. , including recycling, reuse and energy recovery. It focuses on the quantitative description of life cycle input and output flows. However, it cannot provide information on actual environmental impacts on its own (Frankl, Rubik, 2000).

LCIA - **Life Cycle Impact Assessment** - follows the life cycle inventory and is an estimate of environmental pressure indicators in terms of climate change, summer smog, resource depletion, human health effects, etc., which are related to environmental interventions caused by the product life cycle (ec.europa.eu, 2021).

SLCA - **Streamlined Life Cycle Assessment** and BLCA (Bottleneck LCA) aims to provide very basic and accessible information on the main environmental impact of the product. SLCA is often performed when relevant data to perform a true LCA will not be available. E.g. SLCA has been used by the Dutch government as a basis for defining ecological criteria under the Ecolabel scheme (Frankl, Rubik, 2000).

LCC - **Life cycle costs** - can be described as an inventory and analysis of the impact of environmental impacts during the life cycle. The LCC tool takes into account all costs during the life cycle of a product, work or service. It includes the acquisition price with additional costs, such as the cost of delivery, installation, insurance, etc., it also includes operating costs, which are energy, fuel, water, spare parts or maintenance, as well as externality costs (eg greenhouse gas emissions) and finally end-of-life costs (decommissioning, disposal, etc.). In applying the LCC, contracting authorities take into account costs that are not taken into account in the purchase price. This often results in a "win-win" situation where the organic product, work or service is generally cheaper. The main potential for life-cycle savings is energy, fuel and water savings, maintenance savings and consequent disposal costs (ec.europa.eu, 2021).
From the above it is possible to try your own draft definition of Innovation in CE:

“Innovations in CE represent a new way of using existing natural, intellectual and financial resources for the development of new opportunities in private and public space, in the context of circular economy

development with the application of overall synergy in sustainability, for the development of products and services to satisfy customers with common to protect the planet and its limited resources".

8. Conclusion

Information for the processing of the submitted text was drawn from secondary sources, mainly from printed professional Czech and foreign literature, professional articles and Internet sources. As the paper shows, applying the principles of circular economics is not entirely simple and requires a multidisciplinary approach. In practice, it is necessary to start with the design of products, which should be created so that their material can be well recycled at the end of its life, or the entire product can be used directly elsewhere (upcycling). Within CE, emphasis is also placed on the efficient use of products. For example, according to the consulting company McKinsey (2015), the average European car is parked 92% of the time, 31% of food is wasted and we use offices only 30% to 50% of the time. Sharing and renting lead to the efficient use of products - ie a shift from traditional ownership to the form of using products as services. It is also very important to promote waste recycling, which generally has large reserves around the world. In the European Union alone, 2.5 billion tons of waste are produced annually, half of which ends up in landfills or incinerators (Nalez.cz, 2020).

Future perspective research of innovations in the field of circular solutions in companies can be realized, for example, in the following specific areas:

- reduction of material intensity of production
- use of secondary raw materials
- replacement of primary input raw materials by secondary ones
- ecodesign of products
- realization of industrial symbiosis
- waste recycling
- acquisition of innovative technologies for the processing of own waste material and its further use in production
- water saving in industry
- innovative technologies, setting up vegetation roofs, retention reservoirs, etc.
- transition to clean energy sources
- acquisition of photovoltaic power plants
- digitization (introduction of digitization elements in manufacturing and non-manufacturing companies)

Such innovations can be called "green development". It is based on not neglecting any of these categories: efficiency of resources used, sensitivity to the environment, attention to people's satisfaction and financial success. The consequence of such an effort will be economic growth with ever lower resource consumption. According to a study for Natural Capitalism, it is possible to achieve a 90-95% reduction in material and energy consumption without reducing the quantity or quality of services that people require (Lovins, Lovins, & Hawken, 2003). This opens up great potential for research in various fields and the possibility of effectively connecting the academic and business environment.

In conclusion, it is possible to recapitulate that the production of new products should be based on resource efficiency, the need to prevent waste, prefer renewable energy sources and the design of products in such a way that they can be put back into circulation. I agree that in order to meet the described areas of CE competence, it is necessary to introduce higher-order innovations so as to help increase the competitiveness of companies in the market. On the other hand, customers (end consumers and business customers) will need to be educated so that they too can use environmentally friendly products and services.

References

Blazek, L., The Future Of Shared Economy İn The Economic System. In Margarethe Überwimmer, Robert Füreder, Michael Schmidthaler, Markus Vorderwinkler. Cross-Cultural Business Conference 2020. 1. Vyd. Düren: Shaker Verlag, 2020. S. 219-232, 11 S. Isbn 978-3-8440-7301-0.

Brkljac, M., Sudarevıc, T., (2018). Sharing Economy And „Industry 4.0“ As The Business Environment Of Millennial Generation - A Marketing Perspective, Proceedings Of The 29. Daaam International Symposium, Pp.1092-1101, B. Katalinic (Ed.), Daaam International, Isbn 9783-902734 -20-4, ,Wien, Austria

Cirkulární Ekonomika Je Výzva Pro Podnikatele A İnovátory [Online]. 2018 [Cit. 2022-04-27]. Available At: Https://Www.Jic.Cz/Magazin/Cirkularni-Ekonomika-Je-Vyzva-Pro-Podnikatele-A-İnovatory/

Cirkulární Ekonomika – Řešení Pro Udržitelnou Společnost [Online]. 2020 [Cit. 2022-04-27]. Available At: Https://Www.Nazeleno.Cz/Cirkularni-Ekonomika-%E2%80%93-Reseni-Pro-Udrzitelnou-Spolecnost/

Co Je Cirkulární Ekonomika? [Online]. 2022 [Cit. 2022-04-26]. Available At: Https://Www.Cirkularnidotace.Cz/Clanky/Co-Je-Cirkularni-Ekonomika

Circular Economy: Commission Delivers On İts Promises, Offers Guidance On Recovery Of Energy From Waste And Works With Eıb To Boost İnvestment. European Commission [Online]. 2017 [Cit. 2021-8-4]. Available At: Https://Ec.Europa.Eu/Commission/Presscorner/Detail/En/Memo_17_105

Circular Economy Missions To Third Countries. European Commission [Online]. 2020 [Cit. 2021-8-9]. Available At: Https://Ec.Europa.Eu/Environment/İnternational_İssues/Missions_En.Htm

Cohesion Policy Support For The Circular Economy. European Commission [Online]. [Cit. 2021-8-4]. Available At: Ttps://Ec.Europa.Eu/Regional_Policy/En/Policy/Themes/Environment/Circular_Economy/

Drucker, P. F. Innovation And Entrepreneurship: Practice And Principles. New York: Harper & Row, 1985. 277 S. Isbn 0887306187

Frankl, Paolo A Frieder Rubık. Life Cycle Assessment İn Industry And Business: Adoption Patterns, Applications And Implications [Online]. Berlin: Springer, 2000 [Cit. 2021-8-6]. Isbn 978-3-642-08574-1. Available At: Https://Books.Google.Cz/Books?İd=Zdytbaaaqbaj&Pg=Pt31&Lpg=Pt31&Dq=Bottleneck+Lca&Source=Bl&Ots=1afımtftm2&Sig=Acfu3u0qld3celrgsf7pyneaxtzrdhkasq&Hl=Cs&Sa=X&Ved=2ahukewjcptt78zvyahuugf0hhwntbıqq6af6bagveam#V=Onepage&Q=Bottleneck%20lca&F=False

Gpp Criteria: Background And Approach. European Commission [Online]. [Cit. 2021-8-5]. Available At: Https://Ec.Europa.Eu/Environment/Gpp/Gpp_Criteria_En.Htm

Kırchherr, Julian; Reıke, Denise; Hekkert, Marko. Conceptualizing The Circular Economy: An Analysis Of 114 Definitions. Resources, Conservation And Recycling, 2017, 127: 221-232.

Krečmerová, Tatiana A Terezie Kovaříková. Metoda Posuzování Životního Cyklu Výrobků Či Procesů V Podnikové Praxi. Enviprofi.Cz [Online]. 2006 [Cit. 2021-8-5]. Available At: Https://Www.Enviprofi.Cz/33/Metoda-Posuzovani-Zivotniho-Cyklu-Vyrobku-Ci-Procesu-V-Podnikove-Praxi-Uniqueidgoke4nvrwuokaqdkuox_Zxoonflpyekntmfcju4hoa0/

Level(S): Building Sustainability Performance. European Commission [Online]. 2020 [Cit. 2021-8-5]. Available At: Https://Ec.Europa.Eu/Environment/System/Files/2020-10/Levels%20newsletter_2020_January.Pdf

Life-Cycle Costing. European Commission [Online]. [Cit. 2021-8-6]. Available At: Https://Ec.Europa.Eu/Environment/Gpp/Lcc.Htm

Lovıns, Amory, Lovınsova, L. Hunter, Hawken, Paul. Přírodní Kapitalismus: Jak Se Rodí Další Průmyslová Revoluce - Orig.: Natural Capitalism, Praha : Mladá Fronta, 2003. - 476 S. ,Isbn 80-204-1078-3

Mckinsey & Company Studies 2015: Europe’s Circular-Economy Opportunity, Available At: Https://Www.Mckinsey.Com/Business-Functions/Sustainability/Our-İnsights/Europes-Circular-Economy-Opportunity

Moldan, Bedřich. Životní Prostředí V Globální Perspektivě. Vydání Druhé, Doplněné. Praha: Univerzita Karlova, Nakladatelství Karolinum, 2021. Isbn 9788024649672.

Morlet, Andrew, Et Al. Intelligent Assets: Unlocking The Circular Economy Potential. Ellen Macarthur Foundation, 2016, 1-25.

Morseletto, Piero. Targets For A Circular Economy. Resources, Conservation And Recycling, 2020, 153: 104553.

Oecd, 2014. Oecd Reviews Of Innovation Policy: France 2014. Paris: Oecd Publishing. 280 P. Isbn 978-92-642-1402-6. Remtová, Květoslava. Ekodesıgn [Online]. 2003. Praha: Ministerstvo Životního Prostředí [Cit. 2021-8-5]. Isbn 80-7212-230-4. Available At: Https://Web.Archive.Org/Web/20110617071413/Http://Www.Mzp.Cz/Osv/Edice.Nsf/7907a38f19e1d57ec1256fc0004fe74d/$File/Ekodesign.Pdf

Rıfkın, Jeremy. Green Deal: Strašák, Nebo Jedinečná Šance? Walden Press, 2022. Isbn 9788090801554.

Sherratt, A. (2013) Cradle To Cradle. In: Idowu S.O., Capaldi N., Zu L., Gupta A.D. (Eds) Encyclopedia Of Corporate Social Responsibility. Springer, Berlin, Heidelberg. Https://Doi.Org/10.1007/978-3-642-28036-8_165

Schulze, Günther. Growth Within: A Circular Economy Vision For A Competitive Europe. Ellen Macarthur Foundation And The Mckinsey Center For Business And Environment, 2016, 1-22.

Schumpeter, Josef A. And John E., Ellıott, 2011. The Theory Of Economic Development: An İnquiry İnto Profits, Capital, Credit, İnterest, And The Business Cycle. New Brunswick: Transaction Publishers. 244 P. Isbn 978-14-128-1592-5.

Stahel, Walter R. The Circular Economy. Nature, 2016, 531.7595: 435-438.

Valenta, F. Tvůrčí Aktivita - İnovace - Efekty. Praha: Svoboda, 1969. 255 S. Isbn 25-093-69.

Walker, Thomas; Gramlıch, Dieter; Dumont-Bergeron, Adele. The Case For A Plastic Tax: A Review Of İts Benefits And Disadvantages Within A Circular Economy. Sustainability, 2020.

What Is Emas? European Commission [Online]. [Cit. 2021-8-5]. Available At: Https://Ec.Europa.Eu/Environment/Emas/İndex_En.Htm

Zınk, Trevor; Geyer, Roland. Circular Economy Rebound. Journal Of Industrial Ecology, 2017, 21.3: 593-602.

Economics of Data Systematic Review for Planning Strategies in the InsurTech industry

Claudio Bonvino and Marco Giorgino
Politecnico di Milano, Milan, Italy
claudio.bonvino@polimi.it
marco.giorgino@polimi.it

Abstract: The knowledge of data enables exploring how value is created from data. Organizations' strategic planning becomes easier if the value of data is understood and adopted. Unless managers know how to use data, its exploitable value remains limited. Previous studies assessed either data dimensions such as volume, variety, velocity, veracity and granularity, or data management processes. However, many of these topics have been treated with a technical approach and only a few focused on the data value in management, strategy, and planning. The ubiquitous of data has allowed insurance incumbents and startups to exploit technologies, from which InsurTech, leveraging a unique data-driven proposition and often gaining a competitive advantage. The paper aims to explore the economics of data, enabling to strategically plan data management practices. It contributes to the management and strategy literature with an evidence-based systematic literature review that embraces the value generated by knowing data sources, data types, extended data dimensions, analyzes enabling technologies, and extends data management practices for reaching organizations' objectives in the InsurTech empirical context. In addition to further avenues of research, it provides managers with a theoretical data-valorization framework for data strategic planning, and institutions an overview for guiding the digital transformation. The novelty of this paper is the comprehensive focus on the economics of data at the intersection between traditional and emerging business models.

Keywords: data value, data knowledge, data management, strategic planning, InsurTech

1. Introduction

Organizations' strategic planning becomes easier if the value of data is understood and adopted. "By 2025, […] most employees will use data to optimize nearly every aspect of their work" (McKinsey, 2022). As reported by a recent special issue, scholars are increasingly interested in the relationship between competition, regulation and data management that allows scaling financial businesses in the new digital era (Giudici et al., 2021).

Data has been studied mainly technically. On the one hand, authors started connotating data dimensions as the 3Vs: volume, velocity, and variety (Laney, 2001), veracity (Goes, 2014), granularity (Aaltonen & Tempini, 2014; Yoo, 2015), portability, interconnectivity (Günther et al., 2017) and others ontological characteristics (Kitchin & McArdle, 2016). On the one hand, scholars proposed technical frameworks to process data in organizations (Alfaro et al., 2019; Lange & Drews, 2020; Faroukhi et al., 2020).

The benefits that organizations perceive as "value" depend on the alignment of their strategic goals with the usage of data (Ghoshal et al., 2014) and it is proven that its adoption could lead to achieving higher economic results (LaValle et al. 2011, McAfee and Brynjolfsson, 2012). The scattered background brings the need for a literature review that explores the value generated by the knowledge of data.

A key empirical context is the evolving insurance sectors, namely InsurTech: insurance plus technologies. Early signals of the term appears in 2015, driven by the implementation of advanced technologies in the FinTech industry (WEF, 2015, Zavolokina et al., 2016), whereas the first studies on InsurTech date 2017-2018 (Lanfranchi & Grassi, 2021). InsurTech perfectly combines three major ingredients: money (Dorfman & Cather, 2013), information (Muller, 1995), and technology. The technology is the major ingredient of InsurTech because it associates insurance services and products with advanced technologies. In less than a decade, information and technologies disrupted business models. The related innovations in business models in InsurTech can be a representative context for generalization of other evolving sectors. Specifically, "insurance companies have always been big users of data in analyzing and measuring the risks they take into insurance coverage, setting conditions for insurance policies and assessing the risk (accepted by insureds) as well as conditions for insurance contracts and claims. Insurers have strong analytic capabilities compared to their peers in other industries" (Njegomir et al., 2021). The proliferation of data has allowed insurance to embrace technologies to harness a unique selling proposition and competitive advantage over other market participants (Cortis et al., 2019). In the financial ecosystem, InsurTech can also help to improve existing products, services, and process-

es, as well as enable new business models (Nagle et al., 2020). Moreover, the insurance industry is strongly connected with society because it is based on customer risks and customer-insurance provider engagement and it is highly regulated (Al-Witwit & Ibrahim, 2020; Eling & Lehmann, 2018), giving this paper the chance to evaluate data regulation. InsurTech becomes an industry worth targeting for this paper's purpose.

The centrality of data in insurance is due to the ability of insurance companies to generate economic value from data usage; the exploitation of data can be understood only starting from its characteristics (McAfee & Brynjolfsson, 2012). Therefore, the paper investigates the following research question: "What are the economics of data that create value for a firm by using data strategically?". By answering this question, the work proposes a theoretical framework that connects the knowledge of data economics and related strategies to generate value. Scholars could be inspired in studying data value implications in strategy, management, and economics. Managers would be guided in their strategic action in the current digital transformation. Policymakers could drive policies for increasing competitiveness.

The paper is structured as follows: first, the authors highlight the methodology; second, they report the data knowledge pillars for generating value; then they resume the management practices into a data valorization framework; finally, the authors summarize how to use data strategically for long-term planning which brings to the implications and conclusions section.

2. Methodology

The authors explore the economics of data through an evidence-based systematic literature review. The aim is to investigate the economics of data and drive top management for well-informed decisions making (Campbell Collaboration, 2001). Many papers tried to study data by limiting the search strings with keywords such as "big" or "social", mainly for analytical studies but not for management. This paper's approach is novel because it assesses an industry and extracts the value generated from data. The review was organized in: planning, conducting and reporting (Tranfield et al., 2003), as per Figure 1. In the first stage, the team identified the need to review data associated with management practices by imposing a review protocol that contained: (i) data related documents in the (ii) InsurTech industry. The review panel adopted the keyword "InsurTech" in titles, keywords, and abstracts to maximize the sensitivity. The search was run in Scopus and Web of Science, as these databases contain a larger number of documents in the management and economics fields. Moreover, the search captured grey literature's documents (Godin et al., 2015) with a content-based approach. Authors applied the language filter of English. The selection of studies was run in double-blind. Finally, selected papers were organized in an extraction table. The assessment included all primary results (Pollock & Berge, 2018), investigating early trends – not limiting documents per quality.

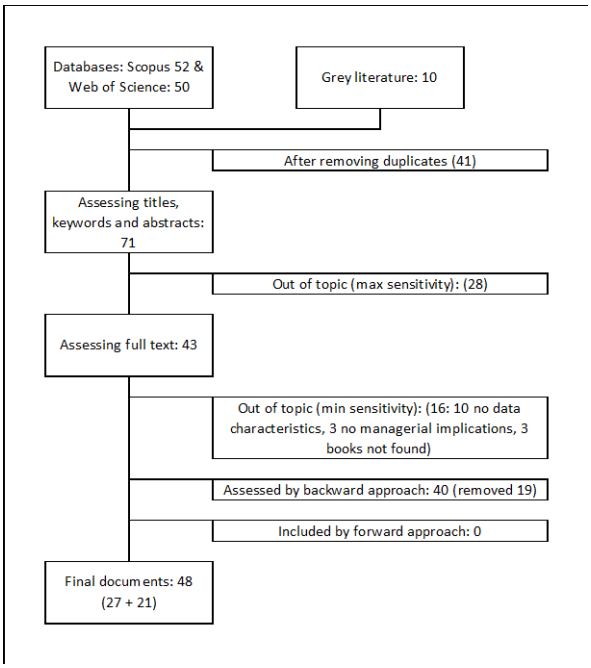


Figure 1: Systematic literature review of data in InsurTech

3. The economics of data in InsurTech

Data, datasets, or big data could interpret different traits but refer to a key input: data as a piece of a unit of information. The paper refers to them as synonymous to concentrate on the knowledge pillars of data that bring value. The InsurTech industry uses data in valuing the risks, setting policies, underwriting, and managing claims. Now, InsurTech organizations are covering specific needs, driven by the knowledge explored from data and extracted by three key pillars: data sources, data types, and data dimensions.

3.1 Pillar I: Data sources

Data sources refer to where the resource is held or stored (Sen, 2004), and they are public, private, exhaust, community or self-quantification (Gerard et al., 2014). Public data are held by public organizations. Private data are held by private organizations or individuals with private information and can be behavioral data, consumers' transactions, browsing, mobile usage or records. Data exhaust denotes passively collected data with zero value unless connected to other sources. They are the product of individuals' daily lives or inferences. Community data are generated by dynamic networks (e.g., social networks, consumers' reviews, voting buttons). Self-quantification data includes individuals' actions or behaviors (e.g., preferences), and they can be connected to psychology (Gerard et al., 2014).

Data sourcing can happen internally, externally or in hybrid ways. Internal sources are produced by an entity's device (Mai, 2018; Yu & Yen, 2020). External sourcing refers to data, often open, elaborated with external private or public organizations (e.g., collaborations, vendors, 3rd parties or service providers) (Mai, 2018; WEF, 2015; Yu & Yen, 2020). Hybrid sources of data can be those collected from public-private partnerships (OECD, 2016). Some institutions are fostering sources sharing for strategic purposes between governments and businesses (EC, 2020a). The present literature does not stand empirical studies on the economic value brought by data sourcing adoption and sharing.

3.2 Pillar II: Data types

The literature on data types is usually covered technically while knowing it with a management view could have strategic implications. Data types can be structured, semi-structured or unstructured. Structured data refers to traditional data, stored in tabular spreadsheets or relational databases, organized in variables, attributes, subjects, and time (Naik et al., 2008). Semi-structured data do not conform to relational databases but can be modified to structural forms. Unstructured data are most of today's data: text, photo, audio, video, clickstream, and sensor data (Ajah & Nweke, 2019; Lee, 2017). Unstructured data are often called alternative or unconventional data. The key role of these data elaborated from advanced technologies is the collection of behaviors and preferences, which enable weather and catastrophes forecasting, road analysis, and accident prediction among others (Cevolini & Esposito, 2020; Ching et al., 2020; Mai, 2018; Nagle et al., 2020; Njegomir et al., 2021; WEF, 2015; Xu & Zweifel, 2020). In numbers, structured data counts for 10-15%, semi-structured data for 5-10% and unstructured data about 80% (Christine Taylor, 2018; Gandomi & Haider, 2015; OECD, 2020). Unstructured data can be dimensioned into structural data.

Data and metadata – embedded data (Sen, 2004) – types management are pillars for knowledge discovery, and for subsequently planning insightful strategies (EU, 2018; Wilkinson et al., 2016). InsurTech organizations use the knowledge of data types for extracting value in daily activity and management strategic planning.

3.3 Pillar III: Data dimensions

The literature studied data dimensions technically. The state-of-the-art limitedly advanced on the value that the knowledge of data dimensions implicate in the management and strategy of organizations. The paper reviews data dimensions, extracts managerial implications in InsurTech, and proposes avenues for research (Table 1).

Table 1: Data dimensions generalization

Data dimensions	InsurTech key implications	Avenues for research
Volume	Data enrichment; Insightful and accurate analyses; Data collection boosts business growth	Economic value
Velocity	Interconnectivity; Real time; Latency	Economic value

Data dimensions	InsurTech key implications	Avenues for research
Variety	Solve hidden relationships or inconsistencies	Economic value
Veracity	Accuracy; Truthfulness; Quality	Economic value
Accessibility	Findability; Interoperability; Reusability; Legal prevention: compliance	Economic value; Entities collaboration vs cooperation
Granularity	Completeness; Rareness; Uniqueness	Economic value
Sharing	Strategic management; Nonrivalry; Portability	Economic and societal value; Entities collaboration vs cooperation
Ownership	Personal vs non-personal; Ethics; Trust	Economic value; Behavioral data from connected devices: issues related to the aggregation and ownership
Privacy	Reputation; Enrichment; Customer protection	Economic & societal value; Paying for preserving privacy; Role of trust; Entities collaboration vs cooperation
Regulation	Compliance; Availability; Security	Tightness of regulation
Central vs Distributed	(Im)mutability; Depletion	Business, economic & societal value

The *volume* of data refers to the size of data collected. Scholars agree on its importance (Cortis et al., 2019; Laney, 2001) and successful entrepreneurs know how it can translate into business growth (IDC). Data volume sums historical (Gramegna & Giudici, 2020), real-time and analyzed data. In InsurTech, data volume is used to evaluate, predict, understand, visualize, personalize and price services and products, engage with customer, modify customer decisions, assess, extract information, explain and create policies (Al-Witwit & Ibrahim, 2020; Ching et al., 2020; Njegomir et al., 2021; Tereszkiewicz & Południak-Gierz, 2021), and signal early warnings. Data volume can have a strategic advantage for the owner, which increases with advanced technologies (Cevolini & Esposito, 2020; EC, 2020b; Njegomir et al., 2021). Although a small number of Big Tech players such as Amazon, Apple, Facebook and Google hold a large part of the world's data, future players are yet to be decided because historical data collected by incumbents is yet fully exploited and start-ups with advanced technologies could easily scale these data (Eling & Lehmann, 2018; Mai, 2018). "The sources of competitiveness for the next decades in the data economy are determined now" (EC, 2020a), and the fastest collection can boost the new winners.

The *velocity* dimension of data refers to the pace of interactions (Laney, 2001) or analyses (Cortis et al., 2019; OECD, 2020) – e.g., extraction, integration, reorganization, access and routing (Laney, 2001). During the years the pace of data increased enabling real-time access. (Yu, 2008) Real time information are relevant, but decision makers should evaluate data for short- and long-term performances.

In InsurTech, organizations use (near) real time for personalized offers at the most prone audience at the right time and price, by processing a person-based contract or customer monetary rewards based on clients' data, detecting frauds or assessing and managing risk-portfolio; while revamping the traditional insurance products (Cortis et al., 2019; Gramegna & Giudici, 2020; Mai, 2018; Stoeckli et al., 2018; Talonen et al., 2021; Tereszkiewicz & Południak-Gierz, 2021; WEF, 2015; Yu & Yen, 2020). In risk management, practices involve time value, where "it is important to adjust dollar values to reflect the earning of interest"(Rejda, 2019).

The data *variety* dimension values the number of sources and types (Anshari & Alas, 2015; Cortis et al., 2019; Laney, 2001; Lee, 2017), because the latter unveil hidden relationships or inconsistencies. "High variety is when there is structural heterogeneity in the dataset" (OECD, 2020).

In InsurTech, data variety has been increasing by merging data of public entities and enterprises (Njegomir et al., 2021). Moreover, "many data sources ensure the deploy of data analytics for evidences on significant correlation or phenomenon" (EC, 2018).

The *veracity* relates to the accuracy, truthfulness, and quality of this digital resource (Goes, 2014; Cortis et al. 2019; Malgieri & Custers, 2018). In the past, it was overlooked by multiple sources, whereas today is a pressing issue because of false information. Data accuracy is a factor of previous dimensions, and it can be verified with advanced AI tests (Al-Witwit & Ibrahim, 2020; EC, 2020b; Gramegna & Giudici, 2020; Marafie et al., 2018), and ensured with data management tools (Rejda, 2019). Moreover, accuracy can be increased with a series of validity checks (e.g., sample representativeness, sample dimension, sample corrections), triangulation of available information, or also relying upon experts' experience.

In InsurTech, the "risk may be reduced by application of the law of large numbers by which an insurer can predict future loss experience with greater accuracy" (Rejda, 2019). Thanks to data accuracy, policyholders could be priced accordingly to their behaviors, although certain individuals fill out (Cortis et al., 2019).

The *accessibility* stands for standardized, free, open, and authenticated and authorized procedure. Accessible data are often related with findable, interoperable, and reusable principles (EC 2018). Legal interoperability – data compliance – must be verified (e.g., anonymization) for ensuring the economic value for humans and machines (EC, 2020a; Tereszkiewicz & Południak, 2021; Wilkinson et al., 2016). Data accessibility could threaten market players, customers, and innovation. In Europe, it led to the Payment Systems Directives, proposing open banking and open finance as a new ecosystem (EC, 2020a). In InsurTech, there are multiple example of collaboration between incumbents and start-ups (Stoeckli et al., 2018), which value is not studied in depth. Given that insurance aims at estimating risks, having access to large data has a relevant role (OECD, 2020).

The literature lacks studies on data *granularity*, despite its empirical evidence. Data granularity is the level of extractable detail (e.g., environment, entity, decision making, preferences). Malgieri & Custers (2018) identify granularity implications such as completeness, rareness, and uniqueness as data monetary value.

In InsurTech, granularity can fine-tune the risk classification, which could modify premiums for some consumers as well as exclude others from the offerings (OECD, 2020; WEF, 2015).

The data *sharing* dimension lies in how entities transact own data. Digitalization eroded transaction costs, which became almost free; for example in exchange for a discount (Nagle et al., 2020; Saliba et al., 2021). InsurTech businesses evidence that sharing standardized data can create an ecosystem of "highly connected operations" (Yu & Yen, 2020), where open finance stimulates innovation (EC, 2020a).

Sharing data multiplicate the effect of having only own data, but the authors did not find studies on the effect of economic value (WEF, 2015). In management, data sharing could be investigated empirically addressing strategic alliances, cooperation-competition dynamics (Eling & Lehmann, 2018; Mai, 2018; OECD, 2020). For example, Lapetus Solutions, a US-based InsurTech start-up, have developed an AI system and is partnering with life underwriters to provide quotations using facial analytics to foster engagement in the sale and claim processing (Cortis et al., 2019). Data sharing implies a key characteristic of data: the nonrivalry. Differently from any other non-fungible uses, data could be used and reused if the access is ensured. Entities have the choice of sharing certain information: portability.

Data *ownership* focuses on the source of the data and the entity storing it (Sen, 2004). The ownership strongly links with the difference between personal and non-personal data. They are often aggregated in anonymized or pseudonymized forms. However, if technologies allow this data to be traced back to the user, it falls under the logic of personal data. Ethically, entities should ask the consent to data owners prior to using their data. A key point for InsurTech industry – and not only – is the ability to process data algorithmically that enables knowing more information than owners. Consumers' trust was identified as an important issue. In this sense, companies could give customers greater control of their own personal data (Talonen et al., 2021). Further research requires studies on the ownership of behavioral data sourced from connected devices and on the ownership of aggregated data (WEF, 2015).

The data *privacy* dimension is in the current debate of scholars, specifically addressing individuals, firms, and governments (Lee, 2017). Previous works imply that individuals are rational and able to share the optimal amount of information (Stigler, 1980; Posner, 1981). However, Acquisti et al. (2013) "raise the issue of individuals' abilities to optimally navigate issues of privacy". Private data are those that could violate an entity – individuals and organizations – information rights and values (e.g., reputation) (Rejda, 2019). Data enrichment such as data profiling must protect customers (Njegomir et al., 2021), and should prevent unfair practices related to ethics, ethnicity, gender, religion and belief discrimination (EC, 2020b; Rejda, 2019). In InsurTech, data privacy should ensure customer coverage (Tereszkiewicz & Południak-Gierz, 2021) with anonymization and processing techniques (Stoeckli et al., 2018; EC, 2020b; Tereszkiewicz & Południak-Gierz, 2021).

The *regulation* dimension of data protects fundamental rights of consumers (e.g., data privacy, data protection - EC, 2020a), discrimination, unfair contracts (Tereszkiewicz & Południak-Gierz, 2021) or unfair pricing (Al-Witwit & Ibrahim, 2020; Rejda, 2019). Entities should be compliant legally and/or ethically depending on coun-

tries regulations, accepting requests to destroy data with eventual economic loss. Data regulation should consider potential issues such as accessibility, market power imbalance, data governance, data infrastructure and technologies, empowering individuals to exercise their rights, skills and data literacy, and risk assessment. Moreover, the integration of regulated and less regulated insurance-related data "might be an efficient way to increase customer engagement" (Stoeckli et al., 2018). "Depending on regulation and willingness to share personal information, asymmetries could become smaller or larger […] regulators must define how and where they have to intervene", especially in fields such as InsurTech where the use of data can be beneficial (Eling & Lehmann, 2018). Organizations should abide rules, by taking necessary measures to minimize the security risks involved (Saliba et al., 2021).

Data *mutability* is an emerging dimension that considers if the information is collected, stored, and maintained in a centralized or decentralized way, from which it derives the easiness to modify an original data. Centralized data is in a server or cloud (Eling & Lehmann, 2018). Decentralized data is owned on local devices, digitally connected, that validate the information by a consensus of devices. Decentralized technologies such as blockchain are driving this change also with the concepts of immutability and depletion. For immutability, data is transparently stored in ledgers and cannot be modified - unless overwriting it; for depletion, data is unique, and it does not need to be copied across devices.

In InsurTech, this dimension helps in checking legal requirements – according to underwriting purpose to secure information with consensus processes (Ching et al., 2020; Eling & Lehmann, 2018). This dimension requires further research in terms of business, economic and societal value.

4. Data enabling technologies

Advanced technologies such as data analytics (e.g., artificial intelligence, machine learning, neural network), Application Programming Interfaces (API), cloud and blockchain are driving to innovative apps, models, and online platforms. "Particularly, in banking and insurance sectors, technologies are disrupting for a decade. Every year, new things and new and innovative styles of operations are taking place in these sectors in the form of FinTech and InsurTech" (Ratnakaram et al., 2021).

By reviewing the InsurTech industry, technological innovations alter risk parameters by enriching traditional data with unconventional data. Technology and data enable a more fine-grained risk assessment by insurance providers. Thanks to telematics devices (e.g., internet of things devices, wearables, and mobiles), people live in a connected world providing a large amount of data. Vehicles, houses, and factories are digitally equipped making them programmable, addressable, sensible, communicable, memorable, traceable, and associable (Yoo, 2010). Without adequate, relevant, timely and complete information, it would be almost impossible for insurance companies to provide insurance services on a sustainable basis (Njegomir et al., 2021).

The literature well covers technologies technically. For the scope of data management and strategic planning, the technologies are key enablers for the creation of data value. Technology's added value is the ability to enable compliance, transparency, accuracy, monitoring and updating and identifiability. Organizations' planning requires individuals with digital competencies – currently scarce resource – for enabling data value creation.

5. Data management for strategic planning in InsurTech

The data economy with its pillars has strongly transformed the activities of organizations in many industries. Limited studies investigated how data and its management have impacted organizations' strategic planning. In the financial ecosystem, insurance integrated slowly innovation since its early origins. Over the past decade, advanced technologies integrated and transformed the insurance business. Traditionally, policies have been priced based on predictions using historical data and sophisticated statistical models (WEF, 2015). Historical information comprehended static data provided by customers through papers or third-party data, including historical data and predictive indicators. Aggregated data enabled the identification of risk and the customers' premium. After contracting the policy, customers and insurers mostly did not interact until renewal or claims' request. Today, the majority of InsurTech organizations are not completely transforming commercial lines of insurance but are more focused on enabling or extending them (Njegomir et al., 2021). With the increased value of data and technologies, insurers can track and refine customers' risk profiles, develop new based-needs services or products, offer and price them in a personalized way, preventively engage with customers, and process claim management and legal activities automatically. Telematics can collect usage and behavioral

data of customers in real-time or near-real-time. Data management is at the core of the value creation of data and embraces the transformational process organizations are living. Integrating previous sections with Stoeckli et al., (2018), characteristics and transformational capabilities of InsurTech innovations explore the understanding of the value creation in a digital world that managers should consider in their strategic planning (Table 2).

Table 2: Data management strategic planning practices in InsurTech starting from Stoeckli et al., (2018)

Strategic planning practices in InsurTech		
Adjustment behavior/need	Digital identification	Loss mitigation
Aggregation	Digital notification	Nutrition data (enrich)
Automated fraud detection	Digital processing	Predictive prevention
Automated processing	Digital submission	Pricing (Usage/behavior/reward)
Automated verification	Digital transaction	Proactive warnings
Data enrichment	Digitalized offer	Recovery service
Digital adjustment	Distribution	Service provisioning at demand
Digital administration	Driving data	Simplified offer
Digital advisory	Individualized offer	Situational/Flexible offer
Digital conversation	Integration	Vitality data (live)

The evidence-based review allows for defining a strategic planning framework that organizations can adopt to generate value from data, which could determine increasing revenues and therefore economic value for the organizations. The organization would require data knowledge which therefore evaluates the economics of data based on the three data pillars: sources, types, and dimensions. Data sources enable the identification of the origin of organization's datasets, available or potentially available. Data types drive the exploitation of organization resources, which could be both objective and subjective. Based on the origins and types of the digital resource, the data dimensions can be exploited to plan the objectives organizations aim at achieving. Then, by combining strategically data knowledge with investments in advanced technologies (data enablers), managers can plan their data management to make forward-looking decisions for cooperating-competing in the market. Managers should govern data for translating data knowledge into economic value (Figure 2).

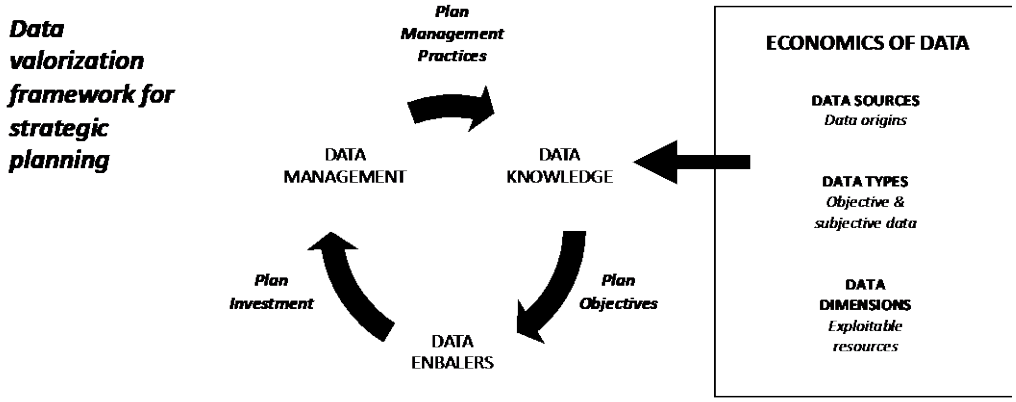


Figure 2: Data valorization framework for strategic planning

6. Conclusion

The review identifies three knowledge pillars for the creation of value from data: sources, types, and dimensions. Together with advanced technologies, these enable successful data management that requires strategic planning of resources, technologies, and practices. The paper answers the research question by providing (i) a novel comprehensive view of the data economics that brings value from data: the pillars; (ii) the extended data dimensions, essential for depicting the organizations' objectives; (iii) a theoretical data valorization framework that enables generating value strategically planning resources, technologies, and management practices. The authors believe the outcomes of the research in the InsurTech industry could be representative of other data-driven industries.

Limits of the work can be the limited number of academic papers extracted with "InsurTech" and the documents' quality. However, the literature review does not limit keywords for evidencing practices and emerging

trends. Further studies can evolve on the impacts of data knowledge on activities of the value chain, and bring a more theoretical structure (e.g., knowledge management theory).

The current literature offers managers to assess and expand their data strategies, financiers to know the determinants of data value in data driven organizations, and policymakers to address guidelines for competitiveness. Altogether, the work contributes to data knowledge that enables the planning of strategic data management practices in the digital era.

References

Acquisti, A., John, L. K., Loewenstein, G., Acquisti, A., John, L. K., & Loewenstein, G. (2013). What Is Privacy Worth? *The Journal of Legal Studies*, *42*(2), 249–274.

Ajah, I. A., & Nweke, H. F. (2019). Big data and business analytics: Trends, platforms, success factors and applications. *Big Data and Cognitive Computing*, *3*(2), 1–30.

Al-Witwit, S. S. I., & Ibrahim, A. A. (2020). Improving operational efficiency of government using artificial intelligence. *IOP Conference Series: Materials Science and Engineering*, *928*(2).

Alfaro, E., Bressan, M., Girardin, F., Murillo, J., Someh, I., & Wixom, B. H. (2019). BBVA's data monetization journey. *MIS Quarterly Executive*, *18*(2), 111–128.

Alshboul, Y., Wang, Y., Nepali, R.K., 2015. Big data lifecycle: threats and security model. *Proceedings of the Twenty-First Americas Conference on Information Systems*, Puerto Rico, August 13–15.

Anshari, M., & Alas, Y. (2015). Smartphones habits, necessities, and big data challenges. *Journal of High Technology Management Research*, *26*(2), 177–185.

Badr, Y., Mohamed, N., & Mohamed, A. (2018). Recent Trends in Big Data Analytics Towards More Enhanced Insurance Business Models. *Int. J. of Computer Science and Information Security*, *15*(12), 39–45.

Campbell Collaboration (2001). http://campbell.gse.upenn.edu/about.htm.

Cevolini, A., & Esposito, E. (2020). From pool to profile: Social consequences of algorithmic prediction in insurance. *Big Data and Society*, *7*(2).

Ching, K. H., Teoh, A. P., & Amran, A. (2020). A Conceptual Model of Technology Factors to InsurTech Adoption by Value Chain Activities. *2020 IEEE Con. on E-Learning, e-Management and e-Services, IC3e 2020*, 88–92.

Christine Taylor. (2018). Structured vs. Unstructured Data. *Datamation*, 67891.

Cortis, D., Debattista, J., Debono, J., & Farrell, M. (2019). InsurTech. In *Disrupting Finance* (pp. 95–128).

Dorfman M. S. & Cather D. A. (2013) *Introduction to Risk Management and Insurance*, 10th Edition. Pearson

Eling, M., & Lehmann, M. (2018). The Impact of Digitalization on the Insurance Value Chain and the Insurability of Risks. *Geneva Papers on Risk and Insurance: Issues and Practice*, *43*(3), 359–396.

European Commission. (2018). Turning fair into reality. In *European Commission* (Issue November).

European Commission. (2020a). A European Strategy for Data. In *European Commission*. https://ec.europa.eu/info/sites/info/files/communication-european-strategy-data-19feb2020_en.pdf

European Commission. (2020b). On Artificial Intelligence - A European approach to excellence and trust EN. In *European Commission* (Vol. 53, Issue 9).

Faroukhi, A. Z., Alaoui, I. El, Gahi, Y., & Amine, A. (2020). An adaptable big data value chain framework for end-to-end big data monetization. *Big Data and Cognitive Computing*, *4*(4), 1–27.

Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management*, *35*(2), 137–144.

Gerard, G., Haas, M. R., & Pentland, A. (2014). From the editor: Big data and management. *Academy of Management Journal*, *129*(2), 321–326.

Giudici G., Grassi L, and Momtaz Paul P. (2021). Special issue Scaling Up the Fintech Business: Competition, Regulation & Data Management. *Journal of Economics & Business*

Godin, K., Stapleton, J., Kirkpatrick, S. I., Hanning, R. M., & Leatherdale, S. T. (2015). Applying systematic review search methods to the grey literature: A case study examining guidelines for school-based breakfast programs in Canada. *Systematic Reviews*, *4*(1), 1–10.

Goes, P.B., (2015). Big data – analytics engine for digital transformation: where is IS? *Proceedings of the Twenty-First Americas Conference on Information.* Puerto Rico, August 13–15.

Ghoshal, A., Larson, E.C., Subramanyam, R., Shaw, M.J., 2014. The impact of business analytics strategy on social, mobile, and cloud computing adoption. *Proceedings of the Thirty Fifth International International Conference on Information Systems*, Auckland, New Zealand, December 14–17.

Gramegna, A., & Giudici, P. (2020). Why to buy insurance? An explainable artificial intelligence approach. *Risks*, *8*(4), 1–9.

Günther, W. A., Rezazade Mehrizi, M. H., Huysman, M., & Feldberg, F. (2017). Debating big data: A literature review on realizing value from big data. *Journal of Strategic Information Systems*, *26*(3), 191–209.

International Monetary Fund, 2019. *The Economics and Implications of Data: An Integrated Perspective.* [Online] https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2019/09/20/The-Economics-and-Implications-of-Data-An-Integrated-Perspective-48596

International Data Corporation, 2020. *Rethink Data.* [Online] https://www.seagate.com/files/www-content/our-story/rethink-data/files/Rethink_Data_Report_2020.pdf

Jones, C. I., & Tonetti, C. (2020). Nonrivalry and the Economics of Data. *American Economic Review*, *110*(9), 2819–2858.
Kitchin, R., McArdle, G., 2016. What makes big data, big data? Exploring the ontological characteristics of 26 datasets. Big Data Society 3 (1), 1–10.
Laney, D. (2001). 3D Data Management: Controlling Data Volume, Velocity, and Variety. *Application Delivery Strategies*, *70*(5), 16.
Lanfranchi, D. & Grassi L. (2021). Translating technological innovation into efficiency: the case of US public P&C insurance companies. *Eurasian Business Review,* 11:565–585.
Lange, H. E., & Drews, P. (2020). From ideation to realization: Essential steps and activities for realizing data-driven business models. *Proceedings - 2020 IEEE 22nd Con. on Business Informatics, CBI 2020*, *2*, 20–29.
LaValle, S., Lesser, E., Shockley, R., Hopkins, M.S., Kruschwitz, N., 2011. Big data, analytics and the path from insights to value. *MIT Sloan Manage. Rev.* 52 (2),21–32.
Lee, I. (2017). Big data: Dimensions, evolution, impacts, and challenges. *Business Horizons*, *60*(3), 293–303.
Mai, H. (2018). Preface: Fin- & Insuretech. In *Springer*.
Malgieri, G., & Custers, B. (2018). Pricing privacy – the right to know the value of your personal data. *Computer Law and Security Review*, *34*(2), 289–303.
Marafie, Z., Lin, K. J., Zhai, Y., & Li, J. (2018). Proactive fintech: Using intelligent IoT to deliver positive insurtech feedback. *Proceeding - 2018 20th IEEE International Conference on Business Informatics, CBI 2018*, *2*, 72–81.
McAfee A., & Brynjolfsson E. (2012). Big data: The management revolution. *Harvard Business Review*, *90*(10), 4
McKinsey. (2022). *The data-driven enterprise of 2025*. Retrieved from https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/the-data-driven-enterprise-of-2025
Muller, W. (1995). Informational products. *Zeitschrift fur Betriebswirtschaft*, 65, 1017–1044.
Nagle, F., Seamans, R., & Tadelis, S. (2020). Transaction Cost Economics in the Digital Economy: A Research Agenda. *SSRN Electronic Journal*.
Naik, P., Wedel, M., Bacon, L., Bodapati, A., Bradlow, E., Kamakura, W., Kreulen, J., Lenk, P., Madigan, D. M., & Montgomery, A. (2008). Challenges and opportunities in high-dimensional choice data analyses. *Marketing Letters*, *19*(3–4), 201–213.
Njegomir, V., Demko-Rihter, J., & Bojanić, T. (2021). Disruptive technologies in the operation of insurance industry. *Tehnicki Vjesnik*, *28*(5), 1797–1805.
OECD (2016), "Public-Private Partnerships for Statistics: Lessons Learned, Future Steps: A focus on the use of non-official data sources for national statistics and public policy", *OECD Development Co-operation Working Papers*, No. 27, OECD Publishing, Paris.
OECD (2020). The Impact of Big Data and Artificial Intelligence (AI) in the Insurance Sector. *OECD*, 36. www.oecd.org/finance/Impact-Big-Data-AI-in-the-Insurance-Sector.htm.%0A
Pollock A. & Berge E. (2018) How to do a systematic review. *International Journal of Stroke.* Vol. 13(2) 138–156
Posner R. A. (1981) The Economics of Privacy. T*he American Economic Review.* (Vol. 71, No. 2)
Ratnakaram, S., Chakravaram, V., Vihari, N. S., & Vidyasagar R., G. (2021). Emerging Trends in the Marketing of Financially Engineered Insurance Products. *Advances in Intelligent Systems and Computing*, *1270*, 675–684.
Rejda, G. (2019). Principles of Risk Management and Insurance. In *Pearson Education* (Vol. 53, Issue 9).
Saliba, B., Spiteri, J., & Cortis, D. (2021). Insurance and wearables as tools in managing risk in sports: Determinants of technology take-up and propensity to insure and share data. *The Geneva Papers on Risk and Insurance - Issues and Practice*, *0123456789*.
Sen, A. (2004). Metadata management : past , present and future. *Decision Support Systems*, *37*, 151–173.
Stigler G. J. (1980) An introduction to Privacy in Economics and Politics. *The Journal of Legal Studies*, 9 623-44.
Stoeckli, E., Dremel, C., & Uebernickel, F. (2018). Exploring characteristics and transformational capabilities of InsurTech innovations to understand insurance value creation in a digital world. *Electronic Markets*, *28*(3), 287–305.
Talonen, A., Mähönen, J., Koskinen, L., & Kuoppakangas, P. (2021). Analysis of consumers' negative perceptions of health tracking in insurance – a value sacrifice approach. *Journal of Information, Communication and Ethics in Society*, *825215*.
Tereszkiewicz, P., & Południak-Gierz, K. (2021). Liability for incorrect client personalization in the distribution of consumer insurance. *Risks*, *9*(5).
Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review* Introduction: the need for an evidence- informed approach. *British Journal of Management*, *14*, 207–222.
Van Aken, J. (2001). Management Research Based on the Paradigm of the Design Sciences: The Quest for Field Tested and Grounded Technological Rules, Working Paper 01.1, *Eindhoven Centre for Innovation Studies*, Eindhoven University of Technology, Eindhoven.
Wedel, M., & Kannan, P. K. (2016). Marketing analytics for data-rich environments. *Journal of Marketing*, *80*(6), 97–121.
Wilkinson, M. D., Dumontier, M., Aalbersberg, Ij. J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J. W., da Silva Santos, L. B., Bourne, P. E., Bouwman, J., Brookes, A. J., Clark, T., Crosas, M., Dillo, I., Dumon, O., Edmunds, S., Evelo, C. T., Finkers, R., … Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Nature*, *3*, 1–9.
World Economic Forum. (2015). The Future of Financial Services. In *World Economic Forum* (Issue June).

Xu X., & Zweifel, P. (2020). A framework for the evaluation of InsurTech. *Risk Management and Insurance Rev.*, *23*(4), 305–329.

Yoo Y. (2010). Computing in everyday life: A call for research on experiential computing. MIS Quar., 213–231.

Yoo Y. (2015). It is not about size: a further thought on big data. *J. Inform. Technol.* 30 (1), 63–65.

Yu, J., & Yen, B. (2020). Re-think insurance: A new perspective of InsurTech. *Proceedings of the International Conference on Electronic Business (ICEB)*, *2020-Decem*, 386–397.

Yu, L. (2008). The Downside of Real-Time Data. *MITSloan Management Review*, *50105*, 8–11.

Zavolokina, L., Schwabe, G., & Dolata, M. (2016). FinTech - What's in a name? *Thirty Seventh International Conference on Information Systems*, *May 2011*, 10–11.

KIBS Role in the Innovation and Internationalization Processes of Firms: A Bibliometric Overview

Alexandra Braga[1], Joana Ferreira[1]and Jorge Sousa[2]
[1]CIICESI/ ESTG-P.Porto, Portugal
[2]ESTG/P.Porto, Portugal
abraga@estg.ipp.pt
8200583@estg.ipp.pt
3jas@estg.ipp.pt

Abstract: In recent decades, KIBS have been one of the most dynamic segments of the service sector in European countries and are one of the fastest growing sectors of the European Union economy. KIBS are firms that provide knowledge-intensive inputs to the business processes of other organizations. In the regional and national economy, KIBS have played a central role in innovation as carriers, producers and mediators of knowledge. Consequently, this knowledge has a critical impact on the internationalization of firms. New sources of information and knowledge help firms compete and grow in markets of which they possess little or no prior knowledge. Firms face difficulties in foreign markets, so they need to develop a strong knowledge base to successfully compete across borders. The intensity of knowledge and the diversity of knowledge sources positively impact both the internationalization of firms and their innovation. Knowledge-intensive firms represent a link between their customers and the knowledge base available across the economy, and therefore act as a catalyst for innovation and internationalization. Recognizing the important role played by KIBS and to provide as overall picture of the research field, a bibliometric approach was performed, based on a mapping of scientific publications, intellectual structure and research trends related to the area under study, highlighting the current approaches of reference on the subject of innovation, internationalization and knowledge. In light of this consideration, the main objective of this study is to identify some of the most relevant research in this field and some of the newest trends, according to the information found in the Web of Science database, thus contributing to the enrichment of the existing literature. The specific objectives of this study are as follows: (1) to identify how the concepts of KIBS, innovation and internationalization are defined in the literature and assess the evolution achieved in the field of research; (2) to identify and measure research productivity, the trend of collaboration between countries, and the main and most relevant journals and authors; and (3) to analyze and map co-citations and research topics to identify the intellectual structure of the literature.

Keywords: bibliometric analysis, innovation, internationalization, Knowledge-Intensive Business Services, KIBS

1. Introduction

Knowledge Intensive Business Services (KIBS) firms are among the most dynamic segments of the service sector in European countries since the last 20 years and are one of the fastest growing sectors in the European Union economy (Strambach, 2008; Hu et al., 2013).

KIBS are firms that provide knowledge-intensive inputs to the business processes of other organizations (Muller & Doloreux, 2009). IT (Information Technology) services, R&D services, technical consulting, legal, financial and management consulting, and marketing communications are typical KIBS firms. In the regional and national economy, KIBS are playing a central role in innovation as carriers, producers and mediators of knowledge (Hipp & Grupp, 2005; Miles et al., 1995; Bao & Toivonen, 2014). This knowledge has critically impacted the internationalization of firms. New sources of information and knowledge help firms compete and expand in markets of which they have little or no prior knowledge (Autio et al., 2000). Therefore, knowledge customization has a positive influence on proactive internationalization strategies, such as external innovation and new organizational methods (Braga et al., 2018).

According to Braga & Marques (2016), internationalization is a dimension yet to be explored. The present study seeks to fill the gap in the literature regarding the role of KIBS in the internationalization of firms, by using a bibliometric analysis to map and analyze the scientific production in this area and thus contribute to enrich the existing literature by providing insight into the main research trends in this field.

The main objectives of this study are as follows: (1) to identify the definition of the concepts of KIBS, innovation and internationalization in the literature and the evolution achieved in the research field; (2) to identify and measure research productivity, the trend of collaboration between countries, and the main and most relevant

journals and authors; (3) to analyze and map co-citations and research themes to identify the intellectual structure of the literature.

2. Literature review

Knowledge-intensive business services (KIBS)

As the world and the modern economy have evolved, the importance of intangible resources has increased, with knowledge featuring prominently as one of the main drivers of business development (Hipp et al. 2015). Companies feel increasingly unable to deal with the growing competition and the challenges of the economy based only on their own resources. In this sense, knowledge-intensive companies are fundamental to avoid the costs in maintaining, and even capturing, new professional knowledge (Baláž, 2004). For several authors, KIBS are firms that aim to find solutions for other companies, based on a specific area of knowledge (Miles et al., 1995; Miles, 2005). Gallego & Maroto (2015) identify KIBS as economic agents specialized in transferring, exchanging and/or selling knowledge to the market, while continuing to learn in networks.

According to Miles et al. (1995), KIBS can be classified as professional KIBS (P-KIBS) or technological KIBS (T-KIBS). The former is associated with firms that require a high level of specialization and whose activities comprise technical skills, such as legal, business and management, consulting, marketing, and other scientific and professional services. On the other hand, T-KIBS are more associated with activities comprising technical-scientific content, such as business consulting hardware and software, computing, and information technology, among others.

Interest in KIBS has significantly increased due to their major impact on the innovation of companies and consequently on the economy of countries. Hipp et al. (2015) even state that KIBS will probably be one of the main drivers of future growth in the European Union. KIBS can act as users, creators and transfer agents of technological and non-technological innovations, playing an important role in the creation and dissemination of organizational, institutional and social knowledge, thus creating positive externalities through the transfer and creation of useful innovations for the remaining economic agents ((Miles et al. 1995; Hertog, 2000). In order for this whole process to be viable, a critical point is the relationship of KIBS with customers. According to Miles (2000), KIBS cooperate with external agents to a greater degree compared to other services, where the relationship with customers is one of the most crucial and characteristic elements of their innovation processes. This interaction is fundamental for KIBS to grasp customers' needs and thus provide the most appropriate service for each specific case. However, this interaction is not only critical for the customization of the service to translate into value for the customer, but it is also a source of information and knowledge that feeds the company's innovation process.

(Castaldi, 2008) further states that, by providing knowledge, KIBS represent a link between their customers and the knowledge base available throughout the economy, thus acting as a catalyst for innovation. This process enhances the customer knowledge base by combining and integrating with the KIBS' knowledge base (Hipp et al. 2015). Therefore, the influence of KIBS on business innovation owes much to the type and intensity of the relationship between the organization providing the service and the customer (Hu et al. 2013).

KIBS: Internationalization

A firm's ability to extract, analyze and use knowledge is also critical in exporting and is one of the most important factors when aiming to enter a new market in which it does not yet have much experience (Love & Roper, 2015) . As companies face difficulties in foreign markets, they need to develop a strong knowledge base to successfully compete across borders. It is widely known that knowledge intensity and diversity of knowledge sources positively impact a firm's internationalization (de Clercq et al. 2012; Hilmersson, 2013) and also its innovation process (Anoruo & Dipietro, 2006; León-Ledesma, 2005). KIBS then serve as touch points with other markets, where they gain access to valuable information and knowledge that they can absorb, store and codify to incorporate into their extant knowledge base (Doloreux & Laperrière, 2014).

There is increasing empirical evidence suggesting the positive influence of knowledge-intensive firms on companies' competitive ability. A study conducted by Martinez-Gomez et al. (2010) shows the positive impact between exporting and the use of services provided by KIBS. This relationship is shown to be favorable when

the firm's export intensity is relatively low. It can be assumed that services provided by knowledge-intensive firms are useful for companies in the early stages of their internationalization process, so that the existing knowledge exchange enhances performance abroad. Moreover, Jack et al. (2008) state that the degree of interaction between KIBS and their customers likely influences the company's choice of entry mode abroad. This fact is reflected in a study by Cardone-Riportella & Cazorla-Papis (2001) that highlights that the intensity or level of interaction required for service delivery is directly linked to foreign market entry modes.

3. Methodology

A bibliometric study is a quantitative analysis that uses a set of mathematical and statistical methods for the processing of scientific literature (Cronin, 2001).

To perform this analysis, the data were extracted from the WoS Core Collection database. The content analysis followed the methodology proposed by Goksu (2021) and Khatib et al. (2021). The articles were selected based on title, abstract, and keywords. First, to search for publications, the following keywords were input: "KIBS" or "Knowledge Intensive Business Services", or "Knowledge-Intensive Business Services", and "Internationalisation" (there was no distinction between the words "internationalization" and "internationalisation" in the extraction because the number of articles obtained in the two searches was the same, so it was not necessary to use a specific search method — in this case, "internationali*ation"). Next, only articles were selected, thus excluding other types of documents. Subsequently, the selected categories were Management, Business and Economics. Finally, the chosen research areas were Business Economics, Operations Research Management Science and Social Science Other Topics. The data collection covers the period from 1993 to 2021, which resulted in a total of 579 articles (see Figure 1).

The results extracted from the database were then compiled in the VOSviewer software. This software is used to construct and visualize bibliometric maps, as well as to present the thematic flow of knowledge and identify information clusters of the analyzed bibliographic data (Khatib et al. 2021).

4. Results

Publication trends

Figure 1 shows the evolution of the number of articles published in the period under analysis. It is worth noting that in the early years, mainly from 1993 to 2002, the number of articles published in this area is very small: a total of only 15 publications. In the following years, interest in KIBS steadily increased, particularly in the last decade, with the exception of 2014, in which more than 30 articles per year were published. In this period, the growth rate was 19%. The most significant years were 2016 and 2020, with 58 and 70 published articles, respectively.

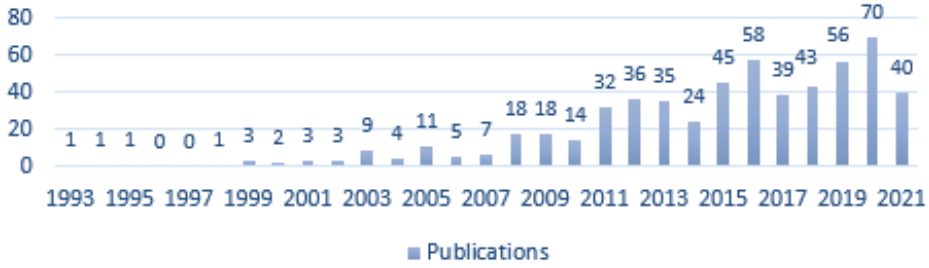


Figure 1: Total number of published articles

Within the subject of KIBS, it is possible to find several areas of research. Breaking down the study into subject areas is a useful tool for identifying the performance of each area based on the publications. The area of KIBS already encompasses a variety of research fields, from Economics to other distinct areas such as Environmental Studies. The categories on the podium — Management, Business, and Economics — represent the majority of published articles, with the Management area standing out as the most relevant, with 336 articles, which represents about 58% of the 579 publications under review. The following categories show a considerable drop in the number of articles, resulting in less than 100 articles for each area.

Most Productive Countries and Journals

Inter-country collaboration is an important factor to take into account because the exchange of knowledge from different sources is useful for academic success and evolution. A total of 68 countries were extracted from the data set. Table 1 shows the 15 most productive countries. England tops the list of most productive countries, with a total of 95 published articles, followed by Spain (92) and Italy (72). These three countries stand out because they represent almost half of the published articles (44.7%). Of the 15 countries under analysis, it is in Europe (11 countries) that most articles on KIBS are published. Next, in North America, the USA and Canada are the countries with the most published articles: 48 and 40, respectively. In South America, only Brazil stands out, with 22 publications. Similarly, in Asia, only China is on the list, with 28 articles.

Table 1: The *15* countries with the most published articles

Countries	Total of Publications	% of 579 Publications	Citations
England	95	16.379	2421
Spain	92	15.862	1789
Italy	72	12.414	2139
USA	48	8.276	1554
Finland	46	7.931	1596
France	41	7.069	688
Canada	40	6.897	916
Germany	37	6.379	1913
Sweden	30	5.172	633
China	28	4.828	641
Brazil	22	3.793	110
Netherlands	22	3.793	447
Portugal	21	3.621	382
Norway	20	3.448	406
Poland	17	2.931	91

Regarding citations, the positions of the countries change significantly, as is the case of Germany: despite having less than half of the articles published in Spain, it has more citations (1,913 citations).

The bibliometric map of inter-country co-authorship shown in Figure 3 provides a broader view of the collaboration between the 60 main countries. England is the country that collaborates most with other countries, presenting 28 links, followed by France (24 links), USA (23 links), Spain (22 links), and Italy (21 links). The remaining countries have fewer than 20 links. It is also observed that England collaborates more frequently with Spain, Italy and the USA. Spain collaborates with several European countries, but mainly with Canada. And China collaborates mostly with the USA, followed by England and other nearby countries, such as Australia and Taiwan. Among all the countries, those that collaborate more with countries anywhere in the world are England, the USA and France. The remaining 8 countries excluded by VOSviewer, such as Turkey, Estonia or the Czech Republic, were not expressively involved in publications with other countries and therefore no connection is observed.

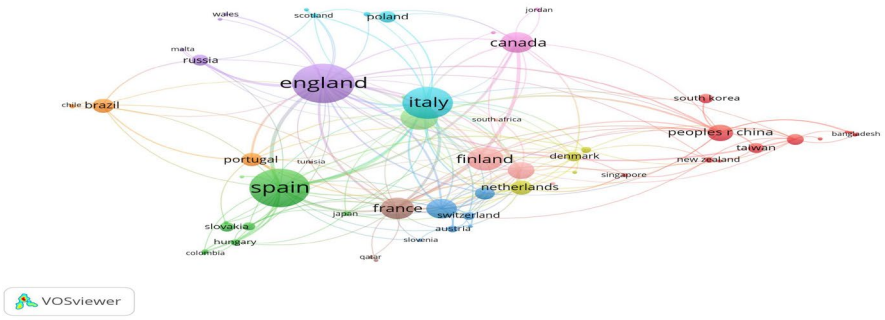


Figure 1: Bibliometric map of inter-country co-authorship

Table 2 lists the 10 scientific journals with the highest number of published articles on the topic. Two indicators were used to evaluate the influence of the journals: ACA (Average Citation per Article) and the impact factor of 2020. This analysis will help differentiate between the quality and productivity of publications in journals. While the number of citations is an indicator of journal influence, the number of publications is an indicator of productivity (Kumar et al. 2020). The scientific journal with the highest production is Service Industries Journal, with 50 published articles. But despite having the largest number of published articles, this journal is not the best performing. *Research Policy* has fewer publications and yet is the journal with significantly more citations (2,282 citations) and the highest ACA (163 citations per article). This proves that a large number of publications does not always guarantee a higher number of citations. It should also be noted that the *Journal of Knowledge Management* presents lower results compared to other journals featured in the list, but it is the most prestigious journal among academics.

Table 2: The 10 scientific journals with the most publications

Journal	Articles	Citations	ACA	Impact Factor (2020)
Service Industries Journal	50	1454	29.08	6.539
Regional Studies	33	642	19.45	4.672
Industrial Marketing Management	20	969	48.45	6.96
Industry and Innovation	16	295	18.44	3.424
International Journal of Technology Management	16	176	11	1.667
Research Policy	14	2282	163	8.11
Service Business	14	305	21.78	2.791
Journal of Knowledge Management	13	626	48.15	8.182
Knowledge Management Research Practice	13	143	11	2. 744
Journal of Business Industrial Marketing	11	156	14.18	3.462

Top authors: the most productive and most influential

1,147 authors were included in this study. The h-index was used as an indicator of research performance. The h-index is a robust estimator of the total impact of an author's contribution to a given field of research. Table 3 presents the top 10 authors who have contributed the most to the literature in this research area. With 22 publications (3.95% of 579 publications), Doloreux D from Canada was the most productive author. Shearmur R, with the best h-index (30), and Miozzo M were the next, with 14 and 10 published articles, respectively. The remaining authors, mostly European, contributed less than 10 articles each. These results show that the study of KIBS and Internationalization is already a growing topic, with author Doloreux D presenting the second highest h-index (27), dominating this field of research.

Table **3***:* The 10 most productive authors

Author	Country	Total of Publications	Total of Citations	% of 579	H-index
Doloreux D	Canada	22	586	3.950	27
Shearmur R	Canada	14	360	2.513	30
Miozzo M	England	10	292	1.795	20
Miles I	Russia	9	132	1.616	2
Grandinetti R	Italy	8	308	1.436	14
Rodriguez M	Spain	8	128	1.436	8
Lafuente E	Spain	7	89	1.257	11
Antonelli C	Italy	6	???	1.077	22
Bolisani E	Italy	6	77	1.077	14
Mas-verdu F	Spain	6	179	1.077	15

In addition to the most productive authors, the most influential authors were also studied, as they are those who have central and important scientific articles in the research field (Racherla & Hu 2010). In this section, the TLS (Total Link Strength) indicator was used, extracted from the VOSviewer software, which indicates the total strength of a given researcher's citation links with other researchers. The top 10 authors in the field of KIBS are shown in Table 4.

Table 4*:* The 10 most influential authors

Auhtor	Country	Total of Publications	Total of Citations	TLS	H-index
Doloreux D	Canada	22	586	856	27
Shearmur R	Canada	14	360	532	30
Muller E	Germany	1	475	435	2
Zenker A	Germany	1	475	435	5
Miles I	Russia	8	132	292	2
Amara N	Canada	5	323	291	27
Landry R	Canada	5	323	291	27
Grandinetti R	Italy	8	308	270	14
Rodriguez M	Spain	8	128	267	8
Bettencourt LA	USA	1	409	244	17

The list is led by two Canadian authors, Doloreux D and Shearmur R, both of whom have the most published articles and highest TLS value. The next two authors stand out because, having only one article, they obtained a high number of citations (475 citations), but the h-index is much lower compared to other authors. Also worth of mention is author Bettencourt LA, who with only 1 article obtained 409 citations. We can then conclude that the most productive authors are not always the most influential ones. 5 of the 10 authors with more publications are not included in the list when the classification is based on the number of citations and the value of TLS.

Analysis of co-citations

A co-citation exists when two references appear together in the same publication. The occurrence of two publications more than once in the reference list of an article can be an indicator of similarity in an empirical discipline, methodology, theory, and theme (Barbosa & Ferreira-Lopes, 2021). The advantage of using co-citation analysis is that in addition to finding the most influential publications, academics can also discover thematic clusters. Here, the thematic clusters are derived based on the cited publications. A scientific limit of 20 articles was set and in the end 82 references remained for analysis.

As shown in the figure below, the analysis results in three clusters featuring high correlation between them. Subsequently, the 5 most cited articles were identified by the Vosviewer software to ensure high quality articles in the analysis of each cluster. This analysis resulted in three themes: absorptive capacity and coproduction with the customer, the role of KIBS in innovation, and types and modes of service innovation.

Thematic Categorization: Clusters

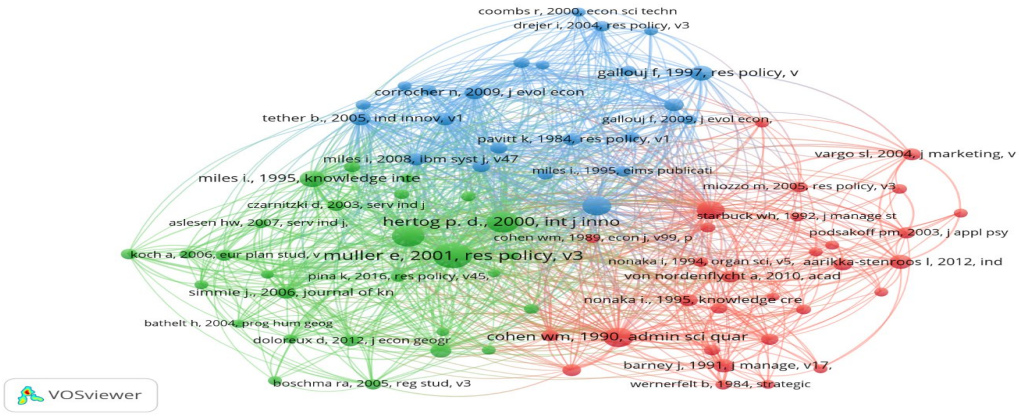


Figure 2: Co-citation of documents

Cluster 1- Absorptive capacity and coproduction with the customer

The first cluster addresses customer relations and the ability to absorb new information. The focus of the economy is shifting from tangible to intangible resources such as skills, information, and knowledge, and therefore knowledge is becoming the fundamental source of competitive advantage for companies. To achieve this competitive advantage, a critical factor is the relationship between the service company and its customer. The exchange of knowledge between these two agents allows for service customization and consequently increases the probability of project success and customer satisfaction. The company's ability to absorb external information is also paramount. The ability to tap into external knowledge sources is in effect a critical component of the capacity to innovate.

Cluster 2: The role of KIBS in innovation

In this second cluster, innovation is the key theme. KIBS contribution to the innovation of companies is indeed a much studied topic. KIBS play an important role in creating and disseminating knowledge, and they primarily represent a source of innovation. Considered "innovation bridges", KIBS become specialized problem-solving actors in providing complementary knowledge inputs, which facilitate the development of innovation. Muller & Zenker (2001) have proven that interacting SMEs and KIBS are more innovation-oriented than non-interacting firms.

Cluster 3: Types and modes of service innovation

The third cluster focuses primarily on the types and modes of innovation in the service sector. Service firms provide non-material knowledge-intensive services to firms and may generate new knowledge as a result of interaction with customers. This relationship creates a source of innovation, as does cooperation with other service firms. Services, particularly those organizationally oriented towards innovation activities, are more likely to obtain new technologies via collaboration processes with customers and suppliers, or by acquiring external intellectual property. According to Gallouj & Weinstein (1997), there are 6 modes of innovation: radical innovation, improvement-based innovation, incremental innovation, ad hoc innovation (innovation for tackling a particular problem), recombinative innovation (new combination), and innovation by formalization.

Keyword Analysis

The technique of word co-occurrence analysis examines the actual content of the publication itself (Donthu et al. 2021). Academics generally perform co-occurrence analysis, as it is an effective method to address research trends regarding a specific topic (Shi & Li, 2019). The keyword co-occurrence network was observed in the keywords that co-occurred more than 10 times in the set of 579 articles, which means that keywords will appear on the bibliometric map when two keywords occur together more than 10 times in a document (Khatib et al. 2021).

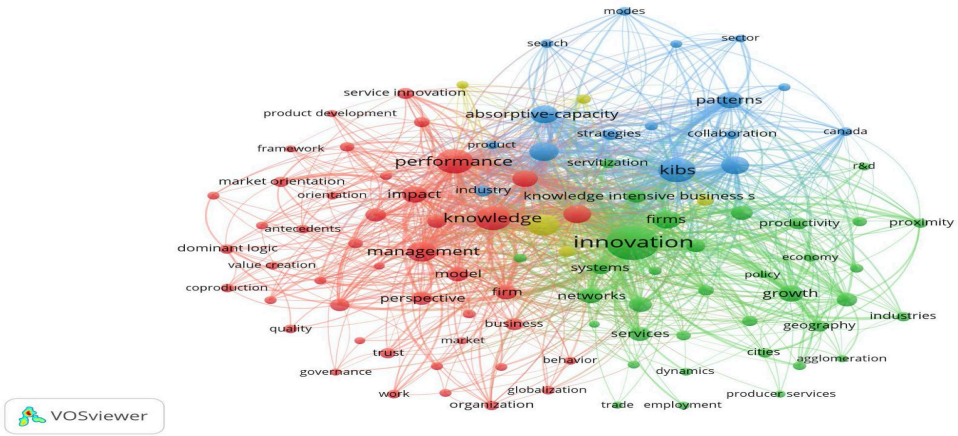


Figure 4: keyword co-occurrence

A set of 2,327 keywords, with the minimum number of occurrences of a keyword defined at 10, resulted in a set of 100 keywords under study. The result of the keyword co-occurrence map (Figure 4) shows that KIBS are mainly focused on innovation (232 occurrences, 98 links). Next appear the words performance, KIBS and knowledge, with 116, 114 and 104 occurrences, respectively. The word internationalization (20 occurrences, 49 links) only appears in position 37 of the list of most frequent keywords. This implies that internationalization associated with KIBS is still an emerging theme.

5. Conclusions

Understanding the role and contribution of KIBS in the learning-based economy has received increasing attention in the last two decades. In this economy, internationalization has been identified as a paramount factor for the expansion and growth of firms. In this vein, this study performed a bibliometric analysis on KIBS and internationalization using a set of 579 articles from the Web of Science database to characterize the field and identify research trends.

The bibliometric approach highlighted the recent growth of the field of KIBS in the last decade via an increasing number of articles and citations. The Service Industries Journal stands out with the largest number of published articles, and Research Policy as the journal with the most citations. The study of KIBS is mainly addressed in categories such as Management, Business and Economics, but it is already starting to cover distinct areas such as Environmental Studies and Applied Psychology. Since these distinct areas have not yet received much attention, it may be a starting point for new studies. Doloureux D stands out as the author with both the largest number of published articles and the largest number of citations. The geographical dispersion of the articles showed that Europe is the most influential and productive region, followed by the USA and Canada. Only in

Africa there is no record of any publication. As for international collaboration, the results show that there is a growing trend of collaboration between countries, mainly by England, France and the USA.

Three key themes emerged from the co-citation analysis: absorptive capacity and co-production with the client; the role of KIBS in innovation; and types and modes of service innovation. It can be concluded that the process of internationalization is still not very relevant in the area of KIBS, and it would be pertinent to further explore this aspect, given that it plays such a critical role for companies and even for the economy.

Finally, among a set of 100 keywords, the following themes stood out: innovation, performance and knowledge. It is clear, then, that innovation is a central theme when associated with KIBS.

This study presents an overview of the extant research in the area of KIBS and internationalization, providing some interesting directions for future research and a complementary approach to the more traditional literature review. One limitation of this study regards data extraction, since the data was only extracted from the Web of Science database and no additional information was considered from other databases. Therefore, in the future, the bibliometry can be significantly extended by including other databases. Conducting new studies in the remaining databases will allow further analysis of the observed changes in research trends over time.

Acknowledgements

The authors gratefully acknowledge financial support from FCT- Fundação para a Ciência e Tecnologia (Portugal), national funding through project UIDB/04728/2020.

References

Anoruo, E., and Dipietro, W. (2006). "Creativity, innovation, and export performance". Journal of Policy Modeling, Vol 28, pp. 133–139. https://doi.org/10.1016/j.jpolmod.2005.10.001

Autio, E., Sapienza, H. J., and Almeida, J. G. (2000). "Effects of Age at Entry, Knowledge Intensity, and Imitability on International Growth". The Academy of Management Journal. Vol. 43, No. 5. http://www.jstor.orgURL:http://www.jstor.org/stable/1556419http://www.jstor.org/stable/1556419?seq=1&cid=pdf-reference#references_tab_contents

Baláž, V. (2004)." Knowledge-intensive business services in transition economies". Service Industries Journal, Vol 24 No. 4, pp. 83–100. https://doi.org/10.1080/0264206042000275208

Bao, S., and Toivonen, M. (2014). "Finnish Knowledge-Intensive Business Services in China: Market Entry and Position in the Value Chain". Technology Innovation Management Review, Vol. 4, pp. 43–52. https://doi.org/10.22215/timreview/784

Barbosa, M. W., and Ferreira-Lopes, L. (2021). "Emerging trends in telecollaboration and virtual exchange: a bibliometric study". Educational Review, 1–29. https://doi.org/10.1080/00131911.2021.1907314

Bettencourt, L., Ostrom, A., Brown, S., and Roundtree, R. (2005). "Client Co-Production in Knowledge-Intensive Business Services". California Management Review, Vol 44. https://doi.org/10.2307/41166145

Braga, A.M. and Marques, C.S. (2016), Knowledge Intensive Business Services Research: a bibliometric study of leading international journal (1994-2014). In J. Ferreira, M. Raposo, C. Fernandes & M. Dejardin (Eds.), Knowledge Intensive Services and regional Competitiveness (pp.11-47). New York, Routledge.

Braga, A., Marques, C. S., and Serrasqueiro, Z. (2018). "Internationalisation Strategy of Knowledge-Intensive Business Services". Journal of the Knowledge Economy, 9(2), 359–377. https://doi.org/10.1007/s13132-017-0461-5

Cainelli, G., de Marchi, V., and Grandinetti, R. (2020). "Do knowledge-intensive business services innovate differently?" Economics of Innovation and New Technology, Vol 29 No. 1, pp. 48–65. https://doi.org/10.1080/10438599.2019.1585639

Cardone-Riportella, C., and Cazorla-Papis, L. (2001). "The internationalisation process of Spanish banks: a tale of two times". International Journal of Bank Marketing, Vol 19 No. 2, pp. 53–68. https://doi.org/10.1108/02652320110694865

Castaldi, C. (2008). The relative weight of manufacturing and services in Europe: an innovation perspective.

Cohen, W., and Levinthal, D. (1990). "Absorptive Capacity: A New Perspective on Learning and Innovation". Administrative Science Quarterly, Vol 35, pp. 128–152. https://doi.org/10.2307/2393553

Cronin, B. (2001). "Bibliometrics and beyond: Some thoughts on Web-based citation analysis". Journal of Information Science, Vol 27, pp. 1–7. https://doi.org/10.1177/016555150102700101

de Clercq, D., Sapienza, H. J., Yavuz, R. I., and Zhou, L. (2012). "Learning and knowledge in early internationalization research: Past accomplishments and future directions". Journal of Business Venturing, Vol 27 No. 1, pp. 143–165. https://doi.org/10.1016/j.jbusvent.2011.09.003

den Hertog, P. (2000). "Knowledge-Intensive Business Services as Co-Producers of Innovation". International Journal of Innovation Management. Vol. 4, Issue 4. www.worldscientific.com

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., and Lim, W. M. (2021). "How to conduct a bibliometric analysis: An overview and guidelines". Journal of Business Research, Vol 133, pp. 285–296. https://doi.org/https://doi.org/10.1016/j.jbusres.2021.04.070

Gallego, J., & Maroto, A. (2015). "The Specialization in Knowledge-Intensive Business Services (KIBS) across Europe: Permanent Co-Localization to Debate". Regional Studies, Vol 49 N0. 4, pp. 644–664. https://doi.org/10.1080/00343404.2013.799762

Gallouj, F., and Weinstein, O. (1997). "Innovation in services". Research Policy, Vol 26 No. 4, pp. 537–556. https://doi.org/https://doi.org/10.1016/S0048-7333(97)00030-9

Hilmersson, M. (2013). "Small and medium-sized enterprise internationalisation strategy and performance in times of market turbulence". International Small Business Journal, Vol 32 No. 4, pp. 386–400. https://doi.org/10.1177/0266242613497744

Hipp, C., Gallego, J., and Rubalcaba, L. (2015). "Shaping innovation in European knowledge-intensive business services". Service Business, Vol 9 No. 1, pp. 41–55. https://doi.org/10.1007/s11628-013-0217-7

Hipp, C., and Grupp, H. (2005). "Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies". Research Policy, Vol 34 No. 4, pp. 517–535. https://doi.org/https://doi.org/10.1016/j.respol.2005.03.002

Hu, T. S., Lin, C. Y., and Chang, S. L. (2013). "Knowledge intensive business services and client innovation". Service Industries Journal, Vol 33 Nos. 15–16, pp. 1435–1455. https://doi.org/10.1080/02642069.2011.634903

Jack, R., As-Saber, S., Edwards, R., and Buckley, P. (2008). "The role of service embeddedness in the internationalisation process of manufacturing firms". International Business Review, Vol 17 No. 4, pp. 442–451. https://doi.org/10.1016/j.ibusrev.2008.02.006

Khatib, S. F. A., Abdullah, D. F., Hendrawaty, E., and Elamer, A. A. (2021). "A bibliometric analysis of cash holdings literature: current status, development, and agenda for future research". Management Review Quarterly. https://doi.org/10.1007/s11301-021-00213-0

Kumar, S., Sureka, R., and Colombage, S. (2020). "Capital structure of SMEs: a systematic literature review and bibliometric analysis". Management Review Quarterly, Vol 70 No. 4, pp. 535–565. https://doi.org/10.1007/s11301-019-00175-4

León-Ledesma, M. (2005). "Exports, Product Differentiation and Knowledge Spillovers". Open Economies Review, Vol 16, pp. 363–379. https://doi.org/10.2139/ssrn.319400

Love, J. H., and Roper, S. (2015). "SME innovation, exporting and growth: A review of existing evidence". International Small Business Journal, Vol 33 No. 1, pp. 28–48. https://doi.org/10.1177/0266242614550190

Martinez-Gomez, V., Baviera-Puig, A., and Mas-Verdú, F. (2010). "Innovation policy, services and internationalisation: The role of technology centres". Service Industries Journal, Vol 30 No. 1, pp. 43–54. https://doi.org/10.1080/02642060802398101

Miles, I. (2000). "Services Innovation: Coming of age in the knlowledge-based economy". International Journal of Innovation Management, Vol. 4, pp. 371–389.

Miles, I. (2005). "Knowledge intensive business services: prospects and policies". Foresight, Vol 7 No. 6, pp. 39–63. https://doi.org/10.1108/14636680510630939

Miles, I., Kastrinos, N., Flanagan, K., Bilderbeek, R., den Hertog, P., Huntink, W., and Bouman, M. (1995). KNOWLEDGE-INTENSIVE BUSINESS SERVICES Users, Carriers and Sources of Innovation A report to DG13 SPRINT-EIMS.

Muller, E., and Doloreux, D. (2009). "What we should know about knowledge-intensive business services". Technology in Society, Vol 31 No. 1, pp. 64–72. https://doi.org/10.1016/j.techsoc.2008.10.001

Muller, E.,and Zenker, A. (2001). "Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems". Research Policy, vol. 30 No. 9, pp. 1501–1516. https://doi.org/https://doi.org/10.1016/S0048-7333(01)00164-0

Racherla, P., and Hu, C. (2010). "A social network perspective of tourism research collaborations". Annals of Tourism Research, Vol. 37 No 4, pp. 1012–1034.https://doi.org/https://doi.org/10.1016/j.annals.2010.03.008

Shi, Y., and Li, X. (2019). "A bibliometric study on intelligent techniques of bankruptcy prediction for corporate firms". Heliyon, Vol. 5 No. 12, e02997.https://doi.org/https://doi.org/10.1016/j.heliyon.2019.e02997

Strambach, S. (2008). "Knowledge-Intensive Business Services (KIBS) as drivers of multilevel knowledge dynamics". IJSTM, Vol. 10, pp. 152–174. https://doi.org/10.1504/IJSTM.2008.022117

Psychological Capital and Entrepreneurial Tendencies

Tiina Brandt
Haaga-Helia University of Applied Sciences, Helsinki, Finland
tiina.brandt@haaga-helia.fi

Abstract: This study is interested in psychological capital and entrepreneurial tendencies. Psychological capital is an individual's attitude and tendency towards Hope, Optimism, Resilience and Self-Efficacy. It has been connected with several positive outcomes in individuals' working life, e.g. career progress, work satisfaction, wage and well-being. However, in the relationship with entrepreneurial tendencies and especially with growth orientation there is still need of more studies. The study focused on the 457 adults' psychological capital and entrepreneurial tendencies, most of them were women (64%). The correlation analyses produced several statistically significant results, indicating that psychological capital is connected to entrepreneurial tendencies and growth orientation. Psychological capital can be increased with interventions, thus the entrepreneurial education at the higher education institutes could consider focusing also on individuals' psychological qualities and increasing for example students' psychological capital with interventions.

Keywords: psychological capital, entrepreneurial tendencies, growth-orientation

1. Introduction

Entrepreneurship has long been acknowledged as the basic engine for economy and wealth creation and plenty of research has tried to solve the entrepreneurial qualities and orientation. The identification of individuals with entrepreneurial attitudes, and encouraging them at schools and higher education institutes could foster more people to entrepreneurial careers.

Entrepreneurship has typically been connected with characteristics like risk-taking, innovativeness and competitiveness and many researchers have reported that risk-taking attitudes and behaviors are distinguishing characteristics of entrepreneurship (e.g. Das and Teng, 1997; Douglas and Shepherd, 2002; Stewart et al, 1998). Innovativeness is important in order to create something new and succeed in changing situations. In relation to competitiveness, it has noted that aggressive competitive orientation is related to firm performance and business success (Covin and Covin, 1990; Matchaba-Hove et al, 2013).

Individual factors like age, gender and personality have been studied in relation to entrepreneurship. Age impacts so, that older people are significantly less likely to engage in entrepreneurial activity than younger individuals (Curran and Blanckburn, 2001; Hart et al, 2004), but on the other hand survival rates of businesses established by older entrepreneurs are higher than those of younger entrepreneurs (e.g., Cressy and Storey, 1995; Rotefoss and Kolvereid, 2005). Personality has an impact so that, some e.g. intuitive and thinking personality preferences are acting more as entrepreneurs than their opposite preferences sensing and judging (e.g. Brandt & Helander, 2020; Carland and Carland, 1992). Among individual variables that have shown to be related to entrepreneurial behavior are also of being a determinate person (Kim-Soon et al., 2013). Here the focus is also on individual factors, and the interest is to see if psychological capital has an impact on entrepreneurial tendencies and growth orientation.

In working life, it has been noted that psychological capital has a huge impact on the individuals' experiences and success. There are multiple studies of its positive impacts on individuals' life at organizations and work-related matters (Avey et al, 2010; Avey et al, 2011; Bergheim et al, 2015; Luthans et al, 2008; Peterson et al, 2011). Psychological capital illustrates individuals' positive capacity in terms of the components of optimism, resilience, self-efficacy, and hope (Luthans et al, 2006). Even though there are some studies that have noted the connection with psychological capital and entrepreneurship, more studies are needed to confirm those. Earlier studies have been done with student samples, but here the data is from adults and also the study is interested in the growth factor of entrepreneurship.

1.1 Entrepreneurial attitudes; risk-taking and competitiveness

Entrepreneurial intention has been studied for example in the context of the Theory of Planned Behavior (TPB), originally formed by Ajzen (1991). Ajzen postulated that behaviour is a function of beliefs that influence a certain behaviour. These beliefs are considered important premises that determine 1) personal attitude, 2) intention and 3) perceived behaviour control. Previous studies have used TPB to predict certain variables that

are related to entrepreneurship. These variables include entrepreneurial intentions, entrepreneurial behavior and entrepreneurial skills and attitudes. Entrepreneurial skills and attitudes are regarded as necessary antecedents in the process of effective entrepreneurship (Zahra, 2005, p. 25). Over the past decades, scholars have been largely interested in exploring this construct of entrepreneurial intention (Fayolle and Liñán, 2014) and also indicate that intention is an accurate predictor of planned behavior and incase of entrepreneurship, people with higher entrepreneurial potential usually have more entrepreneurial intentions (Conner and Armitage, 1998; Jakopec et al., 2013).

The ability to take risks has been defined a crucial quality for entrepreneurs (Frishamme and Andersson, 2009) and multiple research indicates this (e.g. Begley and Boyd, 1987; Carland et al, 1995; Pekkala et al, 2019; Zhang et al, 2015). For example, according to Karabey (2012), entrepreneurs' risk preference was found to be higher than expected.

Risk preference can be defined as the general tendency or the desire to pursue or avoid risks (Sitkin and Pablo, 1992). Also, risk reflects the degree of uncertainty and potential loss associated with the outcomes which may follow from a given behavior or a set of behaviors (Forlani and Mullins, 2000). Gunawan, Manatunge, and Pratiwi (2013) noted that risk-taking orientation reflects an individual's tolerance of uncertainty and the ability to become involved in and to make risky investments. The important fact about risk-taking is not just the resources to be committed but also the high probability of failure (Wiklund and Shepherd, 2003).

Some research indicates that with risk-taking ability the need for autonomy in decision making is also needed. The stronger the risk-taking tolerance of the individual has, and the stronger is their preference for decision-making autonomy, the stronger is their intention to be self-employed (Douglas and Shepherd, 2002). The intervention study indicated that people can learn to take risks (Kyrö and Tapani, 2008). Gunawan et al. (2013) noted that risk-taking orientation reflects an individual's tolerance of uncertainty and the ability to involve in and make risky investments. Other authors have shown that highly risk-minded entrepreneurs are generally willing to take on high-risk ventures for the chance of high returns (Covin and Slevin, 1989; Lumpkin and Dess, 1996).

Competitiveness drives efforts which improve performance (Krishnan et al., 2002) and it is associated with the adaptation of deep learning strategies (King et al., 2012) and related to learning effort as well as general self-efficacy (Wang and Netemeyr, 2002). Many studies have focused on entrepreneurial orientations and the relationship of aggressive competitive orientation to firm performance and business success (Covin and Covin, 1990; Matchaba-Hove et al, 2013).

1.2 Psychological capital and entrepreneurial tendencies

Psychological capital serves as a job-related positive psychological resource within an individual's cognitive and attitudinal perspective (Luthans et al, 2007). It is a construct of further development and also decreasing (Gardner et al, 2005a), in contrast to most other personal traits, which are seen as unchangeable natural tendencies. Several studies have focused on the quantitative results of leadership's, trainings' and interventions' impact on psychological capital (Luthans et al., 2006).

A definition of psychological capital is "an individual's positive psychological state of development that is characterized by: (1) having confidence (self-efficacy) to take on and put in the necessary effort to succeed at challenging tasks; (2) making a positive attribution (optimism) about succeeding now and in the future; (3) persevering toward goals and, when necessary, redirecting paths to goals (hope) in order to succeed; and (4) when beset by problems and adversity, sustaining and bouncing back and even beyond (resilience) to attain success" (Luthans et al, 2007, p. 3). Self-efficacy identifies an individual's belief about his or her ability to successfully execute a specific and even sudden task. Optimism is a more general positive view of the world and expectation that things will turn to be positive rather than negative (Luthans et al, 2010). Resilience is an individual's adaptive response to negative events and setbacks, promoting well-being or protecting against risk factors (Reich et al., 2010). Hope is goal-directed thinking in which people perceive that they can produce routes or pathways to desired goals. Goals may vary temporally from short to long term, but they must be of sufficient personal value for a person to engage in them (Lopez et al, 2003).

Earlier studies indicate that psychological capital has a positive impact on individuals' satisfaction, performance, and commitment at organizations (Avey et al, 2011; Luthans et al, 2005; Luthans et al, 2008; Peterson et al, 2011). For example, Karatepe and Karadas (2015) found that employees scoring high on psychological capital are more satisfied with their jobs, careers, and lives. It has also been associated with positive career mobility (Järlström and Brandt, 2017) and objective career success measured in wages and hierarchical career progression (Järlström et al, 2020). At the organizational level, it is connected to organizational performance (Hmieleski and Carr, 2008), business excellence (Hsu et al., 2014) and competitive advantage (Youssef and Luthans, 2010).

In relationship with entrepreneurship, only few studies exist with student samples (Contreras et al., 2017; Ebhrem et al., 2019). According to the study of Contreras et al. (2017) with the sample of 100 persons, the results indicate that entrepreneurial intention is related to psychological capital with dimensions of self-efficacy and resilience and as an integrated construct as a whole. A study by Ebhrem et al (2019) highlighted the importance of psychological capital in explaining why some students are more willing to start-up business than others. Indeed, the higher the student's psychological capital, the higher the intention to start-up a business.

Concerning psychological capital dimensions there are more studies in relation to entrepreneurship. For example, the relation between self-efficacy and entrepreneurial behavior has been widely established (Akmaliah and Pihie, 2009; Chandler & Jansen, 1997; Chen et al, 1998; Saeid et al., 2011). Also optimism (Laguna, 2006; Lingfei and Li, 2011; Robledo et al, 2015) and hope (Laguna, 2006) are predictors of entrepreneurial intention and hope indicates entrepreneurs' satisfaction with business ownership according to Jensen and Luthans (2002). According to these studies it seems like persistence is the only dimension which has not been studied as a relationship with entrepreneurship. Here this study is focused on the entrepreneurial tendencies and growth mindset, which further gives insights on the individual factors impact on entrepreneurship.

2. Method

2.1 Sample

The data was gathered in 2021 – 2022 of various occupational fields at open university and updating education courses related to leadership and self-understanding. 457 persons participated in this study. They all have higher education background, but the detailed background information of gender and age were not gathered. Respondents were middle managers in various fields, e.g. health and social care, construction, IT, administration of education, restaurants and nutrition etc. The data was gathered in the before the course did began, thus most of them did not have understanding about psychological capital when the data was gathered.

2.2 Questionnaire of psychological capital

The questions were either-or, so respondents should be sure of their quality or tendency in this regard. At the same time, this was the first time to measure psychological capital with this kind of measurement and to test how it works. The questions of psychological capital were analyzed with factor analyses (Varimax) and dimensions and questions were formed accordingly. The questions were coded either-or getting values 0 or 3, where three was meaning more positive response in regard to psychological capital.

Self-efficacy was measured with five questions, e.g. "Challenging situations make me very insecure – I trust in my own capability even in challenging situations". *Resiliency* was measured also with five items, e.g. "I tend to think a long time about the shocks I have experienced – I recover and get over fast of the shocks I have experienced". *Optimism* consists of three items, e.g. "I tend to be suspicious towards new things – I tend to think that things turn out to be in the best possible way". *Hope* consisted three also, e.g. "At this moment my goals are a little bit lost – At this moment I am aspiring to achieve my goals with high energy". Alphas were good, minimum was at Hope 0,553 and the best alpha was at Resilience 0,748.

2.3 Questionnaire of entrepreneurship

Entrepreneurial orientation was measured with five items which measured risk-taking and growth-orientation capacity. Factor analyses with Varimax were made to ensure that those items belong into different groups. Three items were measuring risk and two items growth-orientation. *Risk-taking* was measured with four items:

- When working as employee, the best thing is safety – you do not need this kind of safeness as such
- Do you participate only on that kind of projects that the success is sure – or – if you wish to success you need to take risks
- Would it be better to avoid solutions which demand risk-taking as much as possible / If you want to be better than your competitors, you must have courage to take risks
- You would never start a business, unless you would be sure of its success / You cannot be sure about success, but you could still start

Growth-orientation was measured with two items:

- When owning a company, you would try to keep it as a living /You would try to do firm as the best in the field
- Your firm's real purpose would be of gaining living for you and your family /You would like to get it grow and gain significant position in the field

Cronbach's alpha of risk-taking was 0,571 and for growth-orientation 0,709, so they fulfill the demands, and the latter one can be regarded as very good value.

3. Results

The highest mean of psychological capital was self-efficacy (mean 2,7), secondly optimism (mean 2,4), thirdly hope (mean 2,3) and the lowest resilience (mean 1,7).

Correlation analyses indicated that three dimensions of psychological capital, namely: self-efficacy, resilience and optimism were related to entrepreneurial qualities concerning risk-taking. Concerning growth orientation all dimensions of psychological capital were related to growth orientation (see Table 1).

Table 1: Correlation analyses

Dimension	Self-Efficacy	Resilience	Optimism	Hope	PsyCap
Entrepreneurial Tendencies	0,176**	0,118*	0,164**	-0,014	0,149**
Growth	0,182**	0,177**	0,121**	0,180**	0,237**

4. Conclusions

Results clearly indicated that psychological capital has connection to entrepreneurial tendencies and growth-orientation with people of higher education. In case of growth-orientation all the dimensions were correlated, which indicates that concerning entrepreneurial competitiveness and growth the psychological capital has even more impact.

In the regard of dimensions, it may be that more optimistic persons can recognize business opportunities where others see chaos, contradiction and confusion (Wernsing, 2014) and hope helps people to set the goals high and see different paths to achievement (Kangarlouei et al, 2012). Resilient persons can take risks and bounce-back from failures and adversity (Sebora, 2017). Zhao et al. (2005), argue that previous experience, risk propensity and formation have an influence on both intentions and self-efficacy as an entrepreneur, as this is about beliefs and perceptions.

Entrepreneurial tendencies and attitudes are important in any occupation. For example, according to European Commission (2006) entrepreneurial competence is about mindset and work orientation, which involve the ability to innovate and take risks and to initiate, plan, and lead actions, which further involves

creativity and an innovative approach in order to reach the set goals. People who have entrepreneurial mindset towards work are key personnel in the startups and growth companies. Thus, according to this study it is important to have good psychological capital in order to enhance positive and innovative work-related attitudes. Psychological capital can be enhanced by interventions (Peterson et al, 2011; Russo and Stoykova, 2015; Wang et al, 2014) and thus it should be taken into consideration in the higher education courses to enhance students' capabilities for the future. For example, courses concerning leadership, marketing and selling are the areas where the entrepreneurial attitude is important. At the minimum sharing information about the psychological capital and giving space for individual reflection can enhance individuals' attention and strengthening these important qualities.

References

Ajzen, I. (1991). The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211.

Akmaliah, Z. and Pihie, L. (2009), "Entrepreneurship as a career choice: an analysis of entrepreneurial self-efficacy and intention of university students", *European Journal of Social Sciences*, Vol.9, No. 2, pp. 338-349

Avey, J., Luthans, F., Smith, R., and Palmer, N. (2010), "Impact of positive psychological capital on employee well-being time", *Journal of Occupational Health Psychology*, Vol. 15, pp. 17–28.

Avey, J.B., Reichard, R.J., Luthans, F. and Mhatre, K.H. (2011), "Meta-analysis of the impact of positive psychological capital on employee attitudes, behaviors, and performance", *Human Resource Development Quarterly*, Vol. 22 No. 2, pp. 127–152.

Begley, T. and Boyd, D. (1987) "Psychological characteristics associated with performance in entrepreneurial firms and smaller businesses", Journal of Business Venturing, Vol 2 No. 2, pp. 79-93.

Bergheim, K., Birkeland Nielsen, M., Mearns, K. and Eid, J (2015) "The relationship between psychological capital, job satisfaction, and safety perceptions in the maritime industry", Safety Science, Vol. 74, pp. 27–36.

Brandt, T., Gomes, J. & Boyanova, D. (2011), "Personality and psychological capital as indicators of future job success? A multicultural comparison between three European countries", Finnish Journal of Business Economics, Vol. 3 No. 11, pp. 263-289.

Brandt, T. & Helander, N. (2020), "Entrepreneurial tendencies by different personalities", *Journal of Finnish Studies,* 23 (2), pp. 104-116.

Carland, JoAnn C., and James W. Carland. (1992) "Managers, Small Business Owners and Entrepreneurs: The Cognitive Dimension", *Journal of Business and Entrepreneurship,* Vol 4 No 2, pp. 55-66.

Carland, J.C., III, Carland, J.W., Carland, J.A. & Pearce, J.W. (1995), "Risk taking propensity among entrepreneurs, small business owners, and managers", *Journal of Business and Entrepreneurship*, Vol. 7 No. 1, pp. 15-30.

Chandler, G. N., & Jansen, E. (1997). "Founder self-efficacy and venture performance: A longitudinal study", *Academy of Management Proceedings*, pp. 98-102.

Chen, C. C., Greene, P. G., & Crick, A. (1998). "Does entrepreneurial self-efficacy distinguish entrepreneurs from managers?" *Journal of Business Venturing*, Vol. 13, pp. 295-316.

Conner, M. and Armitage, C.J. (1998), "Extending the theory of planned behavior: a review and avenues for further research", *Journal of Applied Social Psychology*, Vol. 28 No. 15, pp. 1429-1464

Contreras, F., Dreu, I & J.C. Espinosa (2017), "Examining the Relationship between Psychological Capital and Entrepreneurial Intention: An Exploratory Study", *Asian Social Science*; Vol. 13, No. 3, pp. 80-88

Covin, J.G. & Covin, T.J. (1990), "Competitive aggressiveness, environmental context and small firm performance", *Entrepreneurship Theory and Practice*, Vol 14 No 4, pp. 35-50.

Covin, J.G., & Slevin, D.P. (1991), "A conceptual model of entrepreneurship as firm behavior", *Entrepreneurship Theory and Practice*, Vol. 16 No.1, pp. 7–25.

Cressy, R. and Storey, D.J (1995), "New Firms and Their Banks", Warwick University Business School and NatWest.

Curran, J. and Blanckburn, R. (2001) "Older people and the enterprise society: Age and self-employment propensities", *Work, Employment and Society*, Vol. 15, pp. 889-902

Das, T.K & Teng, B. S. (1997), "Time and entrepreneurial risk behavior", *Entrepreneurship Theory and Practice*, Winter 1997: 69-88.

Douglas, E.J. & Shepherd, D.A. (2002), "Self-employment as a career choice: attitudes, entrepreneurial intentions, and utility maximization", *Entrepreneurship Theory and Practice*, Vol 26 No 3, pp. 81-90.

Ephrem, A.N., Namatovu, R., & Basalirwa, E.M. (2019), "Perceived social norms, psychological capital and entrepreneurial intention among undergraduate students in Bukavu", *Education + Training*, 91, 7/8, 963-983.

Fayolle, A. and Liñán, F. (2014), "The future of research on entrepreneurial intentions*", Journal of Business Research,* Vol. 67 No. 5, pp. 663-666.

Forlani, D. & Mullins, J.W. (2000), "Perceived risks and choices in entrepreneurs' new venture decisions", *Journal of Business Venturing*, Vol 15 No 4, pp. 305-322.

Frishammar, J. and Andersson, S. (2009) "The overestimated role of strategic orientations for international performance in smaller firms", *Journal of International Entrepreneurship*, Vol. 7 No. 1, pp. 57-77.

Gunawan, B., Manatunge, J., & Pratiwi, F. D. (2013). Livelihood status of resettles affected by the Saguling Dam project, 25 years after inundation. *International Journal of Water Resources Development*, Vol. 29 No.1, pp. 25–34.

Hart, M. Anyadike-Danes, M., and Blackburn, R. (2004) "Entrepreneurship and age in the UK: Comparing Third Age and Prime Age new venture creation across the regions", Paper presented at the RENT XVIII, Copenhagen

Hmieleski, K.M. and Carr, J.C. (2008), "The relationship between entrepreneur psychological capital and new venture performance", Frontiers of Entrepreneurship Research Journal, Vol. 28 No. 4, pp. 1-15.

Hsu, S., Wang, Y., Chen, Y. and Dahlgaard, S.M. (2014), "Building business excellence through psychological capital", *Total Quality Management and Business Excellence*, Vol. 25 No. 11, pp. 1210-1233

Jakopec, A., Miljković Krečar, I., & Sušanj, Z. (2013), "Predictors of entrepreneurial intentions of students of economics", *Studia Psychologica*, Vol. 55 No. 4, pp. 289-297

Jensen, S. M., & Luthans, F. (2002). The impact of hope in the entrepreneurial process: Exploratory research findings. Decision Sciences Institute Conference Proceedings, San Diego, CA

Järlström, M., Brandt, T. & Rajala, A. (2020), "The relationship between career capital and career success among Finnish knowledge workers", *Baltic Journal of Management,* Vol. 15 No. (5), pp*.* 687-706*.*

Järlström, M. & Brandt, T. (2017), "Psychological capital and psychological career mobility among Finnish business school graduates", *Journal of Finnish Studies*, Vol. 20 No. 2, pp.144-170.

Kangarlouei, S.J., Shadkami, N. and Motavassel, M. (2012), "The impact of intellectual capital, social capital and psychological capital on competitive advantage of vehicle industries in Tehran stock exchange (TSE)", *International Journal of Academic Research in Business and Social Sciences*, Vol. 2 No. 1, pp. 559-566.

Karatepe, O. and Karadas, G. (2015), "Do psychological capital and work engagement foster frontline employees' satisfaction?: A study in the hotel industry", *International Journal of Contemporary Hospitality Management*, Vol. 27 No. 6, pp. 1254–1278.

Karabey, C.N. (2012). Understanding entrepreneurial cognition through thinking style, entrepreneurial alertness and risk preference: do entrepreneurs differ from others?" Procedia – Social and Behavioral Sciences: 8th International Strategic Management Conference, Vol. 58, pp. 861-870.

King, R.B., McInerney, D.M., & Watkins, D.A. (2012). Competitiveness is not that bad…at least in the East: Testing the hierarchical model of achievement motivation in the Asian setting. *International Journal of Intercultural Relations*, Vol. 36 No. 3, pp. 446-457.

Kim-Soon, N., Ahmad, A. R., Saberi, A. Z. M., & Tat, H. H. (2013), "Discriminate analyses of motivators and obstacles on youth entrepreneurial intention", *Asian Social Science*, Vol. 9 No. 17, pp. 53-57.

Krishnan, B.C., Netemeyer, R.G. & Boles, J.S. (2002). "Self-efficacy, competitiveness and efforts as antecedents of salesperson performance", *Journal of Personal Selling & Sales Management*, Vol. 22 No. 4, pp. 285-295.

Kyrö, P. & Tapani, A. (2007). Learning risk-taking competences", In: Fayolle, A. (eds.). Handbook of Research in Entrepreneurship Education, Great Britain: MPG Books Ltd.

Laguna, M. (2006), "Hope, optimism entrepreneurial intention", *Przeglad Psychologiczny,* Vol. 49, No. 4, pp. 419–443.

Lingfei, W. and Li, J. (2011), "Perceived value of entrepreneurship: a study of the cognitive process of entrepreneurial career decision", *Journal of Chinese Entrepreneurship*, Vol. 3 No. 2, pp. 134-146.

Luthans, F., Avey, J.B., Avolio, B.J., Norman, S. and Combs, G. (2006), "Psychological capital development: Toward a micro-intervention", *Journal of Organizational Behavior*, Vol. 27, pp. 387–393.

Luthans, F., Avey, J.B., Avolio, B.J. and Peterson, S. (2010), "The development and resulting performance impact of positive psychological capital", *Human Resource Development Quarterly*, Vol. 21 No. 1, pp. 41–67.

Luthans, F., Avolio, B.J., Walumbwa, F.O. and Li, W. (2005), "The psychology capital of Chinese workers: Exploring the relationship with performance", *Management and Organization Review*, Vol. 1, pp. 249–271.

Luthans, F., Avolio, B.J., Avey, J. and Norman, S. (2007), "Positive psychological capital: measurement and relationship with performance and satisfaction", *Personnel Psychology*, Vol. 60 No. 3, pp. 541–572.

Luthans, F., Avey, J. and Patera, J. (2008), "Experimental Analysis of a Web-Based Training Intervention to Develop Positive Psychological Capital", *Management Department Faculty Publications*, Vol. 135.

Lumpkin, G.T., & Dess, G.G. (1996), "Clarifying the entrepreneurial orientation construct and linking it to performance", *Academy of Management Review*, Vol. 21 No. 1, pp. 135–172.

Matchaba-Hove, T. Farrington, S. & Sharp, G. (2015), "The entrepreneurial orientation – Performance relationship: A South African small business perspective", *The Southern African Journal of Entrepreneurship and Small Business Management*, Vol. 7 No. 1, pp. 36-68.

Pekkala Kerr, S., Kerr, W.R., & Dalton, M. (2019), "Risk attitudes and personality traits of entrepreneurs and venture team members", *PNAS,* Vol. 116, No. 36, pp. 17712-17716.

Peterson, S., Luthans, F., Avolio, B., Walumbwa, F. and Zhang, Z. (2011), "Psychological capital and employee performance: A latent growth modeling approach", *Personnel Psychology*, Vol. 64, pp. 427–450.

Robledo, J., Sanchez, V., Arán, M. and Molina, M. (2015), "The moderating role of gender on entrepreneurial intentions: a TPB perspective", *Intangible Capital Journal*, Vol. 11 No. 1, pp. 92-117

Rotefoss, B., & Kolvereid, L. (2005), "Aspiring, nascent and fledging entrepreneurs: an investigation of the business start-up process", *Entrepreneurship & Regional Development*, Vol. 17, pp. 109-127.

Russo, S. & Stoykova P. (2015) "Psychological capital intervention (PCI): a replication and extension", *Human Resource Development Quarterly*, Vol 26 No 3, pp 329-347.

Saeid, K., Harm, B., Thomas, L., Zahra, A., Mohammad, C. and Martin, M. (2011), "Application of structural equation modelling to assess the effect of entrepreneurial characteristics on students' entrepreneurial intention", paper presented at the 6th European Conference on Entrepreneurship and Innovation, Robert Gordon University, Aberdeen, pp. 954-967.

Sitkin, S.B. & Pablo, A.L.(1992), "Reconceptualizating the determinants of risk behaviour", *Academy of Management Review*, Vol. 17 No. 1, pp. 9-38.

Stewart, W.H., Watson, W.E., Carland, J.C., & Carland, J.W. (1999), "A proclivity for entrepreneurship: A comparison of entrepreneurs, small business owners, and corporate managers", *Journal of Small Business Venturing*, Vol. 14, pp. 189-214

Wang, G., & Netemeyer, R. G. (2002), "The effects of job autonomy, customer demandingness, and trait competitiveness on sales person learning, self-efficacy, and performance", *Academy of Marketing Science*, Vol. 30 No. 3, pp. 217-228.

Wang, X., Zheng, Q. and Cao, X. (2014), "Psychological capital: a new perspective for psychological health education management of public schools*", Journal of Public Personnel Management*, Vol. 43 No. 3, pp. 371-383.

Wernsing, T. (2014), "Psychological capital: a test of measurement invariance across 12 national cultures", *Journal of Leadership and Organisational Studies*, Vol. 21 No. 2, pp. 179-190.

Zhang, P., Wang, D. D., & Owen, C. L. (2015), "A study of entrepreneurial intention of university students", *Entrepreneurship Research Journal*, Vol. 5 No. 1, pp. 61-82.

Zhao, H., Seibert, S. E., & Hills, G. E. (2005), "The mediating role of self-efficacy in the development of entrepreneurial intentions", *Journal of Applied Psychology*, Vol. 90 No. 6, pp. 1265-1272.

Youssef, C.M. and Luthans, F. (2010), An Integrated Model of Psychological Capital in the Workplace, Oxford University Press, Inc., New York, NY

Insights on Creative Networks: A Social Network Analysis of Five Arts Organisations

Fraser Bruce, Shaleph O'Neill and Sharifa Hawari-Latter
University of Dundee, UK
f.s.bruce@dundee.ac.uk
s.j.oneill@dundee.ac.uk
s.latter@dundee.ac.uk

Abstract: Many arts organisations can generate large amounts of value through their activities and networks, but often find it difficult to gather, analyse and evidence the data that can inform business decisions and leverage opportunities for product and service innovation. Compared to larger corporations, the creative ecosystem in which they operate depends on "quick business" and requires them to be more agile, adaptive and faster when identifying hidden potential within their networks. Moreover, their interdisciplinary and collaborative ways of working create emerging opportunities for spin-off companies and other entrepreneurial ventures. This study (part of the Arts API Project) aimed to examine the networks of arts organisations to understand some of their defining features and characteristics. The project aimed to show that by visualising and analysing relational data, it was envisioned that arts organisations would be able to operate on a more evidence-based, commercial and entrepreneurial basis, enabling better informed decision making and more defined business strategies. This paper focuses on the role and value of big data in the Arts and Humanities, provides the context and background to the Arts API Project and outlines the methodological approach, presenting one particular aspect of the larger research project. Adopting the technique of Social Network Analysis (SNA), the networks of five UK-based art organisations were visually mapped and analysed using measures such as Density, Connectivity, Centralization and Clique Participation Index. Within the limitations of the study, the findings reveal valuable insights on the effect of de/centralisation of information flow within creative networks, the importance of maintaining a balance between weak and strong network ties and mitigating risk by distributing responsibility across networks.

Keywords: big data, creativity, relationships, value, network structures, innovation

1. Big Data in the arts and humanities

In 2006 when Clive Humby, the inventor of the Tesco Loyalty Card, announced that "data was the new oil", there were very few people that recognised the value of data in the creative and cultural sector. Fast forward to the 2020's and we are arguably amid a new economy, an economy that is driven by understanding and using "big data". De Mauro, Greco and Grimaldi (2015) usefully point out that:

> *"Big Data represents the Information assets characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value" (p. 103).*

Some people claim that the use of data within the arts and humanities is only "in its embryonic state" as they have traditionally not engaged in collecting data to inform their business strategy to the same extent as other sectors (Lilley and Moore 2013; Schiuma and Carlucci 2018). Moore (2016) elaborates on the reasons behind the slow uptake compared to other sectors, pointing out that arts organisations find it difficult to drive forward their business according to traditional Key Performance Indicators (KPI) and that technology might be perceived as not making desired contributions in a creative and cultural context. Others, however, claim the arts are now leading the way in reimagining the human relationships with data (Scott 2019). The reality is something in-between. Indeed, there are areas of the cultural sector which are leading the way in using data, but there are others that drastically need updating. It is in this complex web that a vast array of practices that an answer or several answers will likely emerge. As with all forms of interpretation, the understanding we draw from data will depend on the methods, practices, processes, and techniques we use. Writing from a digital transformations perspective, Prescott (2015) suggests, in the prompting of creative endeavours within the arts and humanities, that "among the many important contributions they can make is a strong awareness of the significance and cultural contexts of design and visualisation, a profound sense of the way in which data is culturally and socially situated, an awareness that data is never 'raw', and an ability to move between macro and micro perspectives". It is therefore pragmatic that this paper focuses on the different uses of digital tools and methods and their appropriateness in the Arts and Humanities, particularly in the context of how arts and other cultural organisations can identify and use data to demonstrate impact and drive decision making inside their businesses. Indeed, arts organisations are unique in the way in which they operate, relying heavily upon the informal and formal networks they create and sustain (Bruce, Malcolm and O'Neill 2017). This is largely a result of the

precarious employment, and reliance on external funding, which is prevalent in the sector therefore impacting on long-term business commitments (Opara et al, 2019). Understanding their own data and the value it offers can enable them to discover the hidden potential that lies within their network and allow them to leverage opportunities for product and service innovation. Compared to larger corporations, the creative ecosystem in which they operate depends on "quick business" and requires them to be more agile, adaptive, and faster when identifying and responding to arising opportunities within their networks (Opara et al, 2019). Moreover, their interdisciplinary, inclusive, and collaborative ways of working create emerging opportunities for spin-off companies and other entrepreneurial ventures, which can be better exploited through the analysis of network relationships (Bruce, Malcolm and O'Neill 2017). Therefore, more studies are clearly needed to understand how data can be used to create added value, which in turn helps arts organisations align and strengthen their core competencies and improve their interactions with stakeholders (Pesce et al, 2019). It is this knowledge gap that was the catalyst for this research study. In 2013, recognising the importance of understanding data to create value in the cultural sector, a £7 million fund from Arts Council England, the Arts and Humanities Research Council and Nesta was launched to support collaboration between arts projects, technology providers and researchers to explore the potential of innovating new business models and services around data. The Arts API project was a year-long project led by FutureEverything (lead arts organisation), University of Dundee (academic partner) and Swirrl (technology partner), made possible through the Digital R&D Fund for the Arts. Many arts organisations can generate large amounts of data through their activities and networks. The wider aim of the Arts API project was to develop a web-based analytical tool that would allow arts organisations to make more sense of a variety of data sources (such as email or social media) relating to their business activities and networks (Bruce, Malcolm and O'Neill 2017). In doing so, it would enable organisations to improve their decision-making and subsequently increase productivity and innovation potential. Applying the technique of Social Network Analysis (SNA), data was gathered and analysed from across five UK arts organisations to 'model' their existing network structures to inform the development of the Arts API tool. Creating a blueprint and automating certain aspects of SNA processes (a tailored version of SNA) the tool would allow the organisations to filter the data in specific and targeted ways, categorise, recognise and add value to their business endeavours. This paper presents one aspect of the larger research project, which focuses on the analysis of the network measures and what they can reveal in terms of innovation activity of an arts organisation.

2. Social networks analysis and creative networks

In the past two decades, the growth of social media along with the widespread adoption of social networking platforms like Instagram, Facebook, Twitter and LinkedIn have transformed the way in which people communicate, interact, and build personal and professional relationships online (Scott 2017; Yang, Keller and Zheng 2017). These platforms have, to some extent, become an integral part of everyday life, helping people connect, share and use knowledge and information online. In sociology, however, the analytical use of social networks can facilitate a much broader contribution around all kinds of network relationships, anything from geopolitical environments and countering terrorism (Choudhary and Singh 2015), to measuring health and infectious diseases (Nagarajan, Muniyandi, Palani and Sellappan 2020). Acknowledging the many conceptual-theoretical explanations of Social Network Analysis (SNA), Professor of Sociology, John Scott, offers the following definition (Scott 2012):

> *"Social network analysis is a collection of concepts, measures, and techniques for relational analysis. It is an approach that is specifically designed to grasp the most important features of social structures and it is unrivalled in this task. It can be used to explore social relations themselves and also the cultural structures of norms and ideas that help to organise those relations in conjunction with material circumstances" (p. 85).*

SNA can therefore be used to make sense of relational data that connects people within a distributed network by capturing a visual representation of social structures (e.g., status, roles, groups, and institutions) across micro, meso and macro levels, as well as deriving insights through deeper quantitative analysis (Bruce, Malcolm and O'Neill 2017). Borgatti, Everett and Johnson (2018) usefully point out that "a generic hypothesis of network theory is that an actor's position in a network determines in part the constraints and opportunities that he or she will encounter, and therefore identifying that position is important for predicting actor outcomes such as performance, behaviour or beliefs" (p. 1). Furthermore, understanding the connections within and across the extended boundaries of a network, especially in terms of recognising weak and strong ties, can either facilitate or impede problem solving, decision making and innovation performance (Bruce & Baxter 2008). Arts organisations in particular, rely heavily on the creativity and characteristics of individuals as well as their ability to establish and sustain positive working relationships via networks to identify and generate new business

opportunities (Kim et al, 2016). However, Gaggioli et al (2013) usefully point out that creativity "is never the result of [an] individual acting alone" (p. 2) and that all individuals are influenced by the social landscapes in which they operate (Csikszentmihalyi 1999). Research has also shown that "creativity as a social process is premised on the idea that exposure and interaction with others stimulates the generation of new ideas" (Perry-Smith & Mannucci, 2015 p. 8) and therefore Social Network Analysis can be a useful tool in identifying the structure and patterns of relationships within a network to understand creative endeavours. Further research on social networks and creativity has revealed that "weak ties enhance creativity when information recipients are highly open to experience, have more domain knowledge, have an innovative style, and are intrinsically motivated" (Kim et al, 2016, pp. 285). So, the fluidity of arts organisation networks can contribute to the creative process, through idea generation, project development and delivery, and reflexivity through the evaluation of their activity. The flow of information facilitates communication within these networks, and it is useful to know how the 'flow' operates.

3. Data gathering

The overarching goal of the wider 1-year research project was to explore the creative networks of arts organisations to help inform the development and testing of the Arts API tool. Within that 1-year project the research team spent 6 months understanding the value in the inter- and intra-organisational relationships that exist within their networks, both formally and informally, resulting from their daily business operations. Due to the high-risk nature of the R&D project, the arts organisations were pre-selected by the lead project partner, FutureEverything, as there was already a high level of trust and well-established working relationships. In addition, the project aimed to further enhance these relationships through the development of the Arts API Tool. Adopting the technique of SNA, the internal and external networks of five UK-based arts organisations were visually mapped and analysed over the same 4-week period, using a modified version of Cross and Parker (2004) six-step process, as outlined in detail in a previous paper by Bruce, Malcolm and O'Neill (2017):

- 1. establishing the objectives of the analysis – through a detailed review of the literature the different components of a creative ecosystem were established, for example, information exchange, sharing ideas, and the creative process.
- 2. administering the online survey/questionnaire in the form of a modified Lickert Scale for data collection based on these key components.
- 3. organising and processing the data into numerical values, exported as Excel data (.csv) to import directly into SNA software package (Cyram NetMiner) to create visualisations of the network maps.
- 4. analysing data gathered through network measures, such as, density, centralisation, and Clique Participation (see below).
- 5. formulating findings and insights to establish key features (or ontology) of the Arts API tool; and
- 6. reflecting on the process and preparing to present findings back to project partners.

For this paper specifically, four key questions from the online survey were used to explore the data and draw cross comparisons across the five arts organisations:

- 1. Who do you regularly engage with professionally outside of any particular project? For example, in ongoing or strategic activity? (Mapped as Professional Engagement Network)
- 2. Who would you most likely engage with when initiating and generating new ideas for business opportunities?
- 3. Who do you actively collaborate with in the delivery of a project or activity? (Mapped as Collaboration & Project Delivery Network)
- 4. Who would you most likely engage with in the evaluation of project outcomes, impacts and benefits?

For the purposes of this paper, only a sample of the data gathered is presented below (Questions 1 and 3). However, key findings from all the questions are considered in the evaluation and analysis of the data when drawing comparisons across all arts organisations studied.

The following SNA measures used to inform both the arts partners and the development of the Arts API tool are briefly outlined below:

- **Density** is a measure that determines the degree of connectedness among nodes within a network. It is defined by the number of direct connections a node has, expressed as a percentage of the maximum possible (Kilduff and Tsai 2003). It provides insights into the network potential that could exist, if new connections are established among nodes (in this paper, "nodes" are used synonymously with the term "actors"). Networks with high density can exchange information much more quickly than low-density networks (Bruce, Malcolm and O'Neill 2017). Density is also highly correlated with Degree Centrality and Connectivity.
- **Connectivity** is a measure of the minimum number of nodes which would need to be removed to disconnect a network. Connectivity therefore provides insights into the vulnerability of a network if nodes in a network are removed. A highly connected network will generally have a high-density score and low levels of vulnerability. In contrast, a network with weak connections will have a higher level of vulnerability.
- **Centralization Index** is a measure of how central nodes are within a network. It is a percentage measure of how similar a network is to the Star Network (i.e., a network where all other nodes in the network are only connected to one central node and no other. Thus, for all nodes to reach other nodes in the network, information exchange must be passed through the central node. The central node is the most powerful node in the network and acts as the gate keeper of all communication and information exchange. Highly centralised networks have high Centralization Index scores, as they are more like Star networks, with one or two highly powerful central nodes controlling information flow.
- **Clique Participation Index (CPI)** is a measure of to what extent the nodes of a network are involved in sub-groups (cliques) within a network. It is calculated by firstly establishing the number of cliques within a network as well as the number of participant nodes in each clique. The number of nodes in each clique is then added together and divided by the number of actual nodes in the network. High CPI identifies high participation by nodes within subgroups (i.e., lots of nodes actively engaging and connecting with each other from group to group). Recent studies have identified a link between high CPI and high social presence within a network. This has also been correlated with a move towards the optimal experience of networked 'flow' and thus an impulse towards originality and creativity in group performance. So, high CPI scores can be viewed as an indicator of how well a group might perform creatively in a particular context.

In sum, the SNA software package provided both visual and mathematical analysis of all network maps across the 5 arts organisations to be performed. This allowed the research team to identify ways of structuring the data in standard formats based on the classifications of Impact Indicators and Innovation Drivers developed through SNA research, which in turn was then used to inform the development of the tool as well as further analysis on innovation potential inside the organisations.

4. Drawing comparisons and generating insights

Applying SNA measures of Density, Connectivity, Centralization Index and Clique Participation Index (CPI), comparisons of network scores were observed across all five arts organisations and insights generated about the wider arts sector. Table 1 shows the results of the SNA measures generated for (Q1): *Who do you regularly engage with professionally outside of any particular project?* Figures 1-2 show Connectivity and CPI measured in relation to Density. Density was used as a baseline measure to allow the data to be organised in a useful and logical way across the arts organisations. It is clear to see that Organisation 1 has the lowest Density score (0.012), whereas Organisation 5 has the highest density score (0.044). This is because Organisation 1 has a much larger, more distributed network than Organisation 5. The high Centralisation score of Organisation 5 is therefore a function of its smaller size. Interestingly, the density scores for the networks of all the arts organisations are particularly low, indicating the type of networks they create and sustain are loosely connected through many pedant nodes lying on the periphery. In other words, the networks are characterised by a densely connected core group of people that work for the organisations, some of whom are broadly connected to multiple external nodes by weak ties. What is also noteworthy is that as Density increases linearly so does Centralization. The findings are not surprising as they reflect the way in which arts organisations generally operate with a small core team engaging with a larger network of peripheral freelancers, temporary project partners or service providers. Due to prevalent funding structures and project-based activities of arts organisations, they are required to be flexible and adaptive to change to grow, develop and innovate. While this small core team act as gatekeepers or brokers, generating connectivity and information exchange across the network, business opportunities can possibly be lost or unexploited, if already well-established peripheral connections are not continually nurtured and developed.

In Figure 1, the step change in Connectivity indicates that it is not highly correlated with Density, even though the trend suggests otherwise. The network scores for all the organisations are relatively low. Scores close to 1 indicate that it will only take the removal of one or two highly central nodes to disconnect the network, thus exposing how vulnerable all the arts organisations are should they lose key individuals. As discussed above, relying solely on a core group of people also suggests that innovation potential can be limited or even lost if any unforeseen changes in the network occur.

Table 1: SNA measures – Professional Engagement Network (PEN)

Professional Engagement	Density	Centralization	Connectivity	CPI
Organisation 1	0.012	0.181	0.843	0.427
Organisation 2	0.020	0.242	1.120	0.512
Organisation 3	0.022	0.328	1.082	0.510
Organisation 4	0.038	0.374	1.387	1.583
Organisation 5	0.044	0.483	1.253	1.047

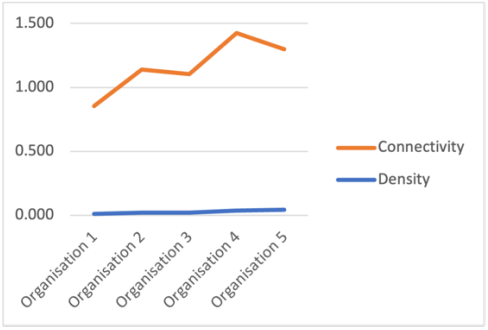


Figure 1: Density and Connectivity – (PEN)

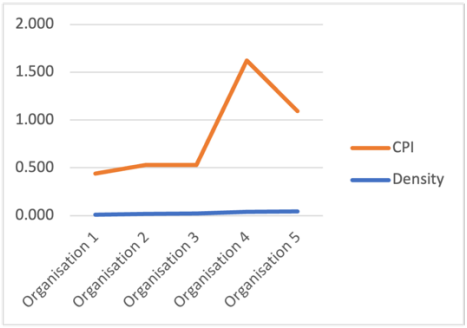


Figure 2: Density and CPI – (PEN)

Organisation 4 has high Connectivity and High Centralization scores compared to all the other art organisations studied (Table 1). Organisations 1, 2 & 3 all exhibit lower levels of CPI within their networks (Figure 2). Organisation 5 has a moderately high CPI score in relation to higher Centralisation and Connectivity scores. Indeed, these scores highlight something uniquely different in the way in which Organisation 4 creates and sustains its professional engagement network, in comparison to the other organisations. For instance, its network contains a very high number of overlapping cliques (sub-groups) that contain a range of both internal and external stakeholders. Most of the cliques appear to be internal sub teams within the organisation but there are several cliques where external stakeholders play a significant role when engaging in project activity. In addition, many of the nodes are involved in multiple cliques. This is highly significant in terms of developing open channels of communication, where attaining optimal flow within the network and ultimately the creative endeavour of the organisation is paramount. Organisations 1, 2 & 3 have very few cliques beyond the internal organisational structure while Organisation 5's higher score reflects its relationship with several key external nodes that are clearly involved in the professional strategic activities of the organisation. Overlapping cliques tend to be quite powerful within a network as they promote knowledge exchange and provide a good foundation

for innovation activity to occur. However, if innovation is complex and requires sharing of tacit knowledge, arts organisations might need to think more carefully about how they integrate and foster multiplex relationships.

Table 2 shows the results of the SNA measures for (Q3): *Who do you actively collaborate with in the delivery of a project or activity?* Figures 3-4 show the Connectivity and CPI scores measured in relation to Density.

To gain additional insights into the day-to-day working of arts organisations, it was important to consider levels of network collaboration around the delivery of projects. It was found that the networks generated were much smaller and more focused when compared to professional engagement activities, resulting in a slight increase across all network scores.

Looking at Centralization, similar patterns to the Idea Generation Network were observed. Scores were around similar lower levels (between 35% and 45%), except for Organisation 2 (65%). Again, this suggests that Organisation 2 has a highly centralised network for both collaboration around project delivery and idea generation activities (to be discussed at a later stage).

Table 2: SNA measures – Collaboration & Project Delivery (C&PD)

Collaboration & Delivery of Projects	Density	Centralization	Connectivity	CPI
Organisation 1	0.050	0.352	1.234	0.860
Organisation 2	0.076	0.652	1.508	0.529
Organisation 3	0.031	0.465	1.096	0.450
Organisation 4	0.053	0.414	1.552	1.458
Organisation 5	0.036	0.434	1.11	0.818

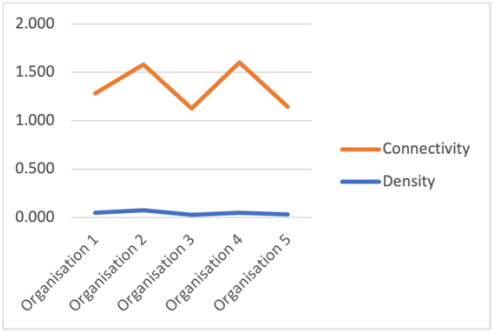


Figure 3: Density and Connectivity – (C&PD)

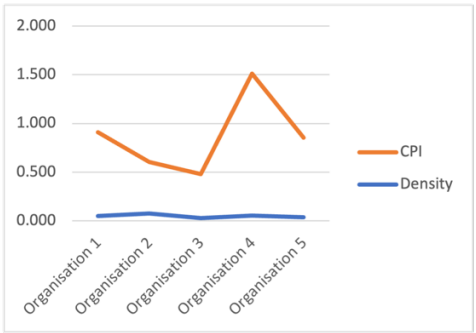


Figure 4: Density and CPI – (C&PD)

Several important insights can be derived in relation to Connectivity (Figure 3). Organisation 4 has the highest Connectivity score, which is closely followed by Organisation 2. As such, it appears that as the Density of a network increases so does Connectivity. Organisations 2 and 4 both are relatively densely connected compared to the other organisations. When comparing CPI scores, Organisation 2 has the densest and most centralized collaborative network but one of the lowest CPI scores (Figure 4). This is particularly interesting when compared

to Organisation 4 which has the highest CPI score, second densest, and the most well connected, collaborative network. Like previous networks, centrality appears to be play an important role in relation to CPI. For instance, Organisation 4 has a relatively low Centralization score compared to Organisation 2 and this points towards an inverse relationship between high Centralization scores and low CPI scores. As mentioned above, the importance of overlapping cliques is paramount for innovation, therefore a high Centralisation score and low clique participation might suggest that Organisation 2 is at a slight disadvantage in the long term and needs to consider reorganising and redesigning their organisational structure. By making sure that information, ideation and entrepreneurial thinking can spread across the whole organisation in a robust and flexible way, Organisation 2 can ensure a more agile and responsive approach in fostering innovation.

It was important to examine idea generation because of its significance within the innovation process. Analysing the network maps for Q2: *Who would you most likely go to in order to brainstorm and generate ideas?* it became clear that Density, Centralization and Connectivity of all networks increased as they became more focused on particular topics. It was also found that four of the organisations had very similar levels of Centralization. However, notably Organisation 2 had a significantly higher score (68%) suggesting that a few influential nodes (or central connectors) might be affecting the organisations' ability to operate in either positive or negative ways (Cross and Parker, 2004). Again, this is a similar finding to previous network maps analysed in relation to Organisation 2, where the centralised organisational structure is putting the organisation at a potential risk of not being able to innovate and exploit new business opportunities. According to Kilduff and Tsai (2003) "organisations with highly centralised information networks may tend to be more mechanistic in their functioning, whereas organisations with multiple centres may be more organic" (p. 32). In addition, CPI scores reveal something interesting in relation to Idea Generation. Organisations 4 and 5 have relatively high CPI scores, but not as high as their Professional Engagement network. Organisation 1 has the highest (around 1.1) indicating that it has a relatively high occurrence of clique participation compared to the other organisations. Overall, there appears to be a trend that when Density and Connectivity are high, CPI may also be high. However, this is not necessary the case for organisations that are highly centralized like Organisation 2, as optimal flow and creativity are dependent on the free flow of information and collaboration between nodes in the development of cross-fertilizing clique participation. Taking a closer look at Q4: *Who would you most likely engage with in the evaluation of project outcomes, impacts and benefits?*, an inverse relationship between increasing Density and decreasing Centralization was observed. This meant that there were more dispersed connections within the network displaying flatter hierarchical structures. Likewise, similar trends were noted in clique participation where all organisations had high scores with the exception of Organisation 2, again highlighting the lack of overlapping cliques. This suggests that the highly centralised structure of Organisation 2 is likely to prevent it from performing effective and collaborative evaluations of project outcomes, impacts and benefits, which subsequently could have a negative effect on the learning and development of the organisation, although further analysis needs to be undertaken.

5. Discussion and conclusion

This research has created some interesting findings in terms of the network characteristics that drive arts organisations' business activities and innovation potential. All the arts organisations examined are characterised by extended networks that have notably low-Density, and Connectivity compared to organisations in different sectors. A major finding of this research is that the networks created and sustained by arts organisations are uniquely vulnerable. In other words, key nodes in arts organisations play bridging roles (also known as boundary spanners) across a range of domains that are not interconnected to other organisational employees (Marrone 2010; Birkinshaw, Ambos, and Bouquet 2017). In cases of such vulnerability, the loss of any key member of staff (i.e., resignation or sickness) would likely result in the loss of connections to a significant number of nodes within and across the network, resulting in missed business opportunities and lower innovation capabilities. This observation is, in part, a result of the nature of the restricted investigation. A decision was made to investigate the wider context in which arts organisations exist (i.e., their lifeblood in terms of business performance), as well as concentrating on the internal dynamics of organisational structures, which would be naturally much denser and more robust due to their smaller size. The size and complexity of these networks beyond the internal organisation meant that it was unmanageable to administer the survey and questionnaire to all nodes identified in the network. Thus, a deeper exploration of the internal structure of organisations (reciprocal relationships) as well as employees' outgoing connections were captured. However, the incoming connections of the external networks were limited in this study. No doubt these circumstances have affected the results, but the overarching goal was to inform the development of the Art API tool. In addition, the data gathered only covered a short

timescale, as to ask participants to enter all their professional contacts and partners would take a considerable amount of time and make the survey unwieldy. As such, participants were asked to enter contacts they had made connections with over the period of one month. As a result of this limited timescale, it meant that this study would be limited across time and space. Nonetheless, another interesting finding that emerged through the investigation was the relationship between Centralization Index measures and CPI measures. The data revealed a possible link between increasing Centralization and decreasing CPI. It makes sense that organisations which are decentralised, highly connected and uninhibited from hierarchical power structures, are the ones capable of forming numerous collaborative sub-groups with both internal and external stakeholders, which fosters innovation activity. These organisations can therefore reach optimal flow and potentially higher levels of creativity exhibited by higher CPI scores. This concurs with earlier work by Mazzoni (2014) where CPI is a strong indicator of collective creativity. Indeed, Organisations 1 and 4 exhibited such network characteristics and to a degree provide a business model for other arts organisations to consider in terms of future design and development. Hence, all art organisations should consider ways in which they can strengthen connectivity within their networks to increase robustness and improve resilience. This helps to overcome vulnerability with the loss of key staff in the workplace, as this more than Centralization, is potentially the greatest threat to their longevity. Undoubtedly, extending the length of the study to examine the network activity of the arts organisation on an on-going basis would allow the highs and lows in business activity to be explored, enabling organisations to recognise pressures and opportunities in real time and adapt current business models accordingly. The following key learning insights can be derived from this research:

- Arts and cultural organisations need to be agile and flexible in the way in which they operate to tap into ad hoc business opportunities, funding sources and foster innovation activity. This study suggests that this can be best achieved by decentralising network structures and nurturing collaborative environments, which in turn result in overlapping cliques of both internal and external project partners and other relevant stakeholders.
- Similarly, arts organisations need to perpetually improve creative output to sustain their daily business activities. Therefore, they require optimal information flow within their network, which, as data suggests, can also be best achieved through decentralised clique participation.
- Arts organisations generally find it difficult to scale up, which leaves them in a constant state of vulnerability. They should consider mitigating this risk by strengthening connections that already exist in their network and distributing key business responsibilities across their employees to eliminate single point of failure across the organisation.
- Arts organisations need to constantly navigate the predicament of maintaining many "shallow" but robust relationships in order maximise awareness of new business opportunities, however, these weak network connections may result in missed opportunities to learn, grow and innovate.

The findings of this research have helped develop the Arts API web-based tool as a proof of concept. It enabled the research team to examine networks and hidden value in email data across several arts organisations. With further time and funding, the following should be considered:

- Extending the length of the study to examine the network activity of the arts organisation on an on-going basis. This would allow the organisations to explore the highs and lows in business activity, enabling them to recognise pressures and opportunities to adapt current business models accordingly.
- Expanding the SNA capabilities of the Arts API tool by incorporating other network measures like Connectivity and Clique Participation Index as reported in this paper.
- Developing a more interactive and customisable user interface for the Arts API tool to allow deeper manipulation of the data. Ideally moving to more real time manipulation and filtering of sectors.
- Broadening the capabilities of the tool to enable engagement with other sectors beyond the arts (e.g., design, new venture creation and innovation management). The tool has unlimited potential to enable the modelling of organisational networks in these sectors as well as the Arts.

Further research is currently being undertaken and will be presented in future publications.

References

Birkinshaw, J., Ambos, T-C. and Bouquet, C. (2017) "Boundary Spanning Activities of Corporate HQ Executives Insights from a Longitudinal Study", *Journal of Management Studies*, Vol 54, No. 4, pp. 422-454.

Borgatti, S-P., Everett, M-G. and Johnson, J-C. (2018) *Analyzing Social Networks.* Sage Publications Ltd, London.

Bruce, F-S. and Baxter, S-H. (2008) "Making Connections: The Importance of Human Relationships in Innovative Practice", In H. Koller, C. Herstatt and T, Teichert. (eds), *15th EIASM International Product Development Management Conference,* Hamburg, Germany, Vol. 2008. (ISSN 1998-7374), pp 1 (18)-20. Brussels: EIASM.

Bruce, F-S., Malcolm, J-S. and O'Neill, S. (2017) "Big Data: Understanding how Creative Organisations Create and Sustain their Networks", *The Design Journal,* Vol 20, No. 1, pp 435-S44.

Cross, R. and Parker, A. (2004) *The Hidden Power of Social Networks: Understanding How Work Really Gets Done in Organisations.* Harvard Business School Press, Boston, Massachusetts.

Carnwath, J-D. and Brown, A-S. (2014) *Understanding the Value and Impacts of Cultural Experiences.* Arts Council England, Manchester, UK.

Choudhary, P. and Singh, C. (2015) "A Survey on Social Network Analysis for Counter Terrorism", *International Journal of Computer Applications*, Vol 112, No. 9, pp 24-29.

Csikszentmihayi, M. (1999) *Creativity: Flow and the Psychology of Discovery and Invention.* HarperCollins, New York.

De Mauro, A., Greco, M. and Grimaldi, M. (2015) "What is Big Data? A Consensual Definition and a Review of Key Research Topics", Proceedings of the 4th International Conference on Integrated Information, Madrid, Spain, AIP Conf Proc, 1644, 97–104.

Gaggioli, A., Riva, G., Milani, L. and Mazzoni, E. (2013) *Networked Flow: Towards an Understanding of Creative Networks.* Springer, New York.

Kilduff, M. and Tsai, W. (2003) *Social Networks and Organisations.* Sage Publications, London.

Kim, S-K., Shin, J- S., Shin, J., and Miller, D-R. (2016) "Social Networks and Individual Creativity: The Role of Individual Differences", *The Journal of Creative Behavior*, Vol 52, No. 4, pp. 285-296.

Lilley, A. and Moore, P. (2013) "Counting What Counts: What Big Data can do for the Cultural Sector", [online], Nesta, https://www.nesta.org.uk/report/counting-what-counts-what-big-data-can-do-for-the-cultural-sector/

Marrone, J. A. (2010) "Team boundary spanning: a multilevel review of past research and proposals for the future", *Journal of Management,* Vol 36, No. 4, pp. 911–940.

Mazzoni, E. (2014) "The Cliques Participation Index (CPI) as an Indicator of Creativity in Online Collaborative Groups", *Journal of Cognitive Education and Psychology*, Vol 13, No. 1, pp. 32-52.

Nagarajan, K., Muniyandi, M., Palani, B. and Sellappan, S. (2020) "Social Network Analysis Methods for Exploring SARS-CoV-2 Contact Tracing Data", *BMC Medical Research Methodology,* Vol 20, No. 233.

Moore, P. (2016) "Big Data and Structural Organisation in Major Arts Bodies: An Evolving Ethnographic Method", *Cultural Trends*, Vol 25, No. 2, pp. 104-115.

Opara, S-C., Stanton, P. and Wahed, W. (2019) "For love or money: human resource management in the performing arts", *Employee Relations*, Vol. 41, No. 6, pp. 1451-1466.

Perry-Smith, J-E. and Mannucci, P-V. (2015) "Social Networks, Creativity, and Entrepreneurship", In Shalley, C-

Pesce, D., Neirotti, P. and Paolucci, E. (2019) "When Culture Meets Digital Platforms: Value Creation and Stakeholders' Alignment in Big Data Use", *Current Issues in Tourism*, Vol 22, No. 15, pp. 1883-1903.

Prescott, A. (2015) "Big Data in the Arts and Humanities: Some Arts and Humanities Research Council Projects", [Online], University of Glasgow, Glasgow Emblem Studies, https://digitransglasgow.github.io/BigDataBooklet/contributions/01_Introduction.html

Schiuma, G. and Carlucci, D. (2018) *Big Data in the Arts and Humanities: Theory and Practice (Data Analytics Applications).* CRC Press, Florida, USA.

Scott, D. (2019) *Reimagining and Performing Data.* Diane G Scott, UK.

Scott, J. (2012) *What is Social Network Analysis?* Bloomsbury Academic, London UK.

Scott, J. (2017) *Social Networks Analysis.* Sage Publications Ltd, London, UK.

Shalley, C-E., Hitt, M-A. and Zhou, J. (Eds.) *The Oxford Handbook of Creativity, Innovation, and Entrepreneurship,* Oxford University Press, New York.

Yang, S., Keller, F-B. and Zheng, L. (2017) *Social Network Analysis: Methods and Examples.* Sage Publications Ltd, London, UK.

Conceptualising Digital Entrepreneurship: Artifacts, Platforms and Infrastructures

Anthony Paul Buckley[1] and Kisito Futonge Nzembayie[2]
[1]TU Dublin, Ireland
[2]Trinity College, Dublin, Ireland
Anthony.buckley@tudublin.ie

Abstract: In this paper we explore how, in the digital age, the micro-level activities of digital entrepreneurs in new venture creation continue to digitally transform and disrupt economic systems at the macro-level. As digital entrepreneurship and other typologies of entrepreneurship in the digital age become increasingly fuzzy, this paper sets out to define the digital entrepreneurship domain – what it is, what is it not and why it is disruptive and distinct. By unbundling the roles of the differing digital technologies at play, we bring much needed clarity to a domain currently noted for its conceptual fuzziness. Our framework, developed from our research, gives academics and practitioners alike a clearer and more accessible way to understand the digital entrepreneurship domain.

Keywords: digital entrepreneurship, digital artifacts, digital platforms, digital infrastructures, external enablers, pure digital entrepreneurship, hybrid digital entrepreneurship

1. Introduction

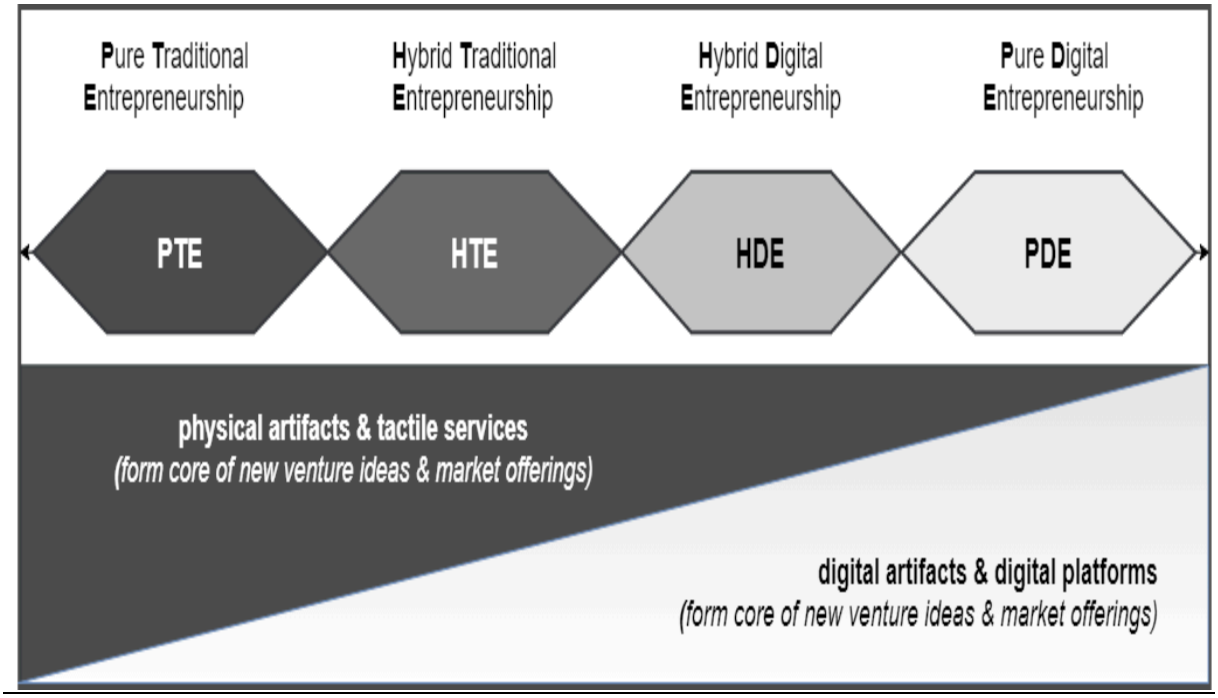
Pervasive digitization has raised significant implications for entrepreneurship in the digital age. Virtually all sectors of the economy have been affected by digital technologies to varying degrees. Not surprisingly, therefore, digital technology-based firms are today the main drivers of economic value creation. Among the top five companies by market capitalization in 2021, four were digital technology-based companies – Apple, Microsoft, Amazon, and Alphabet (Google). These companies have one thing in common – they are digital platform-based organizations.

However, if we journey back 15 years, the opposite is true. Traditional organizations such as ExxonMobil, General Electric, and Citigroup were among the top 5 companies, with Microsoft being the only digital technology-based company. What this shows is a seismic shift in the basis of economic value creation in about a decade. We are indeed in a Second Machine Age or Fourth Industrial Revolution (Schwab, 2017), marked by the 'digitization of just about everything' as pointed out by Brynjolfsson & McAfee (2014). In this new age, 'software is eating the world,' as Andreessen (2011) figuratively puts it.

But does pervasive digitization imply that all new venture creation in the digital age is somehow digital entrepreneurship? Our answer to that is an emphatic No! However, we are sympathetic to the fact that the blurring of lines between digital and traditional forms of entrepreneurship presents both conceptual and practical difficulties for those looking to engage with the subject as noted by Nambisan (2017), Kraus et al. (2018) and Ulhoi (2021).

So, what is digital entrepreneurship? Digital entrepreneurship specifically refers to entrepreneurship in which digital artifacts and digital platforms (software-based products and systems) form the core of new venture ideas and market offerings. It manifests in two main typologies – Pure and Hybrid (Nzembayie & Buckley, 2022).

Pure digital entrepreneurship is a typology of entrepreneurship in which digital artifacts and platforms *solely* form the the core of new venture ideas and new market offerings. In contrast, Hybrid digital entrepreneurship is a typology of entrepreneurship in which digital artifacts and platforms combine with physical artifacts and tactile services to *jointly* form the core of new venture ideas and new market offerings. The difference with Hybrid traditional entrepreneurship is discussed in more detail later in the paper. However a defining difference between the two hybrid typologies is the degree to which the digital artifacts and platforms are core or peripheral to the new venture idea or market offering. In Hybrid traditional entrepreneurship, clearly the digital artifacts and platforms are more peripheral than core. In Pure traditional entrepreneurship typologies then, digital artifacts and platforms play an insignificant or non-existent role in new venture creation.



Source: Nzembayie & Buckley, (2022).

Figure 1: Typologies of entrepreneurship in the digital age

But what is the significance of making distinctions between typologies of entrepreneurship in the digital age? Without critical distinctions, we risk arriving at misleading generalizations in research and offering the wrong advice to aspiring digital entrepreneurs (Giones & Brem, 2017). In fact, upon realizing that proposed traditional entrepreneurship models did not reflect practice in the digital age, digital entrepreneurs began to develop innovation models such as the Lean Start-up (Ries, 2011), Agile Development and its variants such as Scrum, XP and Kanban (Cohn, 2005), Customer Development (Blank, 2013) and Design Thinking (Brown, 2008), which more accurately speak to practice in their world. The academic world found itself playing catch up. To understand why, we must examine digital entrepreneurship as a separate genre (Nzembayie & Buckley, 2022). However to contextualise it appropriately, it is important to begin by identifying what is common to all forms of entrepreneurship.

2. Commonalities in all forms of entrepreneurship

Entrepreneurship is a 'slippery concept' (Penrose, 1959) - a complex, multidimensional process whereby individuals initiate ideas and act to pursue them as opportunities, leading towards various outcomes (Casson, 1982; Shane, 2003). Action, called new venture creation, is central to this process. It leads to outcomes such as new market offerings – manifested in new products, new organizations, and new markets. Higher-level outcomes may also result in new societal norms and behaviours. New venture ideas are often externally enabled by changes in the environments in which entrepreneurs are embedded – changing technology, consumer behaviour, regulation, environmental and ecological conditions, and others. Entrepreneurs need not be fully aware of external enabling changes in order to initiate new venture ideas or to take action. Additionally, ideas are often motivated by the need to solve problems for segments of society through the creation of a product or service combination. Problems are often the needs and wants of consumers or customers. Given this problem-solution motive, the purpose of all productive forms of entrepreneurship is to create value for society (Baumol, 1996).

There are several moving parts in this conceptualization – hence the complexity. Two main concepts are of interest here: *New Venture Ideas* and *External Enablers* (Davidsson, 2015; 2021). These concepts in the entrepreneurship literature refer to the objective WHAT of most entrepreneurial processes.

3. How is digital entrepreneurship different?

The New Venture Idea – Digital Artifacts & Digital Platforms as Core

The new venture idea is a major differentiator of various typologies of entrepreneurship. It is that on which entrepreneurs act. New venture ideas are metaphors for new market offerings. Digital entrepreneurship is uniquely differentiated by the fact that digital artifacts and digital platforms form the core of digital business ideas and market offerings. When something is core instead of peripheral to an entity, it means that entity cannot exist without it.

Digital artifacts is a collective term for software-based products and objects. By 'software-based,' we mean software itself, such as mobile and desktop applications, Artificial Intelligence and machine learning algorithms, and more. It also refers to by-products of software such as media content and other types of digital content such as eBooks, infographics, and the rest. Meanwhile, a digital platform is a software-based system designed to host complementary offerings. Digital platforms are matchmakers. They match producers and consumers.

When entrepreneurship is based on the creation of software-based products and services, the HOW of traditional entrepreneurship gets upended. In fact, many business schools continue to teach entrepreneurship with underlying assumptions of the creation of physical and tactile offerings – with their corresponding spatial and temporal limitations. Such spatial and temporal constraints are seen to impose rigidity and undue linearity on entrepreneurial processes. However, when software-based offerings form the core of entrepreneurship, those limitations either evaporate or are greatly minimized. For these reasons, we need to place digital entrepreneurship in its own category and examine it differently (Nzembayie et al., 2019.)

The reasons for this distinctiveness can be explained by examining the characteristics of software-based objects and their implications for new venture creation. As we shall see, these characteristics translate into agility and extreme flexibility in new venture creation, which are possible but less feasible when creating physical products and tactile services. It, therefore, questions our core logic of how to bring such products and services to market and what constitutes success (Nzembayie et al., 2019). For instance, do you begin new venture creation with a deliberate business plan or experiment towards an emergent one?

4. Software-Based offerings and implications for digital entrepreneurship

Software-based products are digitized goods and services.

By this, we mean they exist merely as bits of data in the form of ones and zeroes. Digitized goods are highly modifiable and instantly distributable over cyberspace. Together, these characteristics allow products and services to remain incomplete by design and subject to infinite expansibility. It explains why your software-based products tend to have an endless number of updates – Windows 8, 9, 10, 11, and so on. Also, software-based content such as eBooks or videos can be continuously edited, updated, and distributed at will over the internet. Compare that to a physical book or print media, which, once printed, is hard to edit and publish without significant costs. Physical products lack such extreme modifiability. Plus, they also are burdened with 'the tyranny of distance' – i.e., they need to be stored and shipped, and this also takes time and added costs. Compared to software-based offerings, the result is limited flexibility regarding how new venture creation can unfold and how business models can be innovated.

Digitized goods are also decomposable and re-combinable.

This is a product of the extreme modularity and granularity of the technology and its standardized protocols. Extreme modularity and standardization allow software-based components to be broken down into the tiniest possible bits and then re-combined later to form a finished product. This decomposability and re-combinability allow multiple participating actors to co-create a product concurrently. Furthermore, since decomposed components can be instantly distributed over cyberspace, multiple participating actors can create a software-based product at a time that suits their availability. The result is extreme agility, flexibility, and dynamism in new venture creation, unlike traditional entrepreneurship, based on the creation of physical and tactile offerings. Such instant, location-independent, and geographically dispersed co-creation supported by digital infrastructures (more on this later) enable digital entrepreneurs to concurrently enact new venture creation at velocities not observed in traditional forms of entrepreneurship.

Software-based goods are also characterized by non-rivalry.

Non-rival goods can be consumed by many people simultaneously without being depleted. When you watch a YouTube or Netflix video, for instance, multiple people watch at the same time, yet the video is not being used up. This is an example of non-rivalry in action. Moreover, non-rival goods can be reproduced at nearly zero marginal cost. By contrast, physical goods such as a car and even your cup of coffee can only be consumed by a limited number of people at any given time. Non-rival goods may even get better as they are consumed as virality enhances their value. The more people watching the 'Despacito' video by Lius Fonsi on YouTube, the more valuable it gets (over 7.7 billion views as of this moment!) – more on network effects later. Similarly, the value of a digital platform improves when consumed. Software-based products never expire or perish like your groceries or medication.

What the non-rivalry of digitized products offers entrepreneurs is extreme flexibility in business model innovation. We are all familiar with the 'freemium' model – where many software-based products are given away for free as part of a business model that captures revenue from advertising and other models. Try giving away too many free copies of your physical products, and you will soon be out of business. Physical products are characterized by rivalry and expensive costs of reproduction, storage, and distribution. Thus, the economics of physical products, unlike software-based products are different, leading to differences in business models and limitations on business model innovation. Furthermore, since software-based products are usually knowledge-intensive, costs tend to tilt in the direction of acquiring or coordinating individuals with relevant software-based knowledge and skills – programmers, graphic designers, digital marketers, and more.

Software-based products are traceable and interactive.

Traceability is the ability to find digitized goods over cyberspace. This is usually done by specialized software-based products such as search engine algorithms. Search engines such as Google and Bing interact with, trace, and locate digital artifacts across the internet. Interactivity allows functions of digital artifacts to be activated without changing their underlying code. These characteristics together, assist in unlocking their value through data-driven operations. Similarly, human users can interact with digitized goods without changing their source code. For instance, when playing a computer game, you interact by dragging and dropping objects and so on. Usually, every interaction leaves a digital trail that can be traced, tracked, and analyzed. Data logs may reveal the journey a digital object takes through cyberspace and how it has been used. Traceability and interactivity are, therefore, the reason digitized products promote data-driven operations, which can unlock more value than the sale of standalone software. This, in turn, translates into flexibility in business model innovation that creates and captures more value. Typically, physical products are hard to trace once distributed. As such, their value creation potential gets limited to a single service and single transaction. Unless we turn them into smart connected products such as IoT devices. So valuable are the characteristics of software-based products that hybrid typologies of digital entrepreneurship increasingly seek to merge software and hardware to create 'smart' connected products that unlock greater value. Think about how your smart grid and smart metering help optimize electricity consumption and reduce waste.

The characteristics of digitized goods and their implications outlined above, challenge our assumptions of new venture creation and performance. Speaking of performance, other metrics relating to network effects become more important at early phases than traditional growth KPIs such as profitability, break-even, and the number of employees. Network effects refer to the idea that the value of a service is enhanced by the number of people consuming it. If you were the only one with a phone, that phone's value will be greatly diminished. Indeed, network effects drive some 70 per cent of the value of software-based companies. Facebook, for instance, derives much of its value from the over 2.7 billion active monthly users accessing the service. Data-driven value allows advertisers to target potential customers with pinpoint accuracy. The value for advertisers is the reduction in marketing costs and a potential higher return on investment (ROI). Consequently, growth in user base leading to positive network effects is often more of a priority than profitability at early stages, with the software being used as bait to gain traction. Companies such as Amazon and Uber grew their user base unprofitably for several years before turning a profit. Moreover, with disruptive innovations, first-mover advantage and market dominance are critical to ensuring that future profits can be harvested. Indeed, the digital environment promotes winner-take-all market dynamics. Digital marketing skills become critical to driving venture growth through network effects. Therefore, the skills we emphasize in digital entrepreneurship education also need to be carefully considered (Nzembayie & Buckley, 2022).

5. Digital infrastructures as external enablers

Now let's turn to that other important concept in all forms of entrepreneurship called *External Enablers* (Davidsson, 2015). They are the result of changes in the environment that have the capacity to elicit a response from discerning actors. So digital entrepreneurs create and distribute software-based products. But software-based products cannot be created without enabling digital tools and systems. Digital infrastructure is the collective term for several enabling technologies such as the internet, broadband, 5G networks, microprocessors and storage, cloud computing and computing devices, and open technical standards. They are the primary external enablers of digital entrepreneurship. However, they are also external enablers of all typologies of entrepreneurship in the digital age. Today, almost every business is enabled by computers and the internet, but that does not automatically suggest that they are digital ventures. Of particular interest today is the role of cloud computing as a primary infrastructural enabler of current and next-wave digital entrepreneurship. It is one technology change that has truly democratized access to critical computing resources which were previously beyond the reach of under-resourced digital entrepreneurs. There is more to talk about on this subject later in the paper, but we move on now to discuss hybrid typologies of entrepreneurship.

6. Hybrid typologies of entrepreneurship in the digital age

Hybrid typologies do blur the lines between pure digital and pure traditional forms of entrepreneurship. Software is indeed eating up the physical world. We identify two main hybrid typologies of entrepreneurship in the digital age – hybrid digital and hybrid traditional. Hybrid digital entrepreneurship combines software-based products with physical artifacts and tactile services to jointly form the core of new venture ideas and market offerings. Your smartwatch, such as Fitbit, Garmin, and similar IoT (Internet of Things) devices, make good examples of new ventures that emerged under this typology. Likewise, we have services such as Deliveroo and Just Eat in the food industry. These ventures are digital platform-based innovations that tightly couple a software-based service with a physical operation of food delivery which jointly forms the core market offerings.

As for hybrid traditional entrepreneurship, there is a subtle distinction in terms of the significant but peripheral development of software-based products, which mainly enhance the core traditional offering. For example, the traditional bank has leveraged software-based products such as a banking app and platform to deliver operational efficiencies for itself and its customers in a significant way. Similarly, a conventional technology such as a car has today been enhanced significantly by software-based services such as Android Auto and Apple Car Play, as well as AI-powered driving assistants. In these examples, the software-based component is significant but remains peripheral – meaning, without it, the essence of the core product remains intact. At the end of the day, your Tesla Model Y or S is still fundamentally a car in spite of the significant software 'bells and whistles'. But when cars become fully autonomous, will that be hybrid digital or hybrid traditional entrepreneurship?

Under hybrid traditional and pure traditional forms of entrepreneurship, the main research interests include digital transformation and digital disruption. Such transformation is the result of software-based products 'eating the world' (Anderssen, 2011). Today's digital new venture ideas are increasingly motivated by the need to develop and apply software-based solutions to existing traditional industries, thereby rendering them more efficient. There are all sorts of implications for the economy and society, which opens up new avenues for research. Take Uber as an example – a software-based new venture sets out to render more efficient, the process of hailing a ride, and an entire market system gets upended as a consequence. Even our vocabulary is changing. We no longer 'grab a cab', we 'grab an Uber'. Likewise, we 'google', not just search online. Digital entrepreneurship has far-reaching consequences for society, making it paradigm-shifting and therefore research-fertile (Nzembayie & Buckley, 2022).

7. Summary and conclusion

In this paper, we have set out to conceptualise digital entrepreneurship by unravelling the complexities of entrepreneurship in the digital age. More importantly, we demonstrated how digital entrepreneurship differs from other typologies of entrepreneurship. In sum, digital entrepreneurship is new venture creation based on software-based products and services. However, like all forms of entrepreneurship in the digital age, it is externally enabled by digital infrastructures such as the internet and computing capabilities. By unbundling the role of the different types of digital technologies in entrepreneurship, conceptual fuzziness gives way to much-needed clarity. As such, our framework, based on our research, gives academics and practitioners alike, an accessible approach to understanding the digital entrepreneurship phenomenon.

References

Anderssen, M. (2011). Why software is eating the world. Wall Street Journal, 20, C2

Ashton, K. (2015). *How to fly a horse: The secret history of creation, invention, and discovery*. Anchor.

Baumol, W.J. (1996). Entrepreneurship: Productive, unproductive, and destructive. *Journal of business venturing*, *11*(1), pp.3-22.

Blank, S. (2013). Why the lean start-up changes everything. *Harvard business review*, *91*(5), pp.63-72.

Brown, T. (2008). Design thinking. *Harvard business review*, *86*(6), p.84.

Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. WW Norton & Company.

Casson, M. (1982). The entrepreneur: An economic theory. Rowman & Littlefield.

Cohn, M. (2005). *Agile estimating and planning*. Pearson Education.

Davidsson, P. (2015). Entrepreneurial opportunities and the entrepreneurship nexus: A re-conceptualization. *Journal of business venturing*, *30*(5), pp.674-695.

Davidsson, P. (2021). Ditching discovery-creation for unified venture creation research. *Entrepreneurship Theory and Practice*, 10422587211030870.

Giones, F., & Brem, A. (2017). Digital technology entrepreneurship: A definition and research agenda. Technology Innovation Management Review, 7(5), 44-51

Kraus, S., Palmer, C., Kailer, N., Kallinger, F. L., & Spitzer, J. (2018). Digital entrepreneurship: A research agenda on new business models for the twenty-first century. *International Journal of Entrepreneurial Behavior & Research*.

Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective of entrepreneurship. *Entrepreneurship theory and practice*, *41*(6), 1029-1055.

Nzembayie, K. F., Buckley, A. P., & Cooney, T. (2019). Researching pure digital entrepreneurship–A multimethod insider action research approach. *Journal of Business Venturing Insights*, *11*, e00103.

Nzembayie, K.F., & Buckley, A.P. (2022). *Digital Entrepreneurship: Disruption and New Venture Creation*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing.

Pnrose, E.T. (1959). *The theory of the growth of the firm*. Oxford: Oxford University press.

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Currency Books.

Schwab, K. (2017). *The fourth industrial revolution*. New York, NY: Currency books.

Shane, S.A. (2003). *A general theory of entrepreneurship: The individual-opportunity nexus*. Edward Elgar Publishing.

Ulhøi, J. (2021). A Digital Perspective on Entrepreneurship. *Journal of Innovation Management*, *9*(3), 71-89.

Exploring Business Model Innovation in the Norwegian Grocery Market

Beniamino Callegari, Adeline Hvidsten and Ranvir Rai
Kristiania University College, Oslo, Norway
Ben.Callegari@kristiania.no
Adeline.Hvidsten@kristiania.no
Ranvir.Rai@kristiania.no

Abstract: This paper focuses on the under-explored dynamics between physical grocery stores and e-grocery through the lens of business model innovation. While e-grocery is expected to grow, we still know little about how it will affect the existing physical stores - and how these actors are reacting to this potential threat. We draw upon in-depth interviews with senior executives from grocery companies, academics, and experts. The data has been subsequently discussed in the light of market literature and the study's' theoretical framework. We find that e-grocery and physical grocery operate with two very different business models, where neither would benefit from emulating the other. While some of the physical chains have been developing e-grocery as add-on services, they are not profitable because they are not compatible with the current business model. Seeing this, physical shops are primarily concerned with competing with other physical shops to survive the growth of e-grocery despite of the development from pure e-grocery players. However, these sustaining actions might over time turn consumers digital, as the reduction of number of physical stores might spark the change in consumer behavior needed by e-grocery to accelerate its growth.

Keywords: e-grocery, business model innovation, digitalization, disruptive innovation

1. Introduction

Since the 1990s, numerous market players and smaller entrepreneurial companies have tried to establish e-grocery models with varying degrees of success, both in Norway and globally. In Norway, the retail giant Rema attempted to sell groceries online in the late 1990s, but quickly realized that the consumer market was undeveloped (Ryde 2021). In 2013, an entrepreneurial team of ten people established Kolonial.no (hereinafter Oda) and in 2016 entered a purchasing collaboration with Rema (Kolonial 2016). Today, Oda is the country's only pure full-range e-grocery player. Since 2013, several other actors have entered the e-grocery market, including Marked.no, which in 2018 shut down operations as they failed to achieve a profitable business (Solem 2018). Hence, the debate about profitability as a barrier to Norwegian e-groceries has been persistent, especially since 2013, and amongst actors and experts, opinions are divided (see Waldeghebriel 2018; Hopland 2018; Gisholt 2014). The main themes that have been highlighted in these discussions are the costs of grocery picking, storage and distribution, as well as consumers' evolving shopping habits.

In our study, we focus on the dynamic interplay between physical shops and e-grocery as they both complement and compete in the same market with distinctively different business models. Hence, we draw insights from the literature of business model innovation to explicate how digitalization create both opportunities and threats for incumbents and new entrants. We have drawn upon various sources to generate rich empirical data, trough semi-structured interviews with senior executives from grocery companies and domain experts from academia.

What we find is that, for e-grocery to be profitable for physical grocery, a dedicated, supporting business model is required. While the physical assets and capabilities of established grocery chains can be effectively used to operate a digital service, with some small additions, obtaining value creation and long-term profitability is difficult. Meanwhile, born-digital firms can set up entirely new processes and do not seek to expand their operations in a physical direction. Thus, we argue that physical and digital capabilities are different, and although one set can be deployed to emulate the other, this is not profitable, neither in the short nor the long term.

The article is organized as follows. After this introduction, section 2 reviews the literature and section 3 describe our theoretical framework of reference. Section 4 illustrates our methodology. Section 5 contains our findings, which are discussed and concluded in Section 6.

2. Literature review

With exception of a few studies (Jocevski et al., 2019; Matzler et al., 2018; Sorescu et al., 2011), the influence of the digital transformation from the retail business model perspective has been underexplored. The rise of e-commerce has extended traditional value chains by changing the logic of value creation, more specifically, influencing how retailers seek competitive advantage by proposing, creating, and capturing value (see Timmers, 1998). With more consumers having access to an Internet connection and with the introduction of reliable electronic payment options (Li et al, 2020), consumer trust in online retailing has increased (Labrecque et al, 2013; Lubis, 2018; Simonson and Rosen, 2014). This has led traditional retailers to find ways to integrate existing and extensive parts of the value chain, witnessing the influx of hybrid forms of multiple channel retailing (Beck and Rygl, 2015), such as multi-channel and omni-channel strategies (Verhoef et al., 2015). In food retail, digitalization is now enabling new platforms for food provisioning that are promoting novel and more sustainable ways of not only provisioning but also storing, preparing, and cooking food (Michelini et al., 2018). These developments challenge the need and role of physical retail space and thus, traditional retailers.

The retailing literature is divided on the long-term development of e-grocery, with some researchers forecasting the secular decline and possible end of physical retailing (Helm et al, 2020), and others recognizing digitalization as a potential new source of competitive advantage for the sector (Mende, 2019; Reinartz et al., 2019). Sorescu et al. (2011) described digitalization as providing opportunities to physical retailers for gaining operational efficiency and effectiveness, designing lock-in themes, promoting value capture strategies, increasing customer efficiency and engagement, and, finally, influencing customer effectiveness. Considering the significant disagreement present on the literature, it is reasonable to assume that the actual effect of digitalization on the retail sector will be significantly affected, if not determined, by contextual factors, to which we now turn.

Norwegian grocery retailers had total revenue of circa 180 billion NOK in 2020 (Nielsen, 2020). Norway has the highest grocery per capita store density in Europe. Stores have recently decreased in number and become bigger with longer opening hours. E-grocery is the fastest growing segment in Norway. The turnover of Norwegian online grocery retailing in 2020 was estimated to be around 3 billion (Nielsen, 2020). Consumers purchasing grocery online are typically in the 30–40 age range. Geographical differences are nonnegligible. In fact, whereas in Oslo 15 % of residents have purchased groceries online, this percentage is much lower in less densely populated areas (Solem, 2018). More than 50% of e-grocery consumers purchase goods online less than once a month making this channel marginal for Norwegian households' grocery purchases. Among e-grocery users, only 16% purchase grocery through this channel more than in supermarkets. Additionally, 65% of e-grocery buyers only purchase 10% of their monthly groceries through this channel (Solem, 2018).

The new e-grocery market sprout can create both business opportunities and challenges for grocery retailers due to its intrinsic peculiarities (Mortimer et al., 2016). The e-grocery retail market includes pure internet actors and multi-channel ones. In different retail markets, pure online players have experienced rapid growth. However, omni-channel grocery retailers have to deal with low profitability and high risk when offering online services, yet the size of the internet channel is still increasing (Larsen & Klyve, 2017). Consumers tend to use online channel as a complement for purchasing grocery rather than a substitute for buying groceries at stores (Couclelis, 2004). Dreyer and Bakås (2017) claim multi-channel retailers in Norway face low profitability and high risk. In fact, 123levert company has announced bankruptcy in 2017 and Kolonial (now Oda) in the same year, the biggest online grocery store in Norway, laid off 100 employees due to competition (Solem, 2018).

3. Theoretical framework

A business model (BM from now on) can be defined as the "architecture of the value creation, delivery, and capture mechanisms [a firm] employs" (Teece, 2018, p. 41). With the help of BM concepts, a company is able to describe its business in terms of "what it does," "what it offers" and "how the offer is made" (Ritter and Lettl, 2018). Digitalization, which has been defined as the exploitation of digital opportunities to improve both the performance and the scope of the business (Westerman et al., 2011), is a macrotrend currently influencing every industry, as it impacts corporate strategies and challenges existing BMs to be reconsidered and evolved to match the new opportunities, challenges and competitors (Linz et al., 2017). Digitalization affects primarily the value proposition, internal infrastructure management and customer relationships areas of existing BMs (Arnold et al., 2016; Kiel et al., 2017). Previously established companies are confronted by new entrants redefining the equilibria of even mature industries (Linz et al., 2017), as existing BMs become obsolete and are either replaced by new ones or evolved into new forms (Matzler et al, 2018).

The extent, however, to which digitalization impacts corporate activities differs from industry to industry and takes time since "business models are more context-dependent than technology," depending on resources and capabilities that are available within the respective company (Teece, 2018, p. 45). The related challenges are well illustrated by the unified business model innovation typology (BMIT from now on), which expands on the previous dichotomous classifications of innovation processes to better capture the strategic and managerial aspects involved in BMI. The BMIT classifies innovation along three dimensions: technology, value network, and financial hurdle rate, dividing the innovation space into two zones: sustaining innovation and business-model innovation proper (Koen et al, 2011). Sustaining innovations are processes of change whose main aim is to support, leverage and augment the value of existing assets, thus maintaining, and enhancing the underlying BM. BMI, instead, requires companies to succeed with business models that require a lower-than-normal financial hurdle rate or the development of new value networks, something that is often challenging for established firms (Christensen and Raynor, 2003; Govindarajan and Trimble, 2005).

From this perspective, we would expect digitalization to affect a mature sector such as grocery retail through two primary innovation channels. Established firms will integrate digital technologies through sustaining innovation efforts, aimed at maintaining the value of their expensive physical assets in the face of new technological trends. BMI will be pursued instead primarily by new, born-digital, entrants seeking to establish themselves as the primary providers of e-grocery solutions, delivered through substantially new value networks as compared to more established players. The relative success of these two strategies will depend on both the capabilities of the firms involved and the relevant contextual factors, determining the relative value of the business opportunities unearthed by digitalization. Furthermore, we expect that, in the long-term, the interaction between these different innovative efforts will also play a significant role in determining the evolution of the sector as a whole.

4. Methodology

As part of this research project, semi-structured interviews were conducted with key stakeholders across companies in the market and domain experts from academia. Informant recruitment started with a thorough mapping of key associates within prominent grocery stores. Media statements, podcasts, industry reports, players' websites and LinkedIn profiles were reviewed in the mapping and used to get in contact with informants. The same approach was employed when identifying relevant experts and academics. We aimed at obtaining a wide selection of informants, to map the phenomenon from different angles (Tjora 2012), eventually obtaining data saturation. Furthermore, we used data gathered from earlier interviews to inform our later efforts, verifying the reliability of the information received in the process. In other words, we selected respondents who were experts in the subject domain or have experiences of interest to us - preferably through their positions. Table 1 presents the informants that have been interviewed, consisting of senior executives at three different companies and two academics from universities.

Table 1: Overview of in-depth qualitative interviews

Respondent	Position	Organization
1	Co-founder	Oda
2	Leader	Norgesgruppen
3	Strategist	Coop
4	Academic	NTNU
5	Academic	Norwegian School of Economics

In-depth interviews provide an effective means of obtaining rich insights into the phenomenon of interest, as they provide access to detailed contextual information and individual insight (Gwinner, Gremler and Bitner, 1998). The interviews were performed with open-ended questions to generate high-quality data from a relatively small sample of respondents (Brinkmann & Kvale, 2015; Wengraf, 2001). The questions in the interview guide were based on the theoretical domain of business model innovation, adapted to the specific challenges brought forward by digitalization. Audio recordings were made only after having obtained explicit consent from the informants (Johannessen et al., 2011, p. 149).

When analyzing the data, we first carried out inductive open coding of the interview transcripts to identify first-order categories. Following this preliminary categorization, we applied selective coding (Flick, 2009) to identify

the sector-specific aspects of the ongoing digitalization processes. We performed this procedure iteratively, moving back and forth between codes and data until consensus among the researchers emerged. After coding our findings from the in-depth interviews in NVivo, we have summarized them in the next section.

5. Findings

Earlier we introduced characteristics of the Norwegian grocery market, such as the high ratio of grocery stores per capita, the geographical dispersion of physical retailing, and the limited but quickly growing e-grocery market, mainly within the densely populated areas of Norway. Here, we explore grocery actors' reactions to the increasing opportunities and threats of digitalization.

Some of our informants described physical stores as initially "closing their eyes and hoping e-groceries goes away". As the e-grocery segment grows, however, different reactions to this potential threat emerges. Some traditional grocery actors have invested in their own platforms for e-grocery. Norgesgruppen, which controls around 50% of the market of physical groceries has multiple types of stores under their umbrella, and in 2017 they invested mainly into e-grocery for one of their high-end stores, Meny. They wanted to participate in the learning process of digital transformation, not falling too far behind e-grocery actors such as Oda. They quickly found, however, that there are multiple hurdles for physical stores expanding their business online.

The first issue for Norgesgruppen and other physical store actors is that most of their stores are managed by local grocers who decide if they want to go online or not. Local competition and the grocer's own motivation and technological competence are deciding factors:

> *"… They see that no one is making money online, "why should I go online?", so it depends on the competitive situation of the individual store. Some grocers are innovative and want to test new technology quickly, and they are allowed to [go online]" (Respondent 2, Norgesgruppen)*

Respondents argue that it is easy to go online; it requires joining a platform, a handheld device and transportation of wares. Store employees do the picking. This means, however, that the jobs currently done by the customer themselves, such as picking their groceries and driving them home, now fall to store's employees – without reducing any of the fixed costs. Especially "last mile"-transportation from store to customers' homes is expensive. Thus, the more innovative local grocers are not necessarily rewarded for their efforts, as online shopping and delivery does not increase revenues, degrading incentives for less innovative actors to follow.

Another large actor, the co-op chain Coop, has seen the growth of e-groceries but chosen to remain on the side, at least for now. Our respondent argues that it would be against company policy as a co-op to use money from profitable but de-centralized parts of Norway to invest heavily in e-groceries – a market seeing significant growth almost exclusively in the few large cities and central areas. Furthermore, as others also point out, Coop sees little merit in "turning customers digital", potentially cannibalizing their physical stores and leading them into the hands of Oda and other, more experienced and focused e-grocery players. As the market share for physical grocery is still the largest by far, it is more profitable to keep their focus there.

From the perspective of established physical stores, e-grocery is an extra service provided to satisfy their customers and keep up with digital actors, but far from a profitable endeavor at present. They rather focus on competition with other physical stores and innovating on automation: this might compensate for any margins potentially lost to e-grocery. This perspective is heavily influenced by the high density of grocery shops in Norway, which heavily influences consumer behavior:

> *"We shop 4-5 times a week, so we use the store as a grocery list and as a refrigerator in a way. Because there are stores everywhere, the Norwegian consumer overall has 3-4 stores to choose from at a shopping distance" (Respondent 2, Norgesgruppen).*

The high shop density means high competition between stores, especially in the competitive budget-segment, which has the largest volume. Here, the concept and business model of the stores are so similar that differentiation lies almost exclusively in the "color of the signs". Competition takes place on the basis of aggressive marketing strategies focused on price, advertising and distribution. This affects profits, leading to very tight margins. Many stores are simply not profitable, due to the overcrowded market and high fixed and variable costs. The former is due to high real estate prices, the latter due to relatively high entry-level wages. The tight margins are significantly affected when new physical shops are established in the near vicinity, with

firms constantly monitoring the market to ensure the right mix of budget, high-end and 24-hour groceries in any given physical area.

When and if e-grocery will mount additional pressure on the already modest margins obtained by physical grocery, informants on both sides of the digital divide agreed that this will lead to heightened competitive pressures between physical stores. This is a way for physical stores recover the lost margins, and a resulting reduction in the number of physical stores, with corresponding job losses:

> *"I think it will adjust. Let´s say an 80 million NOK store loses turnover to e-groceries, but then a nearby store closes down: for example, a Kiwi shop that had 40 million but is now down to 28 for the same reason. They say, "28 million is not viable, lets close". And then 28 million is available, and the 80 million store is back on let's say 75, because it takes part of the turnover form the competitor. So, you have these dynamics that you can get, so I think that the total effect of investing in groceries online will be fewer stores, but about the same amount of turnover in the stores that are there today so you can see that profitability is maintained" (Respondent 3, Coop)*

> *"They must compensate for it [e-grocery] and close stores, and then hope the volume goes into the remaining stores, so they are then able to maintain their in-store sales. And then, the question emerges: which shops will go? Is it Rema, is it Kiwi or is it Coop? It will be difficult either way, you cannot get past it. This is a change in the value chain … It will be very expensive, and they will take great losses" (Respondent 1, Oda)*

While not committing wholeheartedly to e-groceries, actors operating physical stores do invest in digital technologies supporting their current business model. Our respondents focused on automation in back-end functions such as warehouses, making the shopping experience seamless for customers though self-service ala *Amazon Go*. Some chains already have unmanned 24-hour stores in Oslo and "ready-made dinner" offers, playing into the established shopping habits of Norwegians. For the future, respondents argued that hybrids of physical/e-groceries could be made more profitable through the integration of more advanced technologies, such as automated picking, dark stores, and driverless cars – as it would lower the high fixed and variable costs experienced today.

While physical stores see e-grocery as extra services to the benefit of physical stores, focusing mainly on physical competition and the potential benefits of automation, Oda, an e-grocery player, has managed to break even. They have achieved this through learning, continuous in-house technological development, and the construction of an entirely new business model, far from the established routines of physical chains:

> *"it will be extremely expensive for [competitors] to try to copy us now. We have momentum, we have scale, we have the technology. For every [Norwegian] krone we sell we make money, and for each krone they sell online they will lose money for a long time, in addition to the cannibalization effect …" (Respondent 1, Oda).*

The co-founder of Oda argues that physical stores and e-grocery operates with distinctly different business models than their competition "[they are] grocery players, but this is e-grocery. It has less in common with their core business than [grocery players] have in common with the car industry" (respondent 1). Indeed, e-grocery has been developing their proprietary technology as their main concern and driver of competitive advantage, while physical shops are mainly concerned with logistics and automation.

While Oda is growing, there are still several challenges facing e-groceries. A key issue revolves around how to profitably serve the small, geographically located market. Oda is now servicing eastern Norway, chiefly Oslo and its suburbs, and cities in other parts of the country. Oda operates based on centrally located warehouses – more are currently being built, but they represent a significant fixed cost that, at the moment, is inconsistent with the size of the fragmented countryside markets. Another challenge is Norwegian consumer patterns, reinforced by the convenience provided by the large amounts of physical shops. Here, Oda has focused on improving same-day delivery and more precise delivery timeslots – but e-grocery still requires more planning that simply going to the store. However, opportunities are also present. Respondent 4, a professor in industrial economics, highlights how network effects, enabled by digital services could lead to lower transaction costs through effective use of big data analytics. The same data could be used to inform effective marketing campaigns grabbing the customers attention, leveraging potential interaction effects between products. Although e-grocery remains a niche at present, it retains the potential to scale without increasing the average cost over time, realizing increasing returns in the process.

6. Discussion and conclusions

In this paper we addressed the underexplored influence of the digital transformation from a business model perspective (Jocevski et al., 2019; Matzler et al., 2018; Sorescu et al., 2011). The findings paint a varied picture of the impact of digitalization on the Norwegian retailing sector. Digital technologies have entered the grocery sector under many guises, leading to increased automation in physical shops and the development of a number of competing e-grocery services. The latter have been created both by existing physical players and by a small number of new, born-digital entrants. Despite these significant developments, however, digitalization has neither revolutionized the field nor significantly affected its long-term issues, yet. E-grocery has established itself as a fast-growing, but small and geographically localized, niche. While the born-digital Oda has recently succeeded in achieving profitability, competitors have failed to emulate this success; while some physical players have successfully developed an e-grocery offer, the gains they have reaped so far remain modest, putting into question the viability of this avenue of expansion.

What we find is that, for e-grocery to be profitable for physical grocery, a dedicated, *supporting* business model is required. While the physical assets and capabilities of established grocery chains can be effectively used to operate a digital service, with some small additions, value is not created in the process. The assets are not leveraged, but rather put to an additional use, competing for resources with the physical retailing process. Further, while physical retailing suffers from tight margins, it is at least profitable. Further evidence in this direction is provided by born-digital firms, which set up entirely new processes and operations when contrasted with physical shops. Additional support to the hypothesis comes from the fact that successful digital players do not seek to expand their operations in a physical direction. Thus, we argue that physical and digital capabilities are different, and although one set can be deployed to emulate the other, this is not profitable, neither in the short nor the long term.

This does not imply, however, that physical shops cannot engage with digitalization; it does mean, however, that, for them, digitalization is a sustaining innovation, their technological adoption efforts aimed "to fit the familiar frameworks of their sustaining businesses" (Koen et. al, 2011, p. 7). Digitalization, especially in the form of automation, provides relief to the profitability problem by lowering labor costs; however, the significant competitive pressures lead to costs-savings being passed on to the customers, as price-based marketing campaigns steadily erode margins. While failing to adopt technologies is not an option, digitalization does not solve the underlying issue of cut-throat competition. In fact, the addition of e-grocery might eventually make things worse. A process of downscaling and merging appear to be inevitable in the future.

We found that most actors see a reduction in physical shops in the future (Helm et al, 2020). Ironically, this response to digital competition may end up further strengthening e-grocery growth, as the reduction of physical shops would reduce their convenience and therefore affect the consumer behavioral patterns constraining the further growth of the e-grocery sector. Indeed, the born digital entrant Oda sees changing consumer behavior as one of their main tasks for the future. At present, digitalization has generated business model innovation only within a small market niche, and has not solved, or even significantly affected, the structural issues affecting the physical side of the business. And yet, the continued profitability issue of physical stores, combined with the continuous, if slow, shift in consumer behavior, may yet produce the conditions required for digitalization to begin disrupting sectorial dynamics in the near future.

The results of our study are affected by several limitations. First, by focusing our empirical work exclusively on the Norwegian case, we cannot meaningfully assess how our results could be transferred to a different geographical context. In fact, the dispersion and thinness of the Norwegian market, together with the high physical shops density, have emerged as key factors affecting the digitalization of the sector. Broader, comparative empirical efforts are needed to distinguish between the relative impact of technological, institutional and contextual factors. Second, we did not include among our informants either consumers' associations' representatives or managers from failed e-grocery firms. A broader perspective could reveal new, relevant factors to explain past developments and current processes. Finally, an investigation of the technological foundations of the digitalization process could enable a more critical and meaningful evaluation of the future perspectives held by the various players. On these and other aspects, more research appear to be needed.

Acknowledgements

We would like to thank Adrian Olsson Nilsen and Christoffer Christie for their help with data collection.

Westerman, G., Calméjane, C., Bonnet, D., Ferraris, P. and McAfee, A., 2011. Digital Transformation: A roadmap for billion-dollar organizations. *MIT Center for Digital Business and Capgemini Consulting*, *1*, pp.1-68.

Appendix A: Interview guide with market actors, experts and academics.

Phase	Category	Question
Introduction	Informant information	Can you tell us a little about yourself and your background?
		What makes the grocery market so interesting for you?
		Based on your experience in the market, what are the most exciting / important developments so far?
Main part	The market	What characterizes the Norwegian grocery market?
		What are your thoughts on establishing yourself as a new market player?
	Attributes	What do you consider to be the most important performance attributes for customers in the grocery market?
	Innovation	How do you innovate towards these attributes?
		What do you want to highlight as important innovations in the Norwegian grocery trade in recent years?
	E-grocery	What potential do you see in pure e-grocery shopping?
		Why did you establish online shopping?
		How would you describe the developments in the market in recent years?
		Do you see opportunities / difficulties for further growth in online shopping?
	Changes	What do you think is the reason for why the grocery market to a large extent have been shielded from upheavals resulting from e-grocery and digitalization?
		How would you describe the development in e-grocery after March 2020?
		Do you think the pandemic brings lasting changes?
Closure	Discussion	Is there anything else you want to add?

References

Arnold, C., Kiel, D. and Voigt, K.I., 2016. How the industrial internet of things changes business models in different manufacturing industries. *International Journal of Innovation Management*, *20*(08), p.1640015.

Beck, N. and Rygl, D., 2015. Categorization of multiple channel retailing in Multi-, Cross-, and Omni-Channel Retailing for retailers and retailing. *Journal of Retailing and Consumer Services*, 27, pp.170-178.

Brinkmann, S. and Kvale, S., 2015. *Interviews: Learning the craft of qualitative research interviewing*. Sage Publications.

Christensen, C.M., Raynor, M.E. and Anthony, S.D., 2003. Six keys to building new markets by unleashing disruptive innovation. *Harvard Management. EEUU*.

Couclelis, H., 2004. Pizza over the Internet: E-commerce, the fragmentation of activity and the tyranny of the region. *Entrepreneurship & Regional Development*, *16*(1), pp.41-54.

Dreyer, H.C. and Bakås, O., 2017. Business models and the planning environment of online food concepts: a multiple case study. Norwegian University of Science and Technology, Trondheim.

Flick, U., 2018. *An introduction to qualitative research*. Sage.

Gisholt, Odd. 2014. "Sannheten om dagligvarer på nett". BI Business Review. Retrieved March 5th 2022. https://www.bi.no/forskning/business-review/articles/2014/02/ sannheten-om-dagligvarer-pa-nett-/.

Govindarajan, V. and Trimble, C., 2005. Building breakthrough businesses within established organizations. *Harvard business review*, *83*(5), pp.58-68.

Gwinner, K.P., Gremler, D.D. and Bitner, M.J., 1998. Relational benefits in services industries: the customer's perspective. *Journal of the Academy of Marketing Science*, *26*(2), pp.101-114.

Helm, S., Kim, S.H. and Van Riper, S., 2020. Navigating the 'retail apocalypse': A framework of consumer evaluations of the new retail landscape. *Journal of Retailing and Consumer Services*, *54*, p.101683.

Hopland, Sindre. 2018. "Hagen: – Mataktørene på nett har undervurdert markedet". E24. Retrieved March 5th 2022. https://e24.no/naeringsliv/i/qnoMMg/hagen- mataktoerene-paa-nett-har-undervurdert-markedet.

Jocevski, M., Arvidsson, N., Miragliotta, G., Ghezzi, A. and Mangiaracina, R., 2019. Transitions towards omni-channel retailing strategies: A business model perspective. *International Journal of Retail & Distribution Management*, *47*(2), pp.78-93.

Johannessen, A., Natland, S. and Støkken, A.M., 2011. Samarbeidsbasert forskning i praksis [Collaborative research in practice]. *Oslo: Universitetsforlaget*.

Kiel, D., Arnold, C. and Voigt, K.I., 2017. The influence of the Industrial Internet of Things on business models of established manufacturing companies–A business level perspective. *Technovation*, *68*, pp.4-19.

Klyve, Henrik, and Ole Erik H Larsen. "Fremtidig Dagligvarehandel: En Kvalitativ Studie Av Hvordan Forbrukeren Handler Dagligvarer i Norge i 2027." Master's Thesis, Universitetet i Agder; University of Agder, 2017.

Koen, P.A., Bertels, H.M. and Elsum, I.R., 2011. The three faces of business model innovation: Challenges for established firms. *Research-Technology Management*, *54*(3), pp.52-59.

Kolonial. 2016. "Kolonial.no får sterkere muskler med Rema på laget". Retrieved March 18th 2022. https://blogg.kolonial.no/post/148876515745/kolonialno-fa-r- sterkere-muskler-med-rema-1000.

Labrecque, L.I., Vor Dem Esche, J., Mathwick, C., Novak, T.P. and Hofacker, C.F., 2013. Consumer power: Evolution in the digital age. *Journal of Interactive Marketing*, *27*(4), pp.257-269.

Li, C., Mirosa, M. and Bremer, P., 2020. Review of online food delivery platforms and their impacts on sustainability. *Sustainability*, *12*(14), p.5528.

Linz, C., Müller-Stewens, G. and Zimmermann, A., 2017. *Radical business model transformation: Gaining the competitive edge in a disruptive world*. Kogan Page Publishers.

Lubis, A.N., 2018. Evaluating the customer preferences of online shopping: Demographic factors and online shop application issue. *Academy of Strategic Management Journal*, *17*(2), pp.1-13.

Matzler, K., von den Eichen, S.F., Anschober, M. and Kohler, T., 2018. The crusade of digital disruption. *Journal of Business Strategy*, *39*(6), pp.13-20.

Mende, M., 2019. Retail apocalypse or golden opportunity for retail frontline management? *Journal of Retailing*, *95*(2), p.84.

Michelini, L., Principato, L. and Iasevoli, G., 2018. Understanding food sharing models to tackle sustainability challenges. *Ecological Economics*, *145*, pp.205-217.

Mortimer, G., Fazal e Hasan, S., Andrews, L. and Martin, J., 2016. Online grocery shopping: the impact of shopping frequency on perceived risk. *The International Review of Retail, Distribution and Consumer Research*, *26*(2), pp.202-223.

Reinartz, W., Wiegand, N. and Imschloss, M., 2019. The impact of digital transformation on the retailing value chain. *International Journal of Research in Marketing*, *36*(3), pp.350-366.

Ritter, T. and Lettl, C., 2018. The wider implications of business-model research. *Long Range Planning*, *51*(1), pp.1-8.

Ryde, Nora. 2021. "Mitt voksenpoeng: Ole Robert Reitan". E24, Retrieved March 5th 2022. https://e24.no/karriere-og-ledelse/i/aPjk3A/det-var-vondt-jeg-ble-faktisk -fysisk-syk-av-det.

Simonson, I. and Rosen, E., 2014. What marketers misunderstand about online reviews. *Harvard Business Review*, *92*(1), p.7.

Solem, Lars Kristian. 2018. "Marked.no gir opp og legger ned". Dagens Næringsliv, retrieved March 5th 2022. https://www.dn.no/handel/stein-erik-hagen/ole-vinje/runar- hollevik/markedno-gir-opp-og-legger-ned/2-1-248622.

Sorescu, A., Frambach, R.T., Singh, J., Rangaswamy, A. and Bridges, C., 2011. Innovations in retail business models. *Journal of Retailing*, *87*, pp. S3-S16.

Teece, D.J., 2018. Business models and dynamic capabilities. *Long Range Planning*, *51*(1), pp.40-49.

Timmers, P., 1998. Business models for electronic markets. *Electronic Markets*, *8*(2), pp.3-8.

Tjora, A., 2012. *Kvalitative forskningsmetoder i praksis* (Vol. 2, pp. 202-217). Oslo: Gyldendal Akademisk.

Verhoef, P.C., Kannan, P.K. and Inman, J.J., 2015. From multi-channel retailing to omni-channel retailing: introduction to the special issue on multi-channel retailing. *Journal of Retailing*, *91*(2), pp.174-181.

Waldeghebriel, Lucas. 2018. "Netthandel-gründer kraftig ut mot Kolonial.no: – Matvarer på nett vil aldri lønne seg". E24. Retrieved March 5th 2022. https://e24.no/teknologi/i/jPWBaw/netthandel -grunder-kraftig-ut-mot-kolonialno-matvarer-paa-nett-vil-aldri-loenne-seg.

Wengraf, T., 2001. Models of research design and their application to semi-structured depth interviewing. *Qualitative Research Interviewing*, pp.51-60.

Changes in the Perception of Business Risks to the Threat of Bankruptcy Due to COVID-19

Martin Cepel[1] and Anna Kotaskova[2]
[1]University of Entrepreneurship and Law, Department of Marketing, Praha, Czech Republic
[2]Pan-European University, Faculty of Economics and Business, Bratislava, Slovak Republic
martin.cepel@vspp.cz
anna.kotaskova@paneurouni.com

Abstract: The aim of the article is to compare the impact of selected business risks on the threat of bankruptcy of small or medium-sized enterprises (SMEs) before COVID-19 and during the first wave of the COVID-19 pandemic. 688 SMEs from the business environment of the Slovak Republic participated in the research. Business risks, such as market, financial, personnel, operational and strategic risk were examined. Correlation and regression analysis were used to evaluate formulated hypotheses. The results yielded several significant findings. The three most important business risks before COVID-19 include market, financial and personnel risk according to entrepreneurs. Financial risk is the most significant business risk affecting the threat of bankruptcy in the SME segment in the Slovak Republic after the outbreak of COVID-19. The company's financial performance indicators and the ability of respondents to manage financial risk influence the threat of the company's bankruptcy more strongly during the pandemic. The findings are important for state organizations in mitigating the impacts of the COVID-19 pandemic on the business environment of SMEs in the Slovak Republic, as well as for entrepreneurs themselves and organizations that help SMEs.

Keywords: business risks, COVID-19, SMEs, financial risk, Slovak Republic, threat of bankruptcy

1. Introduction

The outbreak of the new coronavirus COVID-19 has led to a global public health catastrophe and to a global economic crisis and has severely affected industries around the world (Lu et al., 2021; Zhang & Sogn-Grundvåg, 2022). Many areas of activity were directly affected, not only tourism, passenger transport (Gazzeh et al., 2022), hospitality and catering services (Pocinho et al., 2022), but also many other negative phenomena have arisen, including fluctuations in the prices of financial instruments, information asymmetries, financial instability, corporate bankruptcies and rising unemployment (Boratynska, 2021).

Available research points to these most significant business risks: product sales (Zhou et al., 2021), financial performance/indicators (Ganlin et al., 2021) and the availability of human capital (Mikołajczak, 2021; Rozsa et al., 2021). SMEs are generally exposed to financial and non-financial risks, but the pandemic has added another risk of uncertainty to maintaining the continuity of their business (Zutshi et al., 2021). The impact of COVID-19 in the study on Polish SMEs was demonstrably more disruptive for micro-enterprises, very young companies and single-person companies (Wieczorek-Kosmala et al., 2021).

The case study maps changes in the risk perception of selected business risks to the threat of bankruptcy of SMEs. The results of the study are unique because they compare the perception of risk at the time of the economic peak (09/2019 to 03/2020) and at the time of the peak of the first wave of COVID-19 in the business environment of Slovakia.

The paper is structured as follows. The first part provides an overview of the latest available research studies mapping the impacts of the COVID-19 pandemic on the business environment of different countries with respect to the SME sector. The next part defines the aim, statistical hypotheses, methodology of the sample selection and describes the methods used in detail. The results of the study include an evaluation of the most significant business risks and the impact of business risks on the threat of bankruptcy of SMEs before and during the COVID-19 pandemic. Finally, the most important findings, the limits of this study and possible directions for future follow-up research activities are summarized.

2. Literature review

Significant political support for companies in the early stages of the COVID-19 crisis has prevented a major wave of corporate insolvency and corporate bankruptcies (Dorr et al., 2022). The pandemic directly threatened businesses as a result of forced lockdowns and an economic downturn. Due to the key role of SMEs in innovation (Kolková & Ključnikov, 2021; Erdei et al., 2022) and the economy (Civelek et al., 2020; Civelek et al., 2021;

Ključnikov et al., 2021), including export activities (Civelek & Krajčík, 2022; Ključnikov et al., 2022; Virglerova et al., 2020), their existential threat was the reason for the introduction of massive financial support schemes around the world (Oláh et al., 2019a; Oláh et al., 2019b; Torres et al., 2022). For example, a study on English companies shows that during the first and second waves of COVID-19 in 2020, up to 92.1% of the total volume of debt provided to companies was covered by the UK government, which is less than 5% under normal circumstances (Calabrese et al., 2022).

The authors Lu et al. (2021) presented a study from the Sichuan region in China in February 2020, the first country to experience the negative effects of the global pandemic. The subject of the research was the immediate impact of the pandemic on primary production, wholesale, retail, the accommodation and catering sector and the new economy industries. In a sample of 3,194 SMEs, there were significant differences in the effects of the pandemic, depending on the industrial sector. The manufacturing sector has faced poor logistics, and the problem of supply chain, in the wholesale and retail sectors an urgent need to accelerate the delivery of online services was created. The most affected hospitality sector showed cash flow shortfalls. All SMEs in the research reported a short-term decline in income, inability to continue working and production.

A study from a primary survey on a sample of 284 SMEs in Bangladesh showed that SMEs faced many problems due to COVID-19, mainly declining demand (92.96%), order cancellations (85.56%), liquidity crises (74.30%), delayed shipments, (72.53%), unsecured work environment (68.31%), lack of raw materials (63.73% and absence of employees (62.67%).SMEs recorded a 40% decrease in production volume compared to the year before the pandemic (Sarker et al.; Mura et al., 2021).

Interesting are the results of a study aimed at examining company-specific factors affecting financial distress and the potential for bankruptcy in the acute stage of the COVID-19 pandemic in a sample of approximately 9000 companies in 25 countries. Empirical results have shown a higher propensity for bankruptcy and corporate financial distress in companies with problematic access to financial resources, in younger companies and in more indebted companies. Financial failure is also affected by the size of the company and the years of experience of its managers (Bozkurt & Kaya, 2022; Szeiner et al., 2022).

A systematic analysis of 34 articles examining SMEs' practices for mitigating the pandemic crisis shows that the most frequently investigated issues regarding business risks were cost and financial problems, business disruptions and the existential problems of SMEs (Zutshi et al., 2021).

Large number of firms entered the pandemic with limited cash buffers what had a direct effect on their financial distress and risk of bankruptcy according to the Reserve Bank of Australia (2020). If it were not for the income support policies in the developed countries, business failures would have risen. For example, a recent study in France showed that the number of bankruptcies in the country decreased by 36% by 2020 compared to 2019 (Cros et al., 2021). Similarly, a study of a sample of around 1.5 million companies in Germany showed that without government support, smaller companies in particular would have gone bankrupt (Dorr et al., 2022).

3. Aim, methodology and methods

The aim of the article is to compare the impact of selected business risks on the threat of bankruptcy of small or medium-sized enterprises (SMEs) before COVID-19 and during the first wave of the COVID-19 pandemic.

The collection of the entrepreneurs´ attitudes was carried out using a questionnaire. Data collection took place in two phases: i. before COVID-19: in the period from 01.09.2019 to 04.03.2020; ii. during COVID-19: in the period from 11.05.2020 to 17.05.2020.

The statistical unit is characterized as an entrepreneur (owner or senior manager) of a small or medium-sized enterprise (SME), which operates in the business environment of the Slovak Republic (hereinafter referred to as the "respondent"). 688 SMEs completed the questionnaire; 368 (53.5%) before COVID-19 and 320 (46.5%) SMEs during COVID-19.

The Cribis database provides paid or publicly available information about companies, organizations and sole traders in the Slovak Republic. The procedure for applying the method of random selection of respondents from databases was as follows:

i. define and determine the basic set of respondents according to the selected criteria (up to 249 employees); ii. give each respondent a serial number (in alphabetical order); iii. generate random numbers using the mathematical function "Randbetween" (range of the function: lowest value - 1, largest value - total number of respondents); iv. assign individual respondents to randomly generated numbers; v. find out the telephone or e-mail contact of the respondent. The above procedure was applied to each NUTS III region of the Slovak Republic

The respondents´ were obtained by the method of questioning in the form of filling in the questionnaire in its online or printed version.

More than 10,100 SMEs in the Slovak Republic were contacted by e-mail; from 01.09.2019 to 31.12.2019 an average of 500 respondents per week. To increase the representativeness, the respondents were contacted by telephone in the period from 01.01.2020 to 04.03.2020. The above form ensured a ratio where the number of completed questionnaires for a given region to the total number of respondents in the region was approximately the same as the total number of respondents in the region to the total number of respondents in the whole SR.

Data collection also took place online in the form of inquiries through the MNFORCE SK & CZ panel, on a sample of 320 respondents (SR). The sample of respondents was created using a random selection of SMEs from the business environment of selected countries. The average questionnaire completion time was 11 minutes and 45 seconds. The criterion for selecting SMEs was the maximum number of self-employed persons in the sample, which could not exceed 60%. The following business risks were assessed using the Likert scale of answers (1 - strongly agree with the statement; ...; 5 - strongly disagree with the statement):

X1: I consider the market risk (lack of sales for my company) to be reasonable.
X2: Our company uses innovative ways to gain new markets and retain existing customers.
X3: I evaluate the financial performance of our (my) company positively.
X4: I can manage financial risk in my (our) company.
X5: I consider the personnel risk in the company to be adequate and it does not have a negative impact on my business.
X6: Indicate the most significant business risks (possibility to indicate max. 3 types of business risks).
Y: Our (my) company is not in danger of going bankrupt in 5 years.
To meet the aim of the article, the following statistical hypotheses were formulated:
H: Sales adequacy for the company (H_X1); using innovative ways to gain new markets or retain existing customers (H_X2); financial performance of the enterprise (H_X3); ability to manage financial risk (H_X4); the adequacy of the personnel risk in the company (H_X5) does not affect the threat of bankruptcy of SMEs before the COVID-19 (H1) pandemic and during the COVID-19 (H2) pandemic.

Linear regression modeling (LRM) was used to evaluate the formulated statistical hypothesis. LRM is a suitable statistical method because the selected variables (Y - dependent variable; X1, ..., X5 - independent variables) are the same metrics. The authors designed the questionnaire in such a way that if the respondents answered in agreement with the selected business risks, then the linear business is not in danger of business failure. The assumption of linearity was verified using a scatter plot. The assumption of a normal distribution was verified by calculating descriptive characteristics (skewness and sharpness).

If the skewness and kurtosis value were in the range of -2 to 2, then the assumption of a normal distribution is accepted (James, 1964). A correlation matrix was used to determine the relationship between the variables. Student's t-test was applied to verify the significance of the regression coefficients of the independent variables. The regression coefficient in the regression model is statistically significant if the p-value of the t-test is lower than the level of significance. The linear regression function has a general form:

$$Y = \beta_0 + \beta_1 \times X1 + \beta_2 \times X2 + \beta_3 \times X3 + \beta_4 \times X4 + \beta_5 \times X5 + \varepsilon_t, \quad (1)$$

where: Y – dependent variable (threat of bankruptcy); X1, ..., X5 – independent variables (selected business risks); β_0 – intercept; β_1; ...; β_5 – regression coefficients of independent variables; ε_t – random component.

We determine the quality of the regression model by calculating and interpreting the regression characteristics: Degree of freedom (DF); Sum of Squares (SS); Mean of Square (MS); Standard Error (SE); Multiple correlation coefficient (R); Coefficient of Determination (R^2) and adjusted R^2 (Adj. R^2); Sig - Significance; F-test (ANOVA). The coefficient of determination (R^2) gives the percentage explanation of the variability of the dependent variable,

which can be explained by the chosen regression model (Lancaster & Hamdan, 1964). The F-test was used to verify the statistical significance of the entire regression model (de Waal, 1977).

The required p-value of the F-test must be lower than the significance level (α = 0.05) for the LRM to be statistically significant. We verify the assumption of multicollinearity in the regression model using the Variance Influence Factor (VIF - test) (Liao & Valliant, 2012). If the value of the VIF test for the independent variable is less than 5, then this coefficient is not affected by multicollinearity (Arnold, S. F., 1980). Bartlett's test was used to verify the assumption of homoscedasticity. This assumption is accepted if the p-value of the Bartlett´s test criterion is higher than the level of significance (Snedecor et al., 1989). The presence of autocorrelation in LRMs has not been detected, due to the fact that it is not a time series data (Breusch, 1978).

Demographic structure of respondents (before COVID-19: n = 368 / during COVID-19: n = 320): company size: 106/61 small enterprises (from 10 to 49 employees), 216/201 micro-enterprises (up to 9 employees), 46 / 58 medium-sized enterprises (from 50 to 249 employees); legal form of enterprise: 59/161 self-employed, 266/113 limited liability company, 21/25 joint stock company, 22/21 other type of legal form; period of operation of the company in the business environment: 53/107 business up to 5 years, 52/77 business from 6 to 10 years, 263/136 business more than 10 years; gender: 253/173 men and 115/148 women; age of entrepreneur: 66/105 age of respondent up to 35 years, 79/96 age of respondent from 36 to 45 years, 106/81 age of respondent from 46 to 55 years, 117/38 age of respondent more than 55 years; position of respondent in the company: 285/192 business owner and 83/128 senior managers in the company.

4. Results and discussion

4.1 The most significant business risks

The total number of possible statements from respondents to claim X6 represented the following sample: 1104 responses before COVID-19 and 960 responses during COVID-19. Respondents used the opportunity to express their position a total of 837 times (75.8%) before COVID-19 and 660 times (68.7%) during COVID-19. The obtained results show that the respondents more often used the opportunity to mark several offered answers in the given question. The absolute and relative numbers of selected business risks listed by the respondents as the three most significant are summarized in the Table 1.

Table 1: Comparison of respondents´ assessment of the most significant business risks

Type of risk	Before COVID-19		During COVID-19	
Strategic risk	67	18,2%	50	15,6%
Market risk	201	54,6%	196	61,3%
Financial risk	130	35,3%	191	59,7%
Personnel risk	231	62,8%	94	29,4%
Legal risk	157	42,7%	60	18,8%
Operational risk	51	13,9%	69	21,6%
Number of respondents	368		320	
Chi-square test (p-value)	98,383 0,000			

Source: Own research.

The results show that the three most significant risks at the peak of economic growth were: personnel risk (62.8%); market risk (54.6%) and legal risk (42.7%). The three most significant risks at the time of the COVID-19 pandemic were: market risk (61.3%); financial risk (59.7%) and personnel risk (29.4%).

Furthermore, it can be stated that while respondents considered personnel risk to be the

most significant before COVID-19 (62.8%), during COVID-19, personnel risk was considered only the third most significant (29.4%). On the other hand, the number of respondents who rated financial risk as one of the three most important business risks almost doubled due to the COVID-19 pandemic (from 35.3% of respondents to

59.7% of respondents). The respondents' perception of the three most significant business risks changed due to the COVID-19 pandemic in the Slovak business environment (p-value = 0.000).

4.2 The impact of business risks before and during COVID-19 on the threat of corporate bankruptcy in the Slovak Republic

The results of the graphical analysis (scater plots) confirmed the linear relationships between the variables before COVID-19 and during COVID-19. The following table (see Table 2) summarizes the results of the descriptive statistics for each variable before and after COVID-19. The assumption of a normal distribution is fulfilled for each variable before and during COVID-19.

Table 2: Selected descriptive characteristics of business risks and corporate bankruptcy

DCH	Before COVID-19					
	Y	**X1**	**X2**	**X3**	**X4**	**X5**
Mean	2.5000	2.6386	2,5163	2,3668	2,1875	2,7283
SD	1.0849	0.9438	0,9958	0,9869	0,8386	1,0960
Skewness	-0.3681	-0.3223	-0,6516	-0,2864	0,0873	-0,8036
Kurtosis	0.3733	0.3286	0,1712	0,5626	0,4991	0,1805
DCH	**During COVID-19**					
	Y	**X1**	**X2**	**X3**	**X4**	**X5**
Mean	2.5875	2.6656	2.6344	2.8469	2.5188	2.7313
SD	0.9883	1.0373	1.0174	1.0437	0.9164	1.0488
Skewness	-0.3591	-0.7056	-0.2544	-0.6217	0.3196	-0.7101
Kurtosis	0.3138	0.4841	0.5656	0.3268	0.7806	0.3913

Note: DCH – Descriptive characteristics; SD – Standard deviation; Y, X1, …, X5 – variables. Source: Own research.

Table 3. summarizes the results of the pair dependencies between selected business risks as well as the results of the pair dependencies between selected business risk and the threat of bankruptcy before COVID-19 and during COVID-19.

Table 3: Correlation matrices of dependencies between variables before COVID-19 (CM1) and during COVID-19 (CM2)

CM1	Before COVID-19					
	Y	**X1**	**X2**	**X3**	**X4**	**X5**
Y	1					
X1	0.0838	1				
X2	0.2396	0.0860	1			
X3	0.3703	0.1690	0.3224	1		
X4	0.3070	0.2270	0.2590	0.4369	1	
X5	0.2337	0.1682	0.2288	0.2284	0.2750	1
CM2	**During COVID-19**					
	Y	**X1**	**X2**	**X3**	**X4**	**X5**
Y	1					
X1	0.1555	1				
X2	0.2673	0.2165	1			
X3	0.4279	0.3203	0.4047	1		
X4	0.3339	0.2787	0.4192	0.5028	1	
X5	0.2435	0.2889	0.2925	0.4090	0.3901	1

Note: Y- dependent variable; CM – Correlation matrix; X1, ..., X6 – independent variables. Source: Own research.

The results (see Table 3) from CMs confirmed rather weak positive dependencies between selected business risks (CM1: r ϵ <0.086; 0.4369>; CM2: r ϵ <0.2165; 0.5028>). According to the respondents, the strongest positive dependence is between the financial risk statements X3 and X4 (CM1: r = 0.4369; CM2: r = 0.5028). The strongest positive dependence is between the respondents' attitudes to the threat of a corporate bankruptcy and the company's positive financial performance (CM1: r = 0.3703; CM2: r = 0.4279). All of the above pairwise correlation coefficients are statistically significant at the level of significance.

The following tables summarize the results of the verification of the impact of selected business risks on the corporate bankruptcy by respondents who responded to the questionnaire before the COVID-19 pandemic (see Table 4: LRM1) and during the COVID-19 pandemic (see Table 5: LRM2).

Table 4: Verification of the impact of selected business risks on the threat of bankruptcy before the COVID-19 pandemic

LRM1 – Before COVID-19					
R	0.4320		*Adj.R²*	0.1754	
R^2	0.1866		*SE*	0.9852	
Verification of the significance of the LRM1					
ANOVA	**DF**	**SS**	**MS**	**F-ratio**	
Regression	5	80.6137	16.1227	16.610	
Residual	362	351.3863	0.9707	**Sig. (p-value)**	
Total	367	432		8.99E-15	
Statistical testing of regression coefficients					
Variables	**β**	**SE**	**t-Stat**	**Sig. (p-value)**	**VIF**
Intercept	0.914	0.221	4.128	0.000	
X1	-0.023	0.056	-0.400	0.690	1.073
X2	0.104	0.044	1.969	0.042	1.162
X3	0.278	0.060	4.632	0.000	1.328
X4	0.186	0.071	2.627	0.009	1.333
X5	0.117	0.050	2.334	0.020	1.135

Source: Own research.

The results (see Table 4) show that LRM1 is statistically significant (F-ratio: p-value = 8.99E-15). LRM1 explains 17.54% of the variability of the dependent variable. Statistically significant business risks are: use of innovative ways to acquire new markets or retain existing customers (X2; t-Stat: p-value = 0.042), positive perception of the company's financial performance (X3; t-Stat: p-value = 0.000), the ability to manage financial risk (X4; t-Stat: p-value = 0.009) and the adequacy of personnel risk in the company (X5; t-Stat: p-value = 0.020). The impact of the adequacy of sales of products/services for the company (t-Stat: p-value = 0.690) is not a statistically significant factor that would affect the threat of bankruptcy of SMEs. The linear regression function has the form:

$$Y = 0.914 - 0.023 \times X1 + 0.104 \times X2 + 0.278 \times X3 + 0.186 \times X4 + 0.117 \times X5, \quad (2)$$

where: Y – dependent variable (threat of bankruptcy); X1, ..., X5 – independent variables (selected business risks).

Multicollinearity is not present in LRM1 (see Table 4). Homoskedasticity was confirmed (Bartlett's test: p-value = 0.187). The normal distribution of deviations was confirmed by S-W test (S-W test: p-value = 0.267). Hypothesis H1_X1 cannot be rejected; hypotheses H2_X2, H1_X3, H1_X4 and H1_X5 were rejected.

Table 5: Verification of the impact of selected business risks on the threat of bankruptcy during the COVID-19 pandemic

LRM2 – During COVID-19					
R	0.4562		*Adj.R²*	0.1955	
R^2	0.2081		*SE*	0.8864	
Verification of the significance of the LRM2					
ANOVA	DF	SS	MS	F-ratio	
Regression	5	64.8474	12.9695	16.5074	
Residual	314	246.7026	0.7857	**Sig. (p-value)**	
Total	319	311.55		1.8E-14	
Statistical testing of regression coefficients					
Variables	**B**	**SE**	**t-Stat**	**Sig. (p-value)**	**VIF**
Intercept	1.104	0.197	5.615	0.000	
X1	-0.011	0.052	-0.207	0.836	1.169
X2	0.072	0.056	1.286	0.199	1.307
X3	0.302	0.059	5.097	0.000	1.551
X4	0.138	0.067	2.074	0.039	1.520
X5	0.042	0.054	0.778	0.437	1.311

Source: Own research.

The results (see Table 5) show that LRM2 is statistically significant (F-ratio: p-value = 8.99E-15). LRM2 is statistically significant (F-ratio: p-value = 1.8E-14). The proposed regression model explains 19.55% of the variability of the dependent variable. Statistically significant business risks are: positive perception of the company's financial performance (X3; t-Stat: p-value = 0.000) and the ability to manage financial risk (X4; t-Stat: p-value = 0.039). Statistically insignificant factors that do not affect the threat of bankruptcy of SMEs are the adequacy of sales of products/services for the company (X1; t-Stat: p-value = 0.836), the use of innovative methods to gain new markets or retain existing customers (X2; t-Stat: p-value = 0.199), the adequacy of personnel risk in the company (X5; t-Stat: p-value = 0.437). The linear regression function has the form:

$$\boldsymbol{Y} = 1.104 - 0.011 \times X1 + 0.072 \times X2 + \boldsymbol{0.302 \times X3} + \boldsymbol{0.138 \times X4} + 0.042 \times X5, \quad (3)$$

where: Y – dependent variable (threat of bankruptcy); X1, ..., X5 – independent variables (selected business risks).

Multicollinearity is not present in LRM2 (see Table 5). Homoskedasticity was confirmed (Bartlett's test: p-value = 0.314). Normal distribution of deviations was confirmed by S-W test (S-W test: p-value = 0.152). Hypotheses H2_X1, H2_X2, H2_X5 cannot be rejected; hypotheses H2_X3 and H2_X4 were rejected.

According to the respondents´ attitudes in the Slovak Republic before COVID-19, the perception of the threat of bankruptcy was influenced by indicators of market, financial and personnel risk. The impact of significant business risks is positive. The more positively the respondents perceive the individual indicators of selected business risks, the more positively they perceive the future of the company/business (the company is not in danger of bankruptcy). The company's financial performance indicators (financial risk indicator; β = 0.278) are the most significant business risks that have the greatest impact on the company's bankruptcy threat. Slightly less important is the ability to manage financial risk by respondents (financial risk indicator; β = 0.187), positive perception of the adequacy of personnel risk in the company (β = 0.117) and the least significant impact, but still statistically significant, is the use of innovative methods to gain new markets or retaining their customers (market risk, β = 0.104).

Indicators of financial risk according to the acquired respondents´ attitudes in the Slovak Republic during COVID-19 affect the perception of the threat of bankruptcy. The impact of market (X1: t-test: p-value = 0.836; X2: t-test: p-value = 0.199) and personnel risk (X5: t-test: p-value = 0.437) indicators was not confirmed. The impact of financial risk indicators is positive. Result: the more positive respondents perceive the individual financial risk indicators, the more positively they perceive the future of the company / business. The company's financial performance indicators (X3: β = 0.302) and the ability of respondents to manage financial risk (X4: β = 0.138) influence the threat of the company's bankruptcy. The strength of the impact of the company's financial performance indicators is more significant than the impact of the ability to manage financial risk on the threat of the company's bankruptcy (β = 0.302 / β = 0.138).

5. Conclusion

The aim of the article was to compare the impact of selected business risks on the threat of bankruptcy of small or medium-sized enterprises (SMEs) before COVID-19 and during the first wave of the COVID-19 pandemic.

The case study shows significant changes in the perception of business risks to the threat of bankruptcy before and during the COVID-19 pandemic. Research has its limitations. Partial data collection took place at the time of the first wave of COVID-19, it is possible that respondents' answers would have been different if they had been interviewed in the later stages of the 2-year pandemic.

Further research should focus on examining the perception of business risks towards the sustainability of SMEs in the SME segment after the end of the pandemic and return to normal and expand it territorially, e.g. other V4 countries. It could also be interesting to verify if there is a similar relationship between going bankrupt and the indicated variables if the variable is not the self-estimation of probability of bankruptcy but the real state of falling into bankruptcy as it was shown that sometimes being optimistic about future means falling into problems (see e.g. Forlicz, Rólczyński, 2019).

References

Arnold, S. F. (1980). Asymptotic validity of F tests for the ordinary linear model and the multiple correlation model. *Journal of the American Statistical Association, 75*(372), 890-894. doi.org/10.1080/01621459.1980.10477568

Boratynska, K. (2021). A New Approach for Risk of Corporate Bankruptcy Assessment during the COVID-19 Pandemic [Article]. *Journal of Risk and Financial Management*, *14*(12), 14, Article 590. https://doi.org/10.3390/jrfm14120590

Bozkurt, I., & Kaya, M. V. (2022). Foremost features affecting financial distress and Bankruptcy in the acute stage of COVID-19 crisis [Article; Early Access]. *Applied Economics Letters*, 12. https://doi.org/10.1080/13504851.2022.2036681

Breusch, T. S. (1978). Testing for autocorrelation in dynamic linear models. *Australian Economic Papers, 17*(31), 334-355. doi:10.1111/j.1467-8454.1978.tb00635.x

Calabrese, R., Cowling, M., & Liu, W. (2022). Understanding the Dynamics of UK Covid-19 SME Financing [Article]. *British Journal of Management*, *33*(2), 657-677. https://doi.org/10.1111/1467-8551.12576

Civelek, M., Gajdka, K., Světlík, J., & Vavrečka, V. (2020). Differences in the usage of online marketing and social media tools: evidence from Czech, Slovakian and Hungarian SMEs.E*quilibrium. Quarterly Journal of Economics and Economic Policy,* 15(3), 537–563. https://doi.org/ 10.24136/eq.2020.024

Civelek, M., Ključnikov, A., Fialova, V., Folvarčná, A., & Stoch, M. (2021). How innovativeness of family-owned SMEs differ depending on their characteristics? *Equilibrium. Quarterly Journal of Economics and Economic Policy, 16(2)*, 413–428. https://doi.org/10.24136/eq.2021 .015

Civelek, M., & Krajčík, V. (2022). How do SMEs from different countries perceive export impediments depending on their firm-level characteristics? System approach. *Oeconomia Copernicana,* 13(1), 55–78. https://doi.org/10.24136/oc.2022.002

Cros, M., Epaulard, A., & Martin, P. (2021). *Will Schumpeter catch COVID-19? Evidence from France*. https://hal.archives-ouvertes.fr/hal-03215379

de Waal, D. J. (1977). Asymptotic distributions for the elementary symmetric functions of two matrices under the assumption of linearity. *Journal of Multivariate Analysis, 7*(1), 223-228. doi:10.1016/0047-259X(77)90042-2

Dorr, J. O., Licht, G., & Murmann, S. (2022). Small firms and the COVID-19 insolvency gap [Article]. *Small Business Economics*, *58*(2), 887-917. https://doi.org/10.1007/s11187-021-00514-4

Erdei, E., Kossa, G., Kovács, S., Popp, J., & Oláh, J. (2022). Examining the Correlations Between Industry 4.0 Assets, External and Internal Risk Factors and Business Performance Among Hungarian Food Companies. Amfiteatru Economic, 24(59), 143–158. https://doi.org/ 10.24818/EA/2022/59/143

Forlicz, M., Rólczyński, T. (2019). Overdue debt and selected personality traits – a research based on international surveys. *Journal of International Studies,* 12(3), 198-211. doi:10.14254/2071-8330.2019/12-3/16

Gazzeh, K., Abubakar, I. R., & Hammad, E. (2022). Impacts of COVID-19 Pandemic on the Global Flows of People and Goods: Implications on the Dynamics of Urban Systems [Article]. *Land*, *11*(3), Article 429. https://doi.org/10.3390/land11030429

James, A. T. (1964). Distribution of matrix variates and latent roots derived from normal samples. *The Annals of Mathematical Statistics*, 35, 475-501

Ključnikov, A., Civelek, M., Fialova, V., & Folvarčná, A. (2021). Organizational, local, and global innovativeness of family-owned SMEs depending on firm-individual level characteristics: evidence from the Czech Republic. E*quilibrium. Quarterly Journal of Economics and Economic Policy*, 16(1), 169–184. https://doi.org/10.24136/eq.2021.006

Ključnikov, A., Civelek, M., Klimeš, C., & Farana, R. (2022). Export risk perceptions of SMEs in selected Visegrad countries. *Equilibrium. Quarterly Journal of Economics and Economic Polic*y, 17(1), 173–190. https://doi.org/ 10.24136/eq.2022.007

Kolková, A., & Ključnikov, A. (2021). Demand forecasting: an alternative approach based on technical indicator Pbands. *Oeconomia Copernicana*, 12(4), 863–894. https://doi.org/10.24136/oc.2021.028

Lancaster, H. O., & Hamdan, M. A. (1964). Estimation of the correlation coefficient in contingency tables with possibly nonmetrical characters. *Psychometrica,* doi:10.1007/BF02289604

Liao, D., & Valliant, R. (2012). Variance inflation factors in the analysis of complex survey data. *Survey Methodology,* 38(1), pp. 53-62.

Lu, L., Peng, J. L., Wu, J., & Lu, Y. (2021). Perceived impact of the Covid-19 crisis on SMEs in different industry sectors: Evidence from Sichuan, China [Article]. *International Journal of Disaster Risk Reduction*, *55*, 9, Article 102085. https://doi.org/10.1016/j.ijdrr.2021.102085

Mura, L., Zsigmond, T., & Machová, R. (2021). The effects of emotional intelligence and ethics of SME employees on knowledge sharing in Central-European countries. *Oeconomia Copernicana*, 12(4), 907–934. https://doi.org/10.24136/oc.2021.030

Oláh, J., Virglerova, Z., Popp, J., Kliestikova, J., & Kovács, S. (2019a). The assessment of non-financial risk sources of SMES in the V4 countries and Serbia. Sustainability, 11(17), 4806, 1–19. https://doi.org/10.3390/su11174806

Oláh, J., Kovács, S., Virglerova, Z., Lakner, Z., Kovacova, M., & Popp, J. (2019b). Analysis and comparison of economic and financial risk sources in SMEs of the Visegrad group and Serbia. Sustainability, 11(7), 1853, 1–19. https://doi.org/10.3390/su11071853

Pocinho, M., Garcês, S., & de Jesus, S. N. (2022). Wellbeing and Resilience in Tourism: A Systematic Literature Review During COVID-19 [Review]. *Frontiers in Psychology*, *12*, Article 748947. https://doi.org/10.3389/fpsyg.2021.748947

Reserve Bank of Australia. (2020). Box V: Business Failure Risk in the COVID-19 Pandemic. Financial Stability Review, October 2020. Available at: https://www.rba.gov.au/publications/fsr/2020/oct/box-b-business-failure-risk-in-the-covid-19-pandemic.html

Rozsa, Z., Belas, J., Khan, K., A. & Zvarikova, K. (2021). Corporate social responsibility and essential factors of personnel risk management in smes. *Polish Journal of Management Studies, 23*(2), 449-463. https://doi.org/10.17512/pjms.2021.23.2.27

Sarker, M. R., Rahman, S. M. A., Islam, A., Bhuyan, M. F. F., Supra, S. E., Ali, K., & Noor, K. M. A. Impact of COVID-19 on Small- and Medium-sized Enterprises [Article; Early Access]. *Global Business Review*, 14. https://doi.org/10.1177/09721509221093489

Snedecor, G. W. & Cochran, W. G. (1989), *Statistical Methods*, Eighth Edition, Iowa State University Press. ISBN 978-0-8138-1561-9

Szeiner, Z., Kovács, Ádám, Zsigmond, T., Mura, L., Sanders, E., & Poor, J. (2022). An empirical study of consulting in a transitional economy in the Central European region during COVID-19. *Journal of Eastern European and Central Asian Research (JEECAR)*, 9(3), 471-485. https://doi.org/10.15549/jeecar.v9i3.854

Torres, O., Benzari, A., Fisch, C., Mukerjee, J., Swalhi, A., & Thurik, R. (2022). Risk of burnout in French entrepreneurs during the COVID-19 crisis [Article]. *Small Business Economics*, *58*(2), 717-739. https://doi.org/10.1007/s11187-021-00516-2

Virglerova, Z., Kliestik, T., Rowland, Z. & Rozsa, Z. (2020). Barriers to internationalisation of SMEs in visegrad group countries. *Transformations in Business and Economics, 19*(3), 58-73

Wieczorek-Kosmala, M., Blach, J., & Dos, A. (2021). COVID-19 Interruptions and SMEs Heterogeneity: Evidence from Poland [Article]. *Risks*, *9*(9), 21, Article 161. https://doi.org/10.3390/risks9090161

Zhang, D., & Sogn-Grundvåg, G. (2022). Credit constraints and the severity of COVID-19 impact: Empirical evidence from enterprise surveys [Article]. *Economic Analysis and Policy*, *74*, 337-349. https://doi.org/10.1016/j.eap.2022.03.005

Zutshi, A., Mendy, J., Sharma, G. D., Thomas, A., & Sarker, T. (2021). From Challenges to Creativity: Enhancing SMEs' Resilience in the Context of COVID-19 [Review]. *Sustainability*, *13*(12), 16, Article 6542. https://doi.org/10.3390/su13126542

Zhou, R., Cai, Z., & Shen, L. (2021). Study on the financing efficiency of SMEs under the epidemic situation of COVID-19 based on DEA-malmquist model. Paper presented at the ACM International Conference Proceeding Series,143-147. https://doi.org/10.1145/3459012.3459035

A Framework for Social Business Models Analyses

Irene Ciccarino and Susana Rodrigues
CARME – Centre of Applied Research in Management and Economics. Polytechnic Institute of Leiria, Portugal
irene.ciccarino@ipleiria.pt
susana.rodrigues@ipleiria.pt

Abstract: Social entrepreneurial initiatives (SEI) answer problems and needs that otherwise would remain unattended. Therefore, they provide high collective interest social value achieved by a stable, reliable, and sustainable operation. Because the economic goal is a means to accomplish the social aim, it is hard to overcome resource constraints. SEIs must prove innovation and efficiency to access funding. However, the investment criteria are usually circumstantial or abstract. Additionally, the theory lacks the recommendation to enlighten how to increase the chances to be funded. The literature does not offer consensual, consistent, empirically tested criteria to compare business models. To help address these issues, this paper provides a Delphi analysis of a social business model taxonomy. The following criteria selected interviews from a broad study: 1) have qualitative and quantitative data recorded; 2) represent different SEIs' types in the taxonomy. Then, four invited scholars blindly reviewed the data. They are experts in social innovation, entrepreneurship, sustainability, and social psychology. Online meetings helped to solve doubts and build synthesis. All Delphi participants described their opinion about the taxonomy fit by e-mail. Results were also compared by previous statistical classification. The Delphi process happened from December 2020 to June 2021. The similarity between statistical and analytical results indicated that the taxonomy is an efficient tool to identify and compare elements of the social business model. The study made the taxonomy easier and more replicable, providing an analytical framework. Evidence can help social agents and investors to frame information and achieve better decision-making.

Keywords: social business models, PIM model, investment criteria, taxonomy, social initiatives classification

1. Introduction

Society faces multidimensional challenges while struggles to build a safe and sustainable path (Rockström and al, 2021). Problems increase faster than solutions, and traditional ways seems to fail in providing reliefs (Tate and Bals, 2018). Additionally, estimates points to a sustainable business potential worth at least US$ 12 trillion yearly until 2030. Since 2015, the United Nations have been fostering commitment to Sustainable Development Goals (SDGs) that work like parameter for best practices and impact assessment. However, they are hard to assess(Claro and Esteves, 2021).

Social entrepreneurship is a popular umbrella concept to initiatives that aim at sustainable development (Hossain *et al.*, 2017, Koehne *et al.*, 2022). It shows in the form of organizations, businesses, or projects whereby economic goals serve social ones. Social entrepreneurial initiatives (SEI) provide high collective interest social value achieved by a stable, reliable, and sustainable operation (Ciccarino *et al.*, 2019, European-Commission, 2016). However, social entrepreneurial literature does not offer consensual, consistent, empirically tested measures, nor criteria to compare its initiatives (Rawhouser *et al.*, 2019, Austin *et al.*, 2006). In general, the classifications available are conceptual and lack empirical testing (Rawhouser *et al.*, 2019, Barki *et al.*, 2020). And traditional analysesdo not fit in with this type of entrepreneurship since its operations and strategies are different (European-Commission, 2016, Ciccarino, 2021, Shaw and de Bruin, 2013).

There is a shortage of practical tools and techniques supported by the social entrepreneurial literature, which can mediate the relationship between investors and entrepreneurs. SEIs must be able to prove their business model innovation and sustainability to mobilize resources. However, neither entrepreneurs nor investors have reliable parameters based on theoretical consensus to support practice and decision-making (European-Commission, 2016, Ciccarino, 2021, Ciccarino *et al.*, 2019). This study describes four cases that fit a recently developed taxonomy PIM Model (Ciccarino, 2021), highlighting social managers narratives. Therefore, the paper provides contextualized evidence by a non-reductionist outlook (Dess and Davis, 1984).

Taxonomy is a tested and statistical validated way to represent the complexity of factors that happen simultaneously (Venkatraman and Prescott, 1990). The process of building it, reduces a vast array of possible combinations to a manageable set (Hambrick, 1980). PIM models distinguish and classify SEIs by significant differences in their business model factors and in their access to funding. PIM's three types are mutually exclusive, and each type's features (i.e., factors) can serve as a guideline to assess frailties and strengths in a

business model. This enables a better understanding between social agents and investors (Ciccarino, 2021, Venkatraman and Prescott, 1990) helping to find the best viable option for a social problems' treatment (Hossain et al., 2017, Seelos and Mair, 2005).

This research aims to analytically examine PIM Model (Ciccarino, 2021), comparing qualitative and statistical classifications to test its usefulness. Insights from the analyses can help to improve the PIM model and expand the ways of using it in further studies (Remenyi *et al.*, 1998, Ghauri, 2004, Tapio, 2002). It can make the taxonomy easier and more replicable, providing an analytical framework to help social agents, investors and scholars to frame information and achieve better decision-making (European-Commission, 2016, Humbrick, 1980).

2. Theoretical foundations

2.1 The challenge of systematizing knowledge

Social and traditional business models are similar in some market features, such as products and services creation and offers, customer and people management, and being a financially sustainable operation. However, the main difference of a social business is its core business, its purpose (Austin *et al.*, 2006). Social initiatives aim to offer society a solution to local demand that the government or other available structures cannot or do not mean to answer (Barki *et al.*, 2020, Mair *et al.*, 2012). The result is a substantial improvement in the living conditions, especially for the most vulnerable people. This provides new opportunities for access to products and services, in addition to employment and income creation (Seelos and Mair, 2005, Christensen *et al.*, 2019).

Social problems' alleviation is currently a central subject in business and public policies (Sachs *et al.*, 2021, Claro and Esteves, 2021) demanding collaborative and multidimensional solutions (Sachs *et al.*, 2021, Rockström and al, 2021). The resulting innovation is a combination of scarce resources in the generation of useful, accessible, and commercially desirable products and services (Kickul *et al.*, 2018, Seelos and Mair, 2005). However, if the initiative does not consider local idiosyncrasies the solutions can fall short, even worsening the situation. Only innovation and investment are not enough (Koehne *et al.*, 2022, Christensen *et al.*, 2019). That is why ways to enable the collaboration between investors and social initiatives became so important (Ciccarino *et al.*, 2019, Ciccarino, 2021).

Social entrepreneurship stands out as epistemology concerning social impact and sustainable development (Hossain *et al.*, 2017, Koehne *et al.*, 2022). The problem is that theory is still in a pre-paradigmatic stage (Hossain *et al.*, 2017) turning difficult properly identifying and comparing SEI (Rawhouser *et al.*, 2019, Austin *et al.*, 2006). Typologies and taxonomies aim at classification and comparison (Venkatraman and Prescott, 1990, Erpf *et al.*, 2019), but they are overlooked in social entrepreneurial research field. They are still conceptual, lacking empirical testing (Rawhouser *et al.*, 2019, Barki *et al.*, 2020). Without a structured way to systematize information, it is hard to accumulate knowledge, slowing theoretical advance. Additionally, without theoretical guidance, practice became less effective (European-Commission, 2016, Venkatraman and Ramanujam, 1986, Lee *et al.*, 2014). The shortage of practical tools and techniques supported by the social entrepreneurial literature increases complexity and subjectivity in the relationship between investors and social initiatives (European-Commission, 2016, Ciccarino, 2021, Ciccarino *et al.*, 2019) endangering or delaying social impact (Tate and Bals, 2018).

As far as we know, the only taxonomies in the social entrepreneurial research field that test hypotheses are those of Mair *et al.* (2012), Erpf *et al.* (2019) and Ciccarino (2021). The latter explicitly defines the unit of analysis and selection criteria, offering a structure for its replication (Venkatraman and Prescott, 1990, Venkatraman and Ramanujam, 1986, Lee *et al.*, 2014).

2.2 PIM model for social entrepreneurial classification

The PIM model (Ciccarino, 2021) applies Porter`s generic strategies (Porter, 1980) logic in social initiatives, as Zott and Amit (2007) have done before for entrepreneurial business models. Taxonomy is a structuration of patterns in an organizational concept (Venkatraman and Prescott, 1990), such as a business model (Teece, 2010). The focus on creating social value is a common point for some classifications of social entrepreneurship initiatives (Zahra *et al.*, 2009, Mair *et al.*, 2012) aligning them with the centrality of the theme on the business model (Osterwalder and Pigneur, 2011). Business models are ways to describe organizational architectures. They

explain the processes of creating and capturing value, in addition to highlighting strategic goals. Being constant and difficult to change, business models are more generic than strategies (Teece, 2010).

The PIM model relies on Osterwalder and Pigneur (2011) business model framework. It classifies SEI by assessing their differences in business model features such as 1) Innovative Value Proposition; 2) Innovation Capacity; 3) Resources Efficiency, and 4) Access to funding in the ecosystem (Ciccarino, 2021). Figure 1 structures PIM's for qualitative data collection.

BM	Factor	Variables	Question
Backstage	Access to funding in the ecosystem	Bank Support	What is your opinion on the level of access of the social initiative to the following resources?
		Access to credit	
		Private investment	
	Resources efficiency	Task allocation	To what extent is the number of employees or volunteers suitable for the volume of tasks?
		HR allocation (time)	To what extent is the time available for employees or volunteers to perform tasks properly suitable?
	Innovation Capacity	Learning Capacity	How does the social initiative encourage innovation? Does it more concerned with avoiding mistakes? Or does it encourage bold actions, even realizing failure risk? Why?
		Flexibility	How is social initiative structured? Does it emphasize command and control structures to promote productivity? Or does it emphasize flexibility to generate agile responses? To what extent does it encourage collaboration and creativity?
		Absorption capacity	How does the social initiative assimilate new processes or ways of work?
Frontstage	Innovative Value Proposition	Process innovation	How does social innovation happen in the social initiative? Innovation type of innovation: Radical, incremental (adaptations, improvements) Frequency.
		knowledge Innovation	
		Services Innovation	

Source: Adapted from Ciccarino (2021, p.40)

Figure 1: Qualitative data collection framework

Types are bunches of features, mutually exclusive and internally homogeneous, that must allow classification and comparison. The classification in a type shall be stable and relevant (Humbrick, 1980, Carneiro *et al.*, 1991). PIM is an acronym for *P*ersistent, *I*nnovative, and stuck in the *M*iddle. Statistically, a SEI can be Innovative or Persistent. When the classification is not possible, it is '*stuck in the middle*'(Ciccarino, 2021). This taxonomy is in line with the business model analysis of Zott and Amit (2007) and with Porter's generic strategies (1980). The business model steers the resources and the capabilities building (Teece, 2010) Efficiency-driven business models need an exploitation strategy and innovation-driven ones an exploration strategy. Moreover, it is difficult to balance cost-cutting decisions with risk-taken ones. Hence, mixing both tends not to be a big deal (Zott and Amit, 2007).

The innovative SEI can deal with the worst or the most neglected social problems. This allows mobilizing different stakeholders to sustain effective social change or to scale up. Hence, the solution can be riskier and more expensive. Because social entrepreneurship is bound to innovation "*If nothing changes, the increase of one unit in each predictor also increases the chance of SEI being an Innovative one*" (Ciccarino, 2021: 30). Persistent SEI are geared towards efficiency and survival. They have fewer resources, innovation capacity, and access to funding in the ecosystem than the others. Despite that, Persistent SEI can deal with hard social problems with innovation regarding risk and cost reduction. In other words: *"Persistent SEI innovate and serve beneficiaries to the extent of their installed capacity. Finally, the Stuck in the Middle SEI do less, using more installed capacity"* (Ciccarino, 2021, p. 31).

In this sense, PIM model classify SEI and comparatively identify their strengths and weaknesses. Hence, it helps investor or supporter to prioritize features like scale, risk, and degree of social change (Zahra *et al.*, 2009) and enables a better strategic choice (Zott and Amit, 2007). PIM answer the claim for tools that make this relationship easier, fair, and efficient (European-Commission, 2016).

> *"(…) it is unlikely that an investor will want to invest more resources in a SEI that already has it, but whose structure is less effective. Unfortunately, this logic is contradicted by common sense, which tends to seek apparently sustainable organizations, with partnerships already established and good access to resources. Thus, social investment does not go where there is more and better innovation, it goes where there is more capacity installed. The PIM model helps to correct this trend with an accuracy of 82.9%." (Ciccarino, 2021: 28)*

Figure 2 summarizes the PIM model, offering the analytical guideline used to classify the social business models.

Factors	Persistent SEI	Stuck in the middle SEI	Innovative SEI
Social value creation summary	Do more with few resources. It is the effective one.	Do well using more resources than anyone.	Do best, with more resources and the boldest innovation.
Business model	Efficiency-driven resource use	Inefficient resource use	Innovation-driven resource use, and the best resource use (do more with less).
Resources efficiency	Lower resources' availability. They have 50% fewer resources than other SEI.	Greater resources availability	Good resources availability
Innovation capacity	They have 50% less innovation capacity than other SEI.	Great innovation capacity, probably because this SEI has resources to take risks.	The biggest innovation capacity
Value proposition innovation	There is some innovation, but probably an efficient-driven value proposition.	The lowest innovative value proposition. Almost 7 times less innovative than Innovative SEI.	The most innovative value proposition.
Funding access	Lower funding access availability. They have 50% less funding access than other SEI.	Greater funding access availability	Good funding access availability

Source: Adapted from Ciccarino (2021).

Figure 2: PIM Model

Although, PIM model (Ciccarino, 2021) has analytical support by Zott and Amit (2007) research, the taxonomy description also finds great similarities with classifications posed by Erpf and Tekula (2019), and Zahra et al (2009), as shown in Figure 3. Therefore, the stuck in the middle can be a transitory condition or even can achieve performance parity in the long run (Porter, 1980, Dess and Davis, 1984). The fact is that the emphasis on the novelty of the social and entrepreneurial business model ends up forcing them to adapt to more robust management practices to access investment. Therefore, it becomes a movement of value creation through increased efficiency. But the opposite can also happen, by achieving innovation by efficiency-driven opportunity exploitation (Kickul *et al.*, 2018). The stuck in the middle is still not the most desirable type, but considering the deepest description, it can just be a traditional social organization in adaptation (Ciccarino, 2021), as shows the Figure 3 by the comparison with other social entrepreneurial classifications.

	PIM Model	Erpf and Tekula (2019)	Zahra et al (2009)
Unit of analysis	Business model	Organizational features	Social Entrepreneur
Types	Innovative SEI	Change promoting organization	Social Engineers
	Stuck in the middle	Service provider organization	Social Constructionist
	Persistent SEI	Philanthropic organization	Social Bricoleur

Source: Authors

Figure 3: Social entrepreneurship classification comparison

3. Methodology

This qualitative study focused on assessing the analytic capacity of Ciccarino´ (2021) PIM model (Dess and Davis, 1984). It analyses to what extent the statistical classification remains stable if PIM model was applied to qualitative data by pattern-matching (Ghauri, 2004). According to Zott and Amit (2007) the design of a business model is composed of elements such as content, structure, and governance. And its configuration is defined by the degree to which these elements are managed and interconnected. Therefore, a stable classification patterns can indicate validity and reliability (Humbrick, 1980, Carneiro *et al.*, 1991). Seelos and Mair (2005) used cases to exemplify social entrepreneurial features, as we use in this paper to offer the taxonomy description. Additionally, managers narratives are usual in studies aiming sustainability and social problem-solving (Claro and Esteves, 2021, Mair *et al.*, 2012).

This paper is part of a broader study that started in 2016. Case selection followed these criteria: 1) the same social initiative must have data available and identifiable from both data collection methods; 2) the selected case must represent different business model types. The amount of data available to characterize each case were equivalent and relevant, resulting in four cases social entrepreneurial initiatives (SEI). Interviews consulted some managers of social initiatives between July and December 2019. Additionally, some social initiatives identified themselves in the survey from November 2019 to February 2020.

Interviews data were framed into a social business model taxonomy by Delphi analysis. It is usually a remotely performed method that uses a series of sequential inquiries to build consensus by an iterative process interspersed with controlled feedback. Delphi is effective in achieving consensus when theory still lacks empirical evidence because it allows to merge the knowledge and abilities of a group of experts (Remenyi *et al.*, 1998, Ahmad and Wong, 2019). The method underlines convergences and divergences (Remenyi *et al.*, 1998, Tapio, 2002), proving to be useful in selecting and validating factors. Evidence from literature consider a consensus when the convergence is 75% or higher (Ahmad and Wong, 2019). Experts were contacted from December 2020. As usual, the selection process was by convenience to ensure proper participation until the end, but credentials were extensively checked (Tapio, 2002). Four scholars committed to the study, they proved experience in social innovation and entrepreneurship, sustainability, social psychology.

Experts received the tables presented in the theoretical foundations and the interviews' transcriptions. Two online meetings helped to solve doubts about the classification into the taxonomy (i.e., 13/02/2021 and 23/04/2021). Experts sent their answers by e-mail until 3rd may. Then, a table organized all the answers and the classification from statistical analyses. The second Delphi round was based on that Table. Experts provided further information about their classification until 8th June. Throughout the process, experts were encouraged to explain their points of view, avoiding the problem of oversimplification linked to the method (Tapio, 2002). Finally, an online meeting on 14th June 2021 allowed discussion and provided the synthesis presented in this paper. All experts received and approved by email the result until 23rd June.

4. Cases' analysis

4.1 SEI1 persistent

SEI1 assists people in situations of social or mental health vulnerability. It has an operating model that goes beyond fixed assistance at a headquarters, acting on the streets or in local communities to identify people in need of support. It works with different audiences, being at the forefront of different proposals of an innovative value proposition, even if the focus is the social exclusion of minorities. Based on the promotion of low-cost activities oriented towards culture, the enhancement of local communities' empathy and well-being, SEI1 can promote effective results by their actions, even though it is difficult to measure their impact. The innovation seems to be incremental and happens empirically, given the specificity of each public or difficulty encountered. The issue of resources efficiency seemed to be a challenge that directly affects the sustainability of the initiative.

4.2 SEI3 innovative

SEI 3 calls itself a voluntary "movement", with three main pillars: ending food waste, ending hunger, and involving the entire community in the process. It more than 50 branches and a local presence, totalling approximately, 7000 employees. According to the SEI3's vision, the innovative value proposition lies in the capacity to collect and redistribute food from partners, mapping families, and logistics for delivery. SEI3 aims at

circular economy principles, refusing business logic. It is proud to be not-for-profit. However, it achieves a mass scale value by a standardized operation that embraces a huge stakeholder mobilization. As noted in the studies of Zott and Amit (2007), business models focused on efficiency are more associated with the performance factor of an entrepreneurial company when resources are scarce and controlled than abundant, which can be seen in elements of E3's speech: "*We don't lack resources nor volunteers. We have a queue of people to volunteer.*" The well-design internal process deals with volunteer's turn-over.

4.3 SEI2 Stuck in the middle

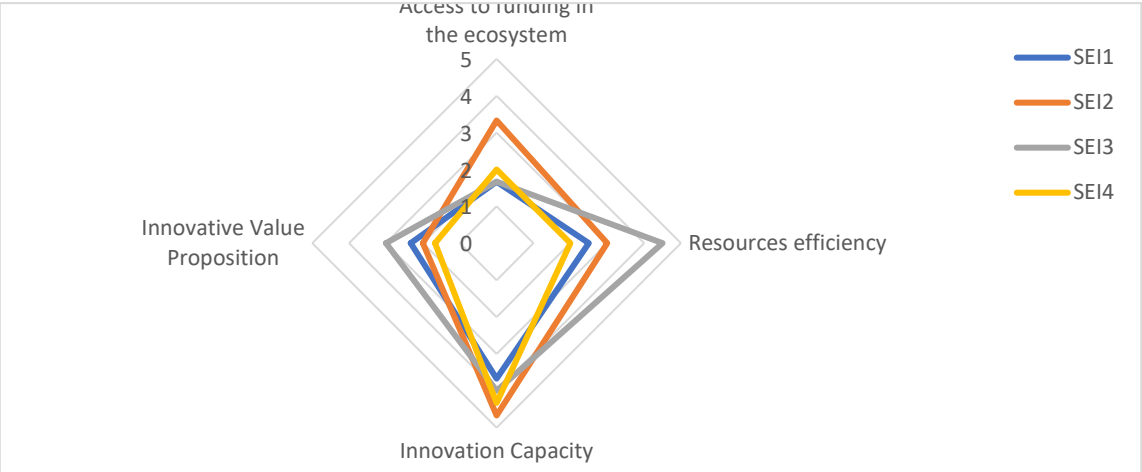
SEI2 is a non-profit association that rebuilds homes for people in need. It started by solving a problem observed in society as an innovative business model. It has already rebuilt hundreds of homes and institutions and mobilized thousands of volunteers inside and outside the country. Its innovative value proposition and innovation capacity rely on stakeholder mobilization. SEI2 resembles other models already implemented in the United States, showing elements of incremental innovation. However, SEI2 invests in new programs inspired by Team Building, and gamification. It can be seen in the speech that the business model continues to insert, over time, new value propositions. While the innovation process is constant, there is a strategic proposal evidenced toward efficiency building. SEI2 presents elements related to the positive association between the business model design, centred on novelty, and the development of scale by standardization. This efficiency-driven concern is justified in the narrative as a funding issue, since SEI2 has capitalized on investment in the early stage.

4.4 SEI4 the divergence

SEI4 is an initiative from a 145 years-old broader organization. SEI4 works in prisons to foster social transformation through training and development of skills related to musical and artistic areas. The project provides an alternative way of life and reinsertion, generating impacts in the community, family, and society. The initiative had different target audiences until being focused on prison communities. Innovation emerges from empathy and community demand against marginalization and prejudice. For the interviewee, social innovation happens naturally, in ways that Science does not even reach. SEI4 managerial elements are inspired by funding needs. The analysis of the SEI4´s resource efficiency shows concern about maintaining the project over time. "*maintaining a project of classical music is costly*".

4.5 Classifications comparison

The cases' analyses followed PIM model features, namely: 1) Innovative Value Proposition; 2) Innovation Capacity; 3) Resources Efficiency, and 4) Access to funding in the ecosystem (Ciccarino, 2021). The factors and questions from Figure 1 guided qualitative data examines to classify each SEI in a Type from the taxonomy. Accordingly, SEI can be Persistent, Innovative, or Stuck in the middle. Ciccarino (2021) performed the classification using statistics, and we tested if the qualitative data induces similar results. Figure 4 shows the SEIs comparison using the survey database of the PIM Model. PIM classify SEI1 and SEI4 as Persistent, SEI3 as Innovative, and SEI2 as stuck in the middle.



Source: Authors

Figure 4: Case's statistical classification

Table 2 summarizes the statistical and analytical classification. The narratives that support the classification presented in Table 2 are highlighted. The qualitative taxonomy replication was consensual and consistent except for SEI4.

Table 2: Classification's summary

	Persistent	Stuck in the middle	Innovative
PIM`s Hit Ratio	90.50%	88.56%	88.56%
PIM	SEI1 and SEI4	SEI2	SEI3
Research 1	SEI1		SEI3 and SEI4
Research 2		SEI2	SEI3 and SEI4
Research 3	SEI1	SEI2	SEI4
Research 4	SEI1 and SEI4	SEI2	SEI3

Source: Authors

"Innovative", and "Stuck in the Middle" SEIs consistently adhere to the PIM Model classification. It was possible to find a clear fit within categories. Regarding "Persistent" SEIs, further discussion was necessary. Besides SEI1 being quickly classified as Persistent, SEI4 provoked debate and was the most discussed classification. It persists in the cause of serving minorities through music, but that might not exactly be an innovative way to do it. However, SEI4´s core is essentially creative. Art can be an innovative value proposition. The point is that assisting minorities is, to a large extent, one of the most constant goals in social entrepreneurship initiatives, as well as resource constraints are usual issues. Maybe SEI4 is a case of the maturity life cycle. Efforts may have geared from innovation to more efficient use of resources due to survival and scale gain concerns. This need for more information to classify the case shed light on concerns about the speed of innovations, the desire to carry out an incremental innovation, and how this dynamic should be classified in a context of innovation capacity and/or scale achieved.

5. Discussion and conclusion

The study met the proposed goal of assessing the analytic capacity of PIM model (Dess and Davis, 1984) to assess in what extent the statistical classification remains stable if PIM model was applied to qualitative data (Humbrick, 1980, Carneiro *et al.*, 1991). Besides testing the PIM model's usefulness, this study also answers the need for more empirically tested tools from a social entrepreneurial standpoint (Ciccarino, 2021, European-Commission, 2016, Erpf *et al.*, 2019). Delphi analyses examined the consistency of the taxonomy to analyse qualitative data. Results highlight convergences, contradictions (Dess and Davis, 1984, Remenyi *et al.*, 1998) deepen the understanding about innovative value Proposition, innovation capacity, resources efficiency, and access to funding (Ciccarino, 2021) by social managers narratives (Claro and Esteves, 2021, Mair *et al.*, 2012).

PIM model (Ciccarino, 2021) relies on Porter`s generic strategies (Porter, 1980) logic in social initiatives, as Zott and Amit (2007) have done before for entrepreneurial business models. Although not all the cases analysed qualitatively have the same results as the statistical classification, the taxonomy seems to be an efficient tool for identifying key factors of SEIs' business models and comparing them. It corroborates Zott and Amit (2007) argument about business model configurations and reinforces the Taxonomy validity (Dess and Davis, 1984, Remenyi *et al.*, 1998). It was possible to visualize the narrative fit into the taxonomy. Among experts, the overall agreement rate was around 81.25%, expressively above benchmarking. (Ahmad and Wong, 2019). This rate is slightly higher comparing statistical classification (85%) reported by Ciccarino (2021).

By assuming a non-reductionist outlook, insights from the analyses improve the PIM model and expand its usefulness in further studies by providing frameworks (Remenyi *et al.*, 1998, Ghauri, 2004, Tapio, 2002). The study made the taxonomy easier and more replicable. The description of the PIM model and the cases´ narrative offers a structured way to collect and analyse information that can be easily replicated in other contexts. As far as we know, there are no models that provide these means of analysis for qualitative and quantitative data within the scope of the social entrepreneurship. Social initiatives and investors can benefit from PIM use, achieving better decision-making.

The study limitation is the usage of the qualitative data from PIM´s study to check its analytical application. But it also allowed the descriptive tables (Figure 1 and 2) that can be used to structure interviews in other contexts.

Results are also supported by a robust qualitative method based on specialists' opinion that contributes, enhancing the structural usage for data collection in future studies (Ahmad and Wong, 2019, Tapio, 2002).

Additionally, there is still space for PIM model improvement. For instance, enhance the description of inside factors with more examples, as provided by the four cases. The development shall achieve a qualitative gradation like the nine-box plot to help classification. This plot can also be helpful to give a sense of progress in analysing longitudinal data. Future studies can address these issues by collecting a large sample. Longitudinal data from a qualitative or quantitative source are important to verify the classification's stability and to understand changes over time, approaching the life cycle issue. Future studies can also explore PIM types, covering their differences in the entrepreneurial business model design.

Acknowledgements

“This work is financed by national funds through the FCT – Foundation for Science and Technology, I.P., under the project UIDB/04928/2020”.

References

"<adam smith paradox.pdf>".

Ahmad, S. and Wong, K. Y. (2019). "Development of weighted triple-bottom line sustainability indicators for the Malaysian food manufacturing industry using the Delphi method". *Journal of Cleaner Production,* 229**,** 1167-1182.

Austin, J., Stevenson, H. and Wei-Skillern, J. (2006). "Social and commercial entrepreneurship: same, different, or both?". *Revista de Administração,* 47**,** 370-384.

Barki, E., Rodrigues, J. and Comini, G. M. (2020). "Negócios de Impacto: Um Conceito em Construção". *Revista de Empreendedorismo e Gestão de Pequenas Empresas,* 9.

Carneiro, J., Cavalcanti, M. and Silva, J. F. (1991). "Os Determinantes da Sustentabilidade da Vantagem Competitiva na Visão Resource-Based". *ENANPAD.*

Christensen, C. M., Ojomo, E. and Dillo, K. (2019). "The prosperity paradox: How innovation can lift nations out of poverty", HarperBusiness.

Ciccarino, I., Rodrigues, S., Almeida, F. and da Silva, J. (2019). "Post crisis outcomes: how social entrepreneurship and social innovation is thriving in Portugal.". *RENT XXXIII - Research in Entrepreneurship and Small Business.*

Ciccarino, I. D. M. (2021). "PIM model for social business investment evaluation". *European Academy of Management - EURAM.*

Claro, P. and Esteves, N. (2021). "Sustainability-oriented strategy and Sustainable Development Goals". *Marketing Intelligence & Planning,* 39**,** 613-630.

Dess, G. G. and Davis, P. S. (1984). "Porter's (1980) Generic Strategies as Determinants of Strategic Group Membership and Organizational Performance". *Academy of Management Journal,* 7**,** 467-488.

Erpf, P., Tekula, R. and Neuenschwander, J. (2019). "Clustering social enterprises: an empirically validated taxonomy". *Social Enterprise Journal,* 15**,** 397-420.

European-Commission (2016). "Social Enterprises and their Eco-systems: Developments in Europe".

Ghauri, P. N. (2004). "Designing and conducting case studies in international business research". *Handbook of Qualitative Research Methods in International Business. EE – Edward Elgar Publishing*.

Hambrick, D. C. (1980). "Operationalizing the concept of business-level in strategy in research". *Academy ot Management Review* 5**,** 567-575.

Hossain, S., Saleh, M. A. and Drennan, J. (2017). "A critical appraisal of the social entrepreneurship paradigm in an international setting: a proposed conceptual framework". *International Entrepreneurship and Management Journal,* 13**,** 347-368.

Humbrick, D. C. (1980). "Operationalizing the Concept of Business-Level Strategy in Research". *Academy of Management Review,* 5**,** 567-575.

Kickul, J., Griffiths, M., Bacq, S. and Garud, N. (2018). "Catalyzing social innovation: is entrepreneurial bricolage always good?". *Entrepreneurship & Regional Development,* 30**,** 407-420.

Koehne, F., Woodward, R. and Honig, B. (2022). "The potentials and perils of prosocial power: Transnational social entrepreneurship dynamics in vulnerable places". *Journal of Business Venturing,* 37.

Lee, M., Battilana, J. and Wang, T. (2014). "Building an infrastructure for empirical research on social enterprise: Challenges and opportunities". *Social Entrepreneurship and Research Methods,* 9**,** 241-264.

Mair, J., Battilana, J. and Cardenas, J. (2012). "Organizing for Society: A Typology of Social Entrepreneuring Models". *Journal of Business Ethics,* 111**,** 353-373.

Osterwalder, A. and Pigneur, Y. (2011). "Business Model Generation"*,* New Jersey, John Wiley & Sons, Inc.

Porter, M. E. (1980). "Competitive Strategy: Techniques for Analysing Industries and Competitors"*,* New York, The Free Press.

Rawhouser, H., Cummings, M. and Newbert, S. L. (2019). "Social Impact Measurement: Current Approaches and Future Directions for Social Entrepreneurship Research". *Entrepreneurship Theory and Practice,* 43**,** 82-115.

Remenyi, D., Williams, B., Money, A. and Swartz, E. (1998). "Doing Research in Business and Management: An Introduction to Process and Method", Kindle, SAGE Publications.

Rockström, J. and al, e. (2021). "Identifying a Safe and Just Corridor for People and the Planet". *Earth's Future,* 9.

Sachs, J. D., Kroll, C., Lafortune, G., Fuller, G. and Woelm, F. (2021). "Sustainable development report 2021.". *Cambridge University Press*.

Seelos, C. and Mair, J. (2005). "Social entrepreneurship: Creating new business models to serve the poor". *Business Horizons,* 48**,** 241-246.

Shaw, E. and de Bruin, A. (2013). "Reconsidering capitalism: the promise of social innovation and social entrepreneurship?". *International Small Business Journal: Researching Entrepreneurship,* 31**,** 737-746.

Tapio, P. (2002). "Disaggregative policy Delphi using cluster analysis as a tool for systematic scenario formation". *Technological Forecasting & Social Change,* 70**,** 83–101.

Tate, W. and Bals, L. (2018). "Achieving Shared Triple Bottom Line (TBL) Value Creation: Toward a Social Resource-Based View (SRBV) of the Firm". *Journal of Business Ethics,* 152**,** 803-826.

Teece, D. J. (2010). "Business Models, Business Strategy and Innovation". *Long Range Planning,* 43**,** 172-194.

Venkatraman, N. and Prescott, J. E. (1990). "Environment-strategy coalignment: An empirical test of its performance implications.". *Strategic Management Journal,* 11**,** 1-23.

Venkatraman, N. and Ramanujam, V. (1986). " Measurement of business performance in strategy research: a comparison of approaches.". *Academy of Management Review,* 11**,** 801-814.

Zahra, S. A., Gedajlovic, E., Neubaum, D. O. and Shulman, J. M. (2009). "A typology of social entrepreneurs: Motives, search processes and ethical challenges". *Journal of Business Venturing,* 24**,** 519-532.

Zott, C. and Amit, R. (2007). "Business Model Design and the Performance of Entrepreneurial Firms". *Organization Science,* 18**,** 181-199.

Benefits of CSR Through Quinoa Biotrade in South American Communities

Franklin Cordova-Buiza[1], Jesus Julio Antaurco-Perez[2], Braulio Edson Espinoza-Prieto[2] and Lucero Nicole Huerta-Tantalean[2]
[1]Research and Innovation Department, Universidad Privada del Norte, Lima, Peru
[2]Business Faculty, Universidad Privada del Norte, Lima, Peru
franklin.cordova@upn.edu.pe
N00046345@upn.pe
N00078750@upn.pe
lucerohuerta05@hotmail.com

Abstract: In recent years, the demand for organic, native products with high nutritional value, that do not contain any type of chemicals or preservatives and that have a certification, has increased. On the other hand, the sustainable development of companies, producers and agricultural areas do not keep pace with this growth. At the same time, companies have begun to make efforts to improve their corporate image by carrying out activities for the benefit of the communities. The main objective of this research is to identify what is known about the benefits of Corporate Social Responsibility (CSR) through the biotrade of quinoa in South American communities in the scientific literature between the years 2010 to 2020. In addition, it specifically focuses on the importance of CSR in quinoa-producing communities and the benefit of Fair-Trade certification in the populations. This way, the models and strategies found can be replicated in the future. Therefore, a systematic review of the literature was carried out, where information was collected on the CSR and Fair-Trade variables following the PRISMA statement (identification, screening, eligibility and included). For which four databases were used, such as: Redalyc, Ebsco, Google Scholar and Scielo; Finally, under the inclusion and exclusion criteria, 22 scientific articles were selected for this work. The results obtained show that companies that incorporate CSR have better management and a positive impact on the community, in the same way, fair-trade improves the quality of life of the producing community and provides environmental benefits. Finally, The research concludes that CSR through the biotrade of quinoa allows development and progress of the producing communities in South America, improving aspects of education and increasing jobs; at the same time, it generates value and increases the image of organizations. More studies focused on CSR in specific communities and the analysis of their adaptation to the context of the pandemic are recommended.

Keywords: Biotrade, communities, CSR, quinoa

1. Introduction

In recent years, quinoa, also called the "sacred grain of the Incas", has been gaining consumers worldwide and even more so on the European continent; being the main producing area the province of San Román in Puno-Peru. Quinoa is an Andean grain with high nutritional value originating from the Altiplano (Peru-Bolivia) and that for more than 5000 years has been part of the diet of the inhabitants of the high Andean areas of ancient Peru, Bolivia, some areas of Ecuador, Chile and Argentina (Ministry of Culture and Irrigation [MINAGRI], 2017). The main European countries such as: France, United Kingdom, Italy and Germany are the ones with the highest consumption in terms of organic products, for this reason the demand for these products grows exponentially. Likewise, the new generation of consumers values organic products more and are willing to pay more money for organic and quality products (Córcega Sutta and Machaca Lima, 2018).

In this context, Fair-Trade is important since it will allow a commercial relationship on good terms, with transparency, trust and respect between the consumer and the producer, benefiting the sustainable development of producers (Laguna, 2008). In addition, with globalization, the production and commercialization process must have optimal management in the value chain process, where all the agents that intervene are well defined and interconnected, since currently value chains are not being established in a standardized way (Inocente Vera and Lara Baldeón, 2019).There are environmental indicators for various crops such as cocoa or coffee, but there is no evidence of research work on quinoa crops that serve as a guide to identify relevant indicators in production and in the increase in crop area in recent years (Pinedo Taco, Gómez Pando and Julca Otiniano, 2017).

Therefore, biotrade is presented as a recent business model that includes marketing products from regions with great biodiversity, allowing to protect and give value to biological resources, and reduce poverty and inequality of rural populations (Lupaca Nina, 2018). Also considering that the vast majority of companies

globally are focusing on Corporate Social Responsibility (CSR), which is a strategy to promote the development of a community, raise awareness and give companies another direction; at the same time, it generates value and improves its corporate image in the community (Laura Castillo, 2017). For all of the above, the general problem of the research is: What is known about the benefits of CSR through the biotrade of quinoa in South American communities in the scientific literature between the years 2010 to 2020? In addition, the specific problems identified are: how important is CSR in the quinoa-producing communities? And what benefit does the Fair-Trade certification bring to the quinoa-producing communities? Bearing in mind that one of the problems that the quinoa producer associations have had, has been the drop in quinoa prices due to the use of pesticides in the production areas, receiving the denial of their entry into various international markets and causing a decline in the economy of quinoa producers in Puno (Limache Yanque, 2018). Therefore, the main objective of the research is to identify what is known about the benefits of CSR through biotrade of quinoa in South American communities in the scientific literature between the years 2010 to 2020. The specific objectives are to identify how important is CSR in the quinoa-producing communities and to present the benefits that Fair-Trade certification brings to quinoa-producing communities.

2. Methodology

The present investigation corresponds to a systematic review of the literature, carrying out an exhaustive analysis based on different research articles, the results obtained were disclosed in a descriptive manner. The PRISMA protocol was used, which "focuses on the ways in which authors can ensure transparent and complete reporting of reviews and meta-analyses" (Liberati et al., 2009, p. 2). Four databases were used among them: Redalyc, Metasearch - Ebsco Discovery (UPN-Universidad Privada del Norte), Google Academic and Scielo. For a detailed search of information, the following terminologies were defined for each database: Redalyc ("exportable demand" and "quinoa biotrade"), Metasearch - Ebsco Discovery (UPN) ("sustainability" and "quinoa biotrade"), Google Scholar ("quinoa biotrade", "social responsibility" and "sustainability") and Scielo ("quinoa biotrade"). The inclusion criteria were defined by databases and search engines: scientific articles, theses, research books, Spanish and English language, and a maximum time range of 11 years old (2010-2020), with the exception of one article from 2008 that gathered interesting data for research. The exclusion criteria were media and sources of information that do not belong to the established time range, research articles that do not present a research methodology similar to ours, and articles with irrelevant information. In the first search phase, 467 articles were obtained, applying the inclusion criteria for analysis, a total of 41 articles were obtained, of which 22 scientific articles were finally included in the investigation, 5 articles from Redalyc, 2 articles from Metasearch - Ebsco Discovery (UPN), 14 articles from Google Scholar and 1 article from Scielo, respectively (Figure 1).

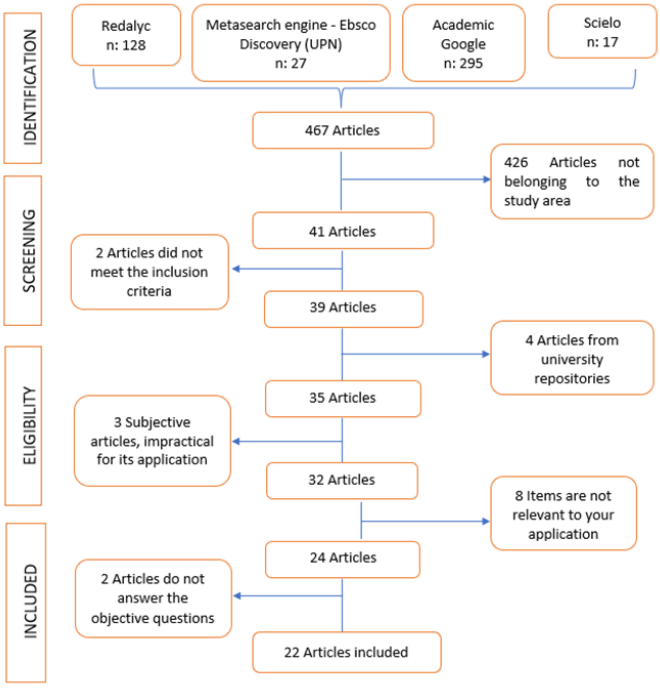


Figure1: Systematic review flow diagram (original elaboration)

3. Results

22 scientific articles were selected for this research, these were ordered and distributed in blocks for a better understanding according to the Author, Title, Database, Country and Approach.

Table 1: Total articles included in the review according to the keywords used

Author and Year	Qualification	Database	Country	Approach
Aguilera Castro and Puerto Becerra (2012)	Crecimiento empresarial basado en la Responsabilidad Social	Redalyc	Colombia	The article addresses issues of corporate social responsibility, contrasting with the reality between the company and the community, and its growth.
Balboa Urbano (2019)	Consorcios de exportación: empresas productoras de quinua en San Román, Puno	Academic Google	Peru	International demand for quinoa and its impact on export consortia formed as quinoa producers.
Barreto Rodríguez, Canto Sáenz and Julca Otiniano (2017)	Sostenibilidad ecológica de la producción agropecuaria tradicional de Carhuaz, Áncash, Perú	Academic Google	Peru	Ecological sustainability and traditional agricultural production, making known the productive reality of these peasants and their productivity.
Barrezueta Unda (2015)	Introducción a la sostenibilidad agraria: con enfoque de sistemas e indicadores	Academic Google	Ecuador	Social, economic and environmental approaches, related to the sustainable development of agrarian systems and their indicators.
Bolívar (2011)	Metodologías e indicadores de evaluación de sistemas agrícolas hacia el desarrollo sostenible.	Academic Google	Venezuela	Evolution of sustainable agriculture and its contrast with the usual performance of agricultural communities and their projected level of performance. As well as social programs and strategies that support sustainable development.
Cáceres Chávez and Loayza Díaz (2016)	Comercialización de Quinua Negra Orgánica vía Comercio Justo	Academic Google	Peru	Quinoa productivity, external factors, evolution and trend. Likewise, it proposes the study of the market regarding exports to the European market and the fair market.
Jiménez, Cárdenas and Soler-Tovar (2017)	Biocomercio en el contexto suramericano: Colombia y Perú como estudios de caso	Scielo	Colombia	Sustainability of biotrade resources and the development of strategies that generate greater benefits for local communities.
Chura Javier and Apaza Mamani (2019)	La gestión empresarial en las cooperativas Exportadoras de Quinua en la Región Puno en el año, 2019	Academic Google	Peru	Demand for quinoa for export in the international market, as well as the business management of these cooperatives made up of farmers.
Córcega Sutta and Machaca Lima (2018)	Plan de negocios para la comercialización de Quinua orgánica de la provincia de Caylloma con Certificación de comercio justo al mercado alemán.	Academic Google	Peru	Market studies for the commercialization of quinoa in the international market, taking into account its development and production.
Cruz, Joffre and Winkel (2015)	Racionalidades campesinas en los Andes del Sur: reflexiones en torno al cultivo de la quinua y otros cultivos andinos	Academic Google	Argentina	Social and environmental factors that influence agricultural production in the communities, as well as the sustainability of its production to market it in the foreign market and the benefit it generates.

Author and Year	Qualification	Database	Country	Approach
Gutiérrez Ríos and Surco Ocas (2020)	Efecto positivo del Comercio Justo en la comunidad puneña con respecto a las exportaciones de quinua hacia Francia, dentro del marco de vigencia del Acuerdo Comercial entre Perú y la Unión Europea, durante los años 2008 – 2018	Academic Google	Peru	It refers to the positive effects obtained by the quinoa export trade, an article that covers issues of sustainability and impact, important for its use.
Guzmán Bautista (2013)	Competitividad de la quinua perlada para exportación: el caso de Puno	Redalyc	Peru	Exportable offer of quinoa, analysis of Porter's 5 forces, relevant to the investigation for its complete analysis regarding the export of quinoa.
Inocente Vera and Lara Baldeón (2019)	Análisis de la cadena de valor de las empresas exportadoras de quinua orgánica de Puno a fin de aumentar su competitividad al mercado alemán del 2012 al 2017	Academic Google	Peru	It covers issues of exportable supply of quinoa, making an analysis of the value chain and its efficiency with respect to exporting companies and their supply.
Pinedo Taco, Gómez Pando and Julca Otiniano (2017)	Indicadores de sostenibilidad de sistemas de producción de quinua en Chiara, Ayacucho	Ebsco	Peru	It deals with qualitative and quantitative indicators related to the economic-social aspects of the production and commercialization of quinoa. Likewise, it reveals the degree of sustainability that they generate towards these producing communities.
Laguna (2008)	Grano pequeño, mercado pequeño, grandes apuestas: estudiando los límites de la regulación estatal francesa del comercio justo a partir del caso de la quinua	Academic Google	Bolivia	It understands the reality of the production and commercialization of quinoa in the market, as well as its importance and transparency on the part of the communities that transcends in its impact.
Laura Castillo (2017)	La responsabilidad social empresarial para alcanzar la ventaja competitiva de los productores de quinua de la provincia de San Román, periodo 2013 - 2014	Academic Google	Peru	Corporate social responsibility and the relationship it has with the benefits received by quinoa producers.
Limache Yanque (2018)	Análisis del proceso de exportación y su incidencia en la comercialización en el mercado internacional de los productores de quinua en la región puno, periodo 2014 – 2015	Academic Google	Peru	Analysis of exportable supply and its impact on quinoa with respect to its production and sustainability.
Lupaca Nina (2018)	El biocomercio de la quinua en el mercado global y sus efectos en los agricultores locales en Perú. Estudio de caso:	Academic Google	Peru	The impact of quinoa biotrade on farmers. It proposes a complete analysis that studies a group of interest and the benefits they perceive acclimated to their reality.

Author and Year	Qualification	Database	Country	Approach
	Cooperativa Agroindustrial Cabana (COOPAIN) Puno			
Ministry of Culture and Irrigation [MINAGRI] (2017)	La Quinua: Producción y comercio del Perú. Lima: Dirección de Estudios Económicos e Información Agraria	Ebsco	Peru	Production and marketing of quinoa for export in the international market, an analysis of the production situation of agricultural communities from their own reality.
Pinedo Taco, Gómez-Pando and Julca-Otiniano (2018)	Sostenibilidad de sistemas de producción de quinua (Chenopodium quinoa Willd.)	Redalyc	Peru	Sustainability and production of quinoa, an analysis of both local and international demand. It exemplifies the impact that commercialization has on producer communities.
Chirinos Araque and Pérez Peralta (2016)	Responsabilidad Social Universitaria: Emprendimiento sostenible como impacto de intervención en comunidades vulnerables	Redalyc	Colombia	Design and creation of social responsibility programs towards communities and their development. It supports the importance of social responsibility and its application.
Volpentesta (2012)	Las acciones sociales en empresas con responsabilidad social	Redalyc	Argentina	Corporate social responsibility and the activities carried out. Impact generated by the projects in the communities or interest groups.

3.1 Benefits of Corporate Social Responsibility-CSR through biotrade of quinoa in South American communities in the literature of the last 10 years

To answer the main research question, it is important to know what is meant by CSR and its application. Aguilera Castro and Puerto Becerra (2012) indicate that CSR is a new alternative to "compete", based on transferring added value to society and hoping that in the medium or long term it will become a source of competitive advantage. In this way, companies and/or legal entities allocate part of their resources to the benefit of the community, generating a benefit for both parties in a given time, which can be understood as a development and growth option for the company, facing the competition and high levels of oversupply, as for society.

Regarding the application of CSR, it can vary according to the objectives of the companies; in the research process, it was possible to verify the efficiency that it had in relation to its objectives and activities with the communities, understood as a shortage in the integration of CSR in its constant actions.

However, it is worth mentioning that these CSR projects not only generate an impact in the communities, since they serve as a support and innovation system for many universities; generating social responsibility and sustainability projects aimed at different communities. In such a way that the vision of sustainable entrepreneurship must be included in the framework of university social responsibility since it will allow the creation of strategies, provide value to human beings and at the same time encourages a better use of advanced technological resources and own production adapted to the requirements of the environment (Chirinos Araque and Pérez Peralta, 2016). Becoming an inspiring model that serves for research and entrepreneurship; providing the necessary tools to obtain much more favorable results.

3.2 Importance of Corporate Social Responsibility-CSR in quinoa-producing communities

The research revealed that those companies that do present strategies linked to the mission and vision of CSR notably demonstrate better management and a positive impact on the community. "In these companies the predominant idea is that carrying out actions in the social field means a real opportunity to generate processes of change and recovery of capacities of those who are their beneficiaries" (Volpentesta, 2012, p. 10).

According to the analysis obtained by the selected articles, they place great emphasis on the positive impact on these agricultural communities; as in the case of COOPAIN Cabana, leader in the production of organic quinoa in Peru, and where the quinoa producers of Cabana, by forming the cooperative through associative strategies, were able to gain experience, standardize their production from traditional quinoa to organic quinoa and improve their income (Laura Castillo, 2017). Demonstrating that the correct management of CSR strategies, focused on generating better performance and benefit in the communities, produces a positive effect for both, represented as a competitive advantage.

Finally, Lupaca Nina (2018) reveals that "the same peasant exports and has better income, in such a way that it has allowed improving the welfare of the poor peasant farmer and his community, promoting employment and developing a sustainable economy" (p. 59), exemplifying that these strategies positively favor the peasant and his environment.

3.3 Benefit of the Fair-Trade certification to the quinoa producing communities

According Gutiérrez Ríos and Surco Ocas (2020), fair-trade greatly favors the producing communities that sell products under this certification, since it makes it easier for customers to pay a fair price even compared to a price above the market because they are aware of the quality of the product; it benefits the development of society, to be more precise, the quinoa-producing communities, so there is gender equality both in optimal working conditions and in equal pay between men and women.

In addition, fair-trade by improving the quality of life of the community helps to protect children since it prohibits child exploitation, it also makes the entire process of extraction and production of quinoa friendly to the environment.

The implementation of the fair-trade certification for organic quinoa in the province of Caylloma involved adopting various challenges that were related to the development of care for the environment, good agricultural practices, corporate social responsibility, benefit of the primary needs in the society, forced labor, among other aspects; being the main benefit the opening of new market segments (Córcega Sutta and Machaca Lima, 2018).

Similarly, Laguna (2008) indicates that this certificate generates a competitive advantage for farmers, since they can expand their market and position themselves against large companies.

4. Discussion

Next, a brief argument about the opinions and points of view of the most relevant authors of this research is presented.

The results obtained by Chirinos Araque and Pérez Peralta (2016); and Aguilera Castro and Puerto Becerra (2012) agree that the creation of these CSR projects in the communities generates a long-term benefit. In addition, these not only offer a positive perspective for the community, but also favor the company, providing new research studies that can be replicated in the future by universities.

Regarding the importance of CSR in the quinoa-producing communities, Volpentesta (2012) mentions that it is a great opportunity in the processes of transformation and organizational change, which can affect success if the integration of CSR in its processes is not considered. In addition, Laura Castillo (2017) states that the associativity of processes and resources fosters a beneficial approach for farmers and the community.

CSR in producing communities presents a series of positive results, as mentioned by Lupaca Nina (2018) since these changes have improved the well-being and quality of life in general of the quinoa-producing peasants, promoting the development of their community and employment. In comparison with Laguna (2008) who concludes that Fair-Trade Certificates are of greater importance, since they propose to encourage small businesses and merchants to compete in a more competitive market; becoming an opportunity to face the big companies that intend to monopolize the market with their prices and scale production.

Finally, Córcega Sutta and Machaca Lima (2018) and Gutiérrez Ríos and Surco Ocas (2020) agree on the fact that these certificates not only aim to support farmers to be able to reach the fair market price and promote

gender equality between men and women, but also generate a positive contribution to their environment, since they seek to adopt new measures to take care of the environment and thus achieve a high-quality product. These good practices help merchants to gain a good image in the market and support the CSR projects in their communities.

5. Conclusions

It is concluded that the benefits of CSR through biotrade have significantly improved the quality of life of the inhabitants of the quinoa-producing communities; being reflected mainly in education, since children currently attend schools more frequently, it can also be said at the housing level, that these have had a great improvement, since now more than 80% have access to an electrical network and almost 50% have a good drinking water service.

CSR is very important since it contributes to the development and progress of the quinoa-producing communities, being reflected mainly in achieving greater access to education and basic services, improvements in working conditions and having an equitable participation of men and women in terms of to land production.

On the other hand, the fair-trade certificate allows the quinoa-producing communities in South America the benefit of being able to sell their products at a good price in accordance with the criteria and demands of the market, substantially improving the quality of life of the inhabitants; taking advantage of these certificates directly benefits these producers since it means an improvement in the quality of life and the development of their communities.

Finally, in relation to the research work, it is recommended to use this review as a basis for future research more specifically within the rural communities of Peru, for example, in the community of San Román in Puno, where a large concentration of peasants dedicated to the production of quinoa constituted as a Cooperative. Likewise, investigate the development of CSR through the biotrade of quinoa during the context of the pandemic. The main limitation of the research was that certain research articles were not open access, which prevented full reading for review.

References

Aguilera Castro, A. and Puerto Becerra, D. P. (2012) “Crecimiento empresarial basado en la Responsabilidad Social”, *Pensamiento & Gestión*, No. 32, pp. 1–26.

Balboa Urbano, D. L. (2019) *Consorcios de exportación: empresas productoras de quinua en San Román, Puno*. Licentiate Thesis. Universidad de San Martín de Porres.

Barreto Rodríguez, J., Canto Sáenz, M. and Julca Otiniano, A. (2017) “Sostenibilidad ecológica de la producción agropecuaria tradicional de Carhuaz, Áncash, Perú”, *Aporte Santiaguino*, Vol 8, No. 2, pp. 219–228.

Barrezueta Unda, S. (2015) *Introducción a la sostenibilidad agraria: con enfoque de sistemas e indicadores*. Edited by Universidad Técnica de Machala. Machala, Ecuador.

Bolívar, H. (2011) “Metodologías e indicadores de evaluación de sistemas agrícolas hacia el desarrollo sostenible”, *CICAG*, Vol 8, No. 1, pp. 1–18.

Cáceres Chávez, J. and Loayza Díaz, J. R. (2016) *Comercialización de quinua negra orgánica vía comercio justo*. Master Thesis. Universidad ESAN.

Chirinos Araque, Y. V. and Pérez Peralta, C. M. (2016) “La responsabilidad social universitaria: emprendimiento sostenible como impacto de intervención en comunidades vulnerables”, *Revista Escuela de Administración de Negocios*, No. 81, pp. 91–110.

Chura Javier, R. and Apaza Mamani, D. Y. (2019) *La gestión empresarial en las cooperativas Exportadoras de Quinua en la Región Puno en el año, 2019*. Bachelor Thesis. Universidad Peruana Unión.

Córcega Sutta, Y. E. and Machaca Lima, J. A. (2018) *Plan de negocios para la comercialización de quinua orgánica de la provincia de Caylloma con certificación de comercio justo al mercado alemán*. Master Thesis. Universidad ESAN.

Cruz, P., Joffre, R. and Winkel, T. (2015) *Racionalidades campesinas en los Andes del Sur. Reflexiones en torno al cultivo de la quinua y otros vegetales andinos*. 1st edn. Edited by Editorial de la Universidad Nacional de Jujuy - EDIUNJU. Jujuy, Argentina.

Gutiérrez Ríos, V. A. M. and Surco Ocas, A. B. (2020) *Efecto positivo del Comercio Justo en la comunidad puneña con respecto a las exportaciones de quinua hacia Francia, dentro del marco de vigencia del Acuerdo Comercial entre Perú y la Unión Europea, durante los años 2008 – 2018*. Bachelor Thesis. Universidad Peruana de Ciencias Aplicadas (UPC).

Guzmán Bautista, J. H. (2013) “Competitividad de la quinua perlada para exportación: El caso de Puno”, *Ingeniería Industrial*, Vol 1, No. 31, pp. 91–112.

Inocente Vera, D. V. and Lara Baldeón, F. C. (2019) *Análisis de la cadena de valor de las empresas exportadoras de quinua orgánica de Puno a fin de aumentar su competitividad al mercado alemán del 2012 al 2017.* Bachelor Thesis. Universidad Peruana de Ciencias Aplicadas (UPC).

Jiménez, T., Cárdenas, J. and Soler-Tovar, D. (2017) "Biocomercio en el contexto suramericano: Colombia y Perú como estudios de caso", *Revista de Medicina Veterinaria*, No. 35, pp. 9–15.

Laguna, P. (2008) "Grano pequeño, mercado pequeño, grandes apuestas: estudiando los límites de la regulación estatal francesa a partir del caso de la quinua", *in 3rd Fairtrade International Symposium*. Montpellier, France.

Laura Castillo, Z. J. (2017) *La responsabilidad social empresarial para alcanzar la ventaja competitiva de los productores de quinua de la provincia de San Román, periodo 2013 - 2014*. Master Thesis. Universidad Nacional del Altiplano.

Liberati, A. et al. (2009) "The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration", *Journal of Clinical Epidemiology*, Vol 62, No. 10, pp. e1–e34.

Limache Yanque, R. M. (2018) *Análisis del proceso de exportación y su incidencia en la comercialización en el mercado internacional de los productores de quinua en la región Puno, periodo 2014 - 2015*. Licentiate Thesis. Universidad Nacional del Altiplano.

Lupaca Nina, N. K. (2018) *El biocomercio de la quinua en el mercado global y sus efectos en los agricultores locales en Perú. Estudio de caso: Cooperativa Agroindustrial Cabana (COOPAIN) Puno.* Master Thesis. Pontificia Univercidad Católica del Perú (PUCP).

Ministerio de Cultura y Riego [MINAGRI] (2017) *La Quinua: Producción y comercio del Perú. Lima: Dirección de Estudios Económicos e Información Agraria*. Lima, Peru.

Pinedo Taco, R., Gómez-Pando, L. and Julca-Otiniano, A. (2018) "Sostenibilidad de sistemas de producción de quinua (Chenopodium quinoa Willd.)", *Ecosistemas y Recursos Agropecuarios*, Vol 5, No. 15, pp. 399–409.

Pinedo Taco, R., Gómez Pando, L. and Julca Otiniano, A. (2017) "Indicadores de sostenibilidad de sistemas de producción de quinua en Chiara, Ayacucho", *Aporte Santiaguino*, Vol 10, No. 2, pp. 197–210.

Volpentesta, J. R. (2012) "Las Acciones Sociales En Empresas Con Responsabilidad Social", *Revista Científica 'Visión de Futuro'*, Vol 16, No. 2.

Strategic Management of E-Commerce in Commercial Companies: A Systematic Review (2016 -2020)

Franklin Cordova-Buiza[1], Kiara Hernandez-Zuniga[2], Katherine Julca-Carrasco[2] and Lucero Nicole Huerta-Tantalean[2]
[1]Research and Innovation Department, Universidad Privada del Norte, Lima, Peru
[2]Business Faculty, Universidad Privada del Norte, Lima, Peru
franklin.cordova@upn.edu.pe
N00091415@upn.pe
N00097173@upn.pe
lucerohuerta05@hotmail.com

Abstract: Currently, electronic commerce has grown rapidly, where technology and the internet intervene to make purchases and sales in a faster and more comfortable way. This modality represents a competitive advantage for small businesses since it allows them to sell their products and/or services to any part of the world on a larger scale and at a lower cost. The objective of this research is to determine what is known about the strategic management of e-commerce in Latin American commercial companies in the scientific literature between 2016 and 2020. Therefore, a systematic review of the literature was carried out following the PRISMA statement, for which four databases were used, such as: Scopus, Redalyc, and ProQuest; after the inclusion process, 24 scientific articles were selected for this work. The main results are related to definition, context in general, adoption of electronic commerce in Latin America, and fundamental strategies for the purchase decision in e-commerce. It is concluded that electronic commerce generates new opportunities to penetrate national and international markets, reducing costs and increasing sales; however, despite its benefits, it has not yet surpassed traditional purchases and this is because the purchase decision in the online context is determined by factors such as the level of trust, the level of technology management and reputation of the company. Likewise, it was shown that Latin America is below the first world countries in the use of this new purchase process as a consequence of the moderating variable of the digital gap. On the other hand, Latin American countries are presented as a potential market with positive growth. It is recommended to continue with empirical research related to e-commerce focused on Latin America and its evolution and adaptation within this new business model. It is important to mention that there were no impediments to this investigation.

Keywords: e-commerce or electronic commerce, Latin America, SMEs

1. Introduction

Currently, the world is in a digital age, where technology has become a fundamental need in people's daily lives. For organizations, technology represents a strategic ally to take off the new purchasing modalities in the market (Limas Suárez, 2020). And among internet clients, who are of different ages, groups, socioeconomic levels and levels of technical experience, the emergence of these networks has significantly varied in their behavior (Dakduk et al., 2017). The history of e-commerce dates back to 1995 with the development of the first online sales web pages, so that after twenty years the internet boom caused a 20% increase in its total turnover in 2016, raising some 1,600 million dollars (Sánchez-Torres et al., 2019). Likewise, during the years 2014-2019, business-to-business [B2C] e-commerce had an annual growth rate of 17.6%, reaching US$ 3,535 billion in 2019 and it is estimated that by 2023 it will reach sales of US$ $6,542 (de Matos, Curth and dos Santos Garcia, 2020). From its appearance in the 90s to the present day, e-commerce has evolved rapidly, becoming one of the main commercial channels of today (Palomino Pita, Mendoza Vargas and Oblitas Cruz, 2020). However, their sales are still lower than in physical stores. Electronic commerce is defined as a form of negotiation that makes use of the internet for buying and selling actions. This modality transformed the traditional way of doing business, promoting the manifestation of other agents in the economy, new forms of commerce and new alternatives for organizations and customers (Wagner Mainardes, Melo de Souza and Días Correia, 2020). E-commerce has many advantages for companies, since it allows them to sell products to a market that can extend throughout the world and to a public that is difficult to access by traditional means, while simultaneously reducing costs and increasing sales (García, Díaz and Arias-Pérez, 2017). On the other hand, it makes it easier for customers to buy regardless of business hours, make comparisons and even review comments from other buyers, as well as the emergence of digital payments that give them the feeling of greater comfort and security (Moreno Sotomayor et al., 2017). Around the world, SMEs have presented a great influence of electronic commerce (Sanchez-Torres and Juarez-Acosta, 2019). This type of business has allowed them to penetrate market improvements and increase their competitive value, in turn eliminates

several of the advantages of large organizations and gives greater opportunities to small companies, such as increasing the dissemination of their products, making sales to any destination and at the same time being able to reduce their costs (Villa et al., 2018). The retail sector is undergoing a technological evolution, but there are also great challenges that managers must face, such as the dynamic transformation in the customer journey and organizations digital (Monteiro et al., 2019). In that sense, Sánchez-Torres et al. (2017) affirm that the great efficiency in the markets allows small and large companies to be able to relate in a context of greater competitiveness. The research question in this systematic review is: What is known about the strategic management of e-commerce in Latin American commercial companies in the scientific literature between 2016 and 2020? Taking into account that Latin America represents a market with a future, since it maintains a constant and accelerated development in almost all its countries, representing 10.5% of internet users worldwide, which leads to a promising growth of 50 % (Dakduk et al., 2017). For this reason, this research aims to determine what is known about the strategic management of e-commerce in Latin American commercial companies in the scientific literature between 2016 and 2020.

2. Methodology

A systematic review was carried out taking as a reference the adaptation of the PRISMA protocol since it allows to improve the report of systematic reviews and meta-analyses, consisting mainly of a flow diagram of four phases: identification, screening, eligibility and included (Moher et al., 2009). To begin this systematic review, Scopus, Redalyc and ProQuest were used as electronic databases. Scopus is recognized for being one of the largest databases in the world, Redalyc is a database of journals from Latin America and ProQuest is database with access facilitated by universities. The search for scientific articles was carried out using the keywords: "e-commerce" and "electronic commerce". To find articles that answer our research question, the Boolean “OR” connector was used, maximizing the search, for which the combination of these was the following: “e-commerce” OR “electronic commerce”. As a consequence of this inquiry, the total number of articles found in all the databases was 2,247,127. The first phase for the selection of articles consisted of defining the inclusion criteria, which were: scientific articles, in English or Spanish, published between 2016 and 2020 and belonging to Latin American countries, after applying the criteria of inclusion, 961 results were obtained. After that, the repeated articles were eliminated, obtaining 937 as a result of the difference. In the second selection phase, exclusion criteria were applied which were: subjects that do not correspond to the business area and articles that do not have the full downloadable text. Then, the review of the title and abstract was carried out to evaluate the relationship of the article with the research problem, resulting in 117 potentially relevant articles. Finally, the documents were downloaded and a complete reading was made of them, excluding those that were not essential for the systematic review, of which 24 articles were used in this systematic review (figure 1).

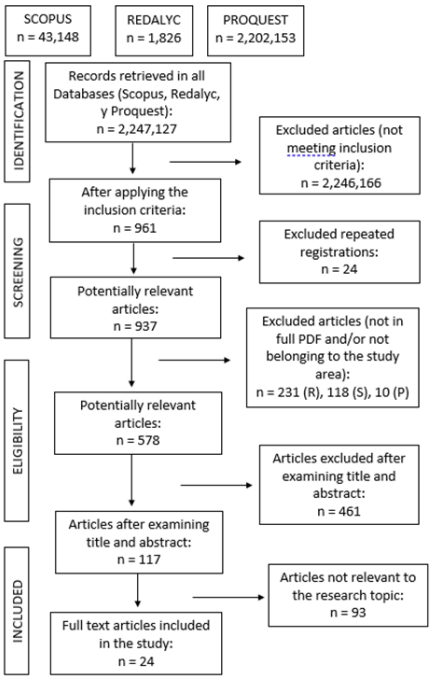


Figure 1: Systematic review flow diagram (original elaboration)

3. Results

As a result of the search for systematic reviews in the selected databases, a total of 2,247,127 scientific articles were found that are related to the research topic between the years 2016 and 2020.

Table 1: Details of the information sources used in the results item, regarding the name, database, journal, apa, year and country

Title	Source	Magazine	Year	Country
Marketing + internet = e-commerce: oportunidades y desafíos	Redalyc	Revista Finanzas y Política Económica	2017	Perú
Hábitos de consumo en plataformas e-commerce en adultos jóvenes de la ciudad de Bogotá	Redalyc	Universidad & Empresa	2020	Colombia
Competitive price and trust as determinants of purchase intention in social commerce	Redalyc	Brazilian Administration Review.	2020	Brasil
Online flow and e-satisfaction in high involvement purchasing processes	Redalyc	Base Revista de Administração e Contabilidade da UNISINOS	2017	Brasil
Modelo para la adopción del comercio electrónico en el sector agroindustrial mexicano	Redalyc	Revista Análisis Económico	2016	México
Del comercio electrónico al comercio social: La innovación al alcance de las organizaciones	Redalyc	Contabilidad y Negocios	2017	Colombia
Comercio electrónico en Chile: ¿qué factores inciden en la decisión de compra?	Redalyc	Revista Academia & Negocios	2018	Chile
Emoción y razón: el efecto moderador del género en el comportamiento de compra online	Redalyc	INNOVAR. Revista de Ciencias Administrativas y Sociales	2018	Colombia
Gestión estratégica de tecnologías de información y comunicación y adopción del comercio electrónico en Mipymes de Córdoba, Argentina	Redalyc	Estudios Gerenciales	2016	Colombia
El impacto del e-commerce en las pymes de la provincia de El Oro	Scopus	Universidad y Sociedad	2020	Ecuador
Building loyalty in e-commerce: Does consumer income matter?	Scopus	International Journal of Business and Systems Research	2020	Brasil
Assessing differences in customers' personal disposition to e-commerce	Scopus	Industrial Management and Data Systems	2019	Chile
Analysis of e-commerce acceptance using the technology acceptance model	Scopus	Scientific Papers of the University of Pardubice	2019	Colombia
Modelo de entorno web para el fortalecimiento de productos agrícolas en Pymes	Scopus	Espacios	2018	Ecuador
El comercio electrónico (e-commerce) un aliado estratégico para las empresas en Colombia	Proquest	Revista Ibérica de Sistemas e Tecnologias de Informação; Lousada	2020	Colombia
Differences between e-commerce buyers and non-buyers in Colombia: The moderating effect of educational level and socioeconomic status on electronic purchase intention	Proquest	DYNA	2017	Colombia
Evaluación de impacto del comercio electrónico en las ventas de las pymes en colombia: un análisis econométrico	Proquest	Revistas de la Universidad del Magdalena	2019	Colombia
Digital trade in Latin America: mapping	Proquest	Emerald Group Publishing	2019	Latinoaméric

Title	Source	Magazine	Year	Country
issues and approaches		Limited		a
Trust and satisfaction: the keys to client loyalty in mobile commerce	Proquest	Business And Economics--Management, Education.	2016	México
Managing the digital consumer: insights from Brazil and Spain	Proquest	Computers--Machine Theory	2019	Brasil
Comercio electrónico y nivel de ventas en las MiPyMEs del sector comercio, industria y servicios de Ibagué	Redalyc	Revista Escuela de Administración de Negocios	2016	Colombia
B2C E-commerce for Home Appliance in the Brazilian Market: A Cost Efficiency Investigation Through a DEA-OCT Model	Redalyc	Revista de Negocios Internacionales (Internext)	2020	Brasil
La confianza como elemento fundamental en las compras a través de canales de comercio electrónico: caso de los consumidores en Antioquia (Colombia)	Redalyc	Revista de ciencias administrativas y sociales (INNOVAR)	2017	Colombia
Diferencias de la adopción del comercio electrónico entre países	Redalyc	Suma de negocios	2016	Colombia

After analyzing 24 articles from the scientific literature, 4 important sections were obtained on the answer to our research question: definition and context in general, adoption of electronic commerce in Latin America, fundamental strategies for the purchase decision in e-commerce and other relevant conclusions of the investigated authors.

According to the articles investigated, technological evolution has been increasing rapidly in recent years, allowing direct access to customer information, influencing the company's decision-making, a new business digital tool called e-commerce continually emerges, the which is defined as a set of actions where a negotiation is carried out through the use of technology. In other words, the term e-commerce refers to the set of activities that are carried out online, today it is a commercial strategy that most companies are using to increase the operations of their goods or services, together with the benefit of having direct communication with consumers and other companies around the world (Caicedo Plúa et al., 2018).

In addition, the benefits that the online platform brings, such as digitization and simplicity to keep us informed anywhere in the world and at any time, results in significant and efficient relationships between the company and customers when carrying out different operations of digital buying and selling. That is why it has made significant progress compared to offline channels, that is, something more advanced such as e-commerce (Guzmán Duque and Abreo Villamizar, 2017). It is important to mention that traditional commerce will never be replaced by electronic commerce, but the latter generates a new and innovative commerce model because it is a mixture of the two (Cardona Valencia et al., 2019).

In the third world, e-commerce reveals an adoption and usage rate well below that of first world countries (Corrales-Liévano, Ruiz-Medina and Angulo-Camargo, 2019). For example, Latin America presents a completely different picture than Europe and Asia. This region maintains less organized and unified proposals in economics and online commerce, as a result of its different approach to internet management (Aguerre, 2019). For this reason, in Latin America, electronic commerce represents approximately only 3% of sales worldwide, Brazil leads the list with 19 billion dollars, followed by Mexico with 17 billion dollars, followed by Chile and then Peru, whose sales are equivalent to a third and a quarter of Mexico's sales, respectively (Carrión González, 2020).

Electronic commerce continues to represent a global phenomenon after approximately 30 years of its emergence. However, not all the expectations for its evolution have been realized; on the contrary, there are still big differences between online and traditional purchases today (Ramírez-Correa, Grandón and Arenas-Gaitán, 2019). Therefore, it is of vital importance for the company to be able to identify how and why customers opt for digital in order to promote the use of electronic commerce and take advantage of all the benefits it brings (Cardona Valencia et al., 2019).

The level of trust between a digital business and its customers is an essential determinant for achieving goals. On the other hand, consumers expect the company to be able to fulfill what was promised in the established time, that online operations be complete, and that its products or services enjoy differentiation; finally, that the privacy policy of their data is respected (Peña-García, Gil-Saura and Rodríguez-Orejuela, 2018). It is important to keep in mind that customers from lower socioeconomic levels prioritize the importance of compliance, unlike customers from higher socioeconomic levels, who value more the quality of the homepage (Rocha Ferreira et al., 2020).

4. Discussion

Regarding the changes that arose globally due to the evolution of technology, the authors Jones, Motta and Alderete (2016); Sepúlveda Robles et al. (2016); Barrientos Felipa (2017); and Rodrigues Maia et al. (2019) agree that the world has changed significantly; that is why large, medium and small companies have had to adapt to this transition to remain in the market, incorporating this new tool called e-commerce or electronic commerce, whose main function is to carry out digital commercial operations working hand in hand with the internet; that is, it allows companies to sell products/services and customers to interact with the brand online.

Regarding the advantages offered by e-commerce, these are diverse, the authors Felix, Tavares and Cavalcante (2018); and Fuentes, Ruiz and Amarillas (2020) point out that the adoption of electronic commerce directly benefits companies with respect to the level of sales, since the correct use of this tool would help increase total profit, have a greater reach of consumers throughout the market, increase profitability and reduce operating expenses, refine your understanding of your target audience's needs, and build meaningful relationships with potential customers. Therefore, the incorporation of electronic commerce promises growth for any business, experts indicate that the future of companies is based on the joint operation of traditional commerce and electronic commerce, with the sole purpose of improving the consumer experience with the brand. The data that results from the fusion of both, allows to have a better knowledge about the tastes and preferences, and the level of satisfaction of the customers.

Regarding the key factors for the success of online purchases, the authors Jimenez, San Martin and Azuela (2016); Sánchez-Alzate and Montoya Restrepo (2017); Linero Bocanegra and Botero Cardona (2020); and Salazar Concha, Mondaca Marino and Cea Rodríguez (2018) indicate that price and trust strongly influence consumers' intention to purchase online; however, it should be noted that obtaining the trust of customers is the most difficult thing to achieve; because they have to face a chain of insecurities that generates fear when using the online platform, such as not having the possibility of palpating the product/service, high risks when exchanging personal information, the ignorance of the use of the online medium, among others.

However, for Bachion Ceribeli, Rodrigues da Silva Tamashiro and Monforte Merlo (2017) the factors mentioned above are not the most relevant for electronic consumers; Due to the fact that there are other personal and psychological aspects that intervene in the decision and/or purchase behavior, this is called the online flow state of e-commerce, which has as its main purpose to increase the disposition during the shopping process on the online platform.

On the adoption of electronic commerce Balasudarsun (2017); Sanabria Díaz, Torres Ramírez and López Posada (2016); Costa Melo et al. (2020) and Sánchez Torres and Arroyo-Cañada (2016) mention that there is a clear difference between developed and developing countries, since first world countries take advantage of and enjoy a better structured equipment, have greater economic possibilities that allow proper development with technological advance; on the other hand, there are the developing countries, the scenarios are totally discriminating for them because some still lack the resources to face the new technological trends; however, for a few years Latin America has been presenting a positive and constant growth in sales through the use of e-commerce, and it is even projected that profits will continue to increase continuously because the business world is becoming increasingly digitized.

5. Conclusions

It was determined that e-commerce is a type of commerce where technology and the internet are used for buying and selling actions. Likewise, it can be concluded that it has great advantages for small and medium-sized companies, since it generates new opportunities to penetrate national and international markets, reducing costs and increasing sales. Despite all these advantages, electronic commerce has not developed

throughout the world at the same speed, it was determined that Latin America has a growth below that of first world countries; however, it is presented as a potential market. It is worth mentioning that during this investigation there were no major limitations were presented. It is recommended to continue conducting empirical research on e-commerce, since there is still much to be discovered within this business model in Latin America.

References

Aguerre, C. (2019) "Digital trade in Latin America: mapping issues and approaches", *Digital Policy, Regulation and Governance*, Vol 21, No. 1, pp. 2–18.

Bachion Ceribeli, H., Rodrigues da Silva Tamashiro, H. and Monforte Merlo, E. (2017) "ONLINE FLOW AND E-SATISFACTION IN HIGH INVOLVEMENT PURCHASING PROCESSES", *Revista Base (Administração e Contabilidade) da UNISINOS*, Vol 14, No. 1, pp. 16–29.

Balasudarsun, N. L. (2017) "Online shopping behavior of students in select asian countries (india, malaysia, singapore, uzbekistan and thailand)", *Journal of Contemporary Research in Management*, Vol 12, No. 4, pp. 97–99.

Barrientos Felipa, P. (2017) "Marketing + internet = e-commerce: Oportunidades y desafíos", *Revista Finanzas y Política Económica*, Vol 9, No. 1, pp. 41–56.

Caicedo Plúa, C. R. et al. (2018) "Modelo de entorno web para el fortalecimiento de productos agrícolas en Pymes", *Espacios*, Vol 39, No. 24.

Cardona Valencia, D. et al. (2019) "Analysis of e-commerce acceptance using the technology acceptance model", *Scientific Papers of the University of Pardubice, Series D: Faculty of Economics and Administration*, Vol 27, No. 1, pp. 174–185.

Carrión González, J. T. (2020) "El impacto del e-commerce en las pymes de la provincia de El Oro", *Universidad y Sociedad*, Vol 12, No. 2, pp. 474–480.

Corrales-Liévano, J. D., Ruiz-Medina, C. J. and Angulo-Camargo, M. F. (2019) "Evaluación de impacto del comercio electrónico en las ventas de las pymes en Colombia: Un análisis econométrico", *Clio Américal*, Vol 13, No. 26, pp. 328–339.

Costa Melo, I. et al. (2020) "B2C E-commerce for Home Appliance in the Brazilian Market: A Cost Efficiency Investigation Through a DEA-OCT Model", *Revista Eletrônica de Negócios Internacionais: Internext*, Vol 15, No. 2, pp. 72–89.

Dakduk, S. et al. (2017) "Customer behavior in electronic commerce: A bayesian approach", *Journal of Theoretical and Applied Electronic Commerce Research*, Vol 12, No. 2, pp. 1–20.

de Matos, C. A., Curth, M. and dos Santos Garcia, A. (2020) "Customer Loyalty in the Online Context: Understanding Trust in Different Parties", *Journal of Electronic Commerce Research*, Vol 21, No. 4, pp. 237–251.

Félix, B. M., Tavares, E. and Cavalcante, N. W. F. (2018) "Critical success factors for big data adoption in the virtual retail: Magazine Luiza case study", *Revista Brasileira de Gestao de Negocios*, Vol 20, No. 1, pp. 112–126.

Fuentes, J. A., Ruiz, G. A. and Amarillas, V. A. (2020) "Online Purchase and Consumer Profile: Case Mexico", *Global Journal of Emerging Trends in E-Business, Marketing & Consumer Psychology*, Vol 6, No. 1, pp. 754–770.

García, A. A., Díaz, H. E. and Arias-Pérez, J. E. (2017) "Information technologies and e-business capabilities: The absorptive capacity mediating effect. [Capacidades de Tecnologías de Información y Capacidades de Negocio Electrónico (E-Business): Efecto Mediador de la Capacidad de Absorción]", *Información Tecnológica*, Vol 28, No. 1, pp. 47–64.

Guzmán Duque, A. P. and Abreo Villamizar, C. A. (2017) "Del comercio electrónico al comercio social: la innovación al alcance de las organizaciones. Estudio para el sector calzado Bucaramanga, Colombia", *Contabilidad y Negocios*, Vol 12, No. 24, pp. 107–118.

Jimenez, N., San Martin, S. and Azuela, J. (2016) "Trust and satisfaction: The keys to client loyalty in mobile commerce", *Academia*, Vol 29, No. 4, pp. 486–510.

Jones, C., Motta, J. and Alderete, M. V. (2016) "Gestión estratégica de tecnologías de información y comunicación y adopción del comercio electrónico en Mipymes de Córdoba, Argentina", *Estudios Gerenciales*, Vol 32, No. 138, pp. 4–13.

Limas Suárez, S. J. (2020) "El comercio electrónico (e-commerce) un aliado estratégico para las empresas en Colombia", *Revista Ibérica de Sistemas e Tecnologias de Informação*, No. E34, pp. 235–251.

Linero Bocanegra, J. P. and Botero Cardona, L. F. (2020) "Hábitos de consumo en plataformas e-commerce en adultos jóvenes de la ciudad de Bogotá", *Universidad y Empresa,* Vol 22, No. 38, pp. 211–236.

Moher, D. et al. (2009) "Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement", *BMJ*, Vol 339, No. b2535, pp. 1–8.

Monteiro, T. A. et al. (2019) "Managing the digital consumer: insights from Brazil and Spain", *Journal of Manufacturing Technology Management*, Vol 30, No. 8, pp. 1196–1215.

Moreno Sotomayor, G. R. et al. (2017) "E-commerce analysis as a technological tool for the development of pymes in Ecuador", *International Journal of Applied Engineering Research*, Vol 12, No. 12, pp. 3188–3195.

Palomino Pita, A. F., Mendoza Vargas, C. and Oblitas Cruz, J. F. (2020) "E-commerce y su importancia en épocas de covid-19 en la zona Norte del Perú [E-commerce and its importance in times of covid-19 in Northern Peru]", *Revista Venezolana de Gerencia*, Vol 25, No. 3, pp. 253–266.

Peña-García, N., Gil-Saura, I. and Rodríguez-Orejuela, A. (2018) "Emoción y razón: El efecto moderador del género en el comportamiento de compra online", *INNOVAR. Revista de Ciencias Administrativas y Sociales*, Vol 28, No. 69, pp. 117–131.

Ramírez-Correa, P. E., Grandón, E. E. and Arenas-Gaitán, J. (2019) "Assessing differences in customers' personal disposition to e-commerce", *Industrial Management and Data Systems*, Vol 119, No. 4, pp. 792–820.

Rocha Ferreira, V. M. et al. (2020) "Building loyalty in e-commerce: Does consumer income matter?", *International Journal of Business and Systems Research*, Vol 14, No. 1, pp. 74–94.

Rodrigues Maia, C. et al. (2019) "Competitive price and trust as determinants of purchase intention in social commerce", *BAR - Brazilian Administration Review*, Vol 16, No. 4, p. e190074.

Salazar Concha, C., Mondaca Marino, C. and Cea Rodríguez, J. (2018) "Comercio electrónico en Chile: ¿qué factores inciden en la decisión de compra?", *Revista Academia & Negocios*, Vol 4, No. 1, pp. 1–14.

Sanabria Díaz, V. L., Torres Ramírez, L. A. and López Posada, L. M. (2016) "Comercio electrónico y nivel de ventas en las MiPyMEs del sector comercio, industria y servicios de Ibagué", *Revista Escuela de Administración de N*egocios, No. 80, pp. 132–154.

Sánchez-Alzate, J. A. and Montoya Restrepo, L. A. (2017) "La confianza como elemento fundamental en las compras a través de canales de comercio electrónico: caso de los consumidores en Antioquia (Colombia)", *INNOVAR. Revista de Ciencias Administrativas y Sociales*, Vol 27, No. 64, pp. 11–22.

Sánchez-Torres, J. A. et al. (2017) "Differences between e-commerce buyers and non-buyers in Colombia: The moderating effect of educational level and socioeconomic status on electronic purchase intention", *DYNA*, Vol 84, No. 202, pp. 175–189.

Sánchez-Torres, J. A. et al. (2019) "The colombian electronic consumer: Analysis of the leading factors of e-commerce use", *International Journal of Electronic Marketing and Retailing*, Vol 10, No. 3, pp. 283–308.

Sanchez-Torres, J. A. and Juarez-Acosta, F. (2019) "Modelling SME e-commerce with IMAES", *Journal of Business and Industrial Marketing*, Vol 34, No. 1, pp. 137–149.

Sánchez Torres, J. A. and Arroyo-Cañada, F.-J. (2016) "Diferencias de la adopción del comercio electrónico entre países", *Suma de Negocios*, Vol 7, No. 16, pp. 141–150.

Sepúlveda Robles, D. E. et al. (2016) "Modelo para la adopción del comercio electrónico en el sector agroindustrial mexicano", *Análisis Económico*, Vol XXXI, No. 76, pp. 47–73.

Villa, E. et al. (2018) "Electronic commerce: factors involved in its adoption from a bibliometric análisis", *Journal of Theoretical and Applied Electronic Commerce Research*, Vol 13, No. 1, pp. 39–70.

Wagner Mainardes, E., Melo de Souza, I. and Días Correia, R. (2020) "Antecedents and consequents of consumers not adopting e-commerce", *Journal of Retailing and Consumer Services*, Vol 55, p. 102138.

Entrepreneurial Business in the Wine Sector: A Business Model Proposal for the Setúbal Peninsula

Teresa Costa[1], Nuno Teixeira[2], Sandra Nunes[3] and Mário Cravidão[4]
[1]Department of Economics and Management, Business School, Polytechnic Institute of Setubal, CITUR, Centre of Tourism Research, Development and Innovation, CICE, Centre for Research in Business Sciences, Portugal
[2]Department of Accountability and Finances, Business School, Polytechnic Institute of Setubal, CICE, Centre for Research in Business Sciences, Portugal
[3]Department of Economics and Management, Business School, Polytechnic Institute of Setubal, Portugal, CMA/FCT/UNL, Center for Mathematic and Applications CICE, Centre for Research in Business Sciences
[4]Department of Marketing and Logistics, Business School, Polytechnic Institute of Setubal
teresa.costa@esce.ips.pt
nuno.teixeira@esce.ips.pt
sandra.nunes@esce.ips.pt
mario.cravidao@esce.ips.pt

Abstract: The frequency and severity of crises and disasters in recent years has highlighted the need and urgency of studying ways to mitigate the impact of these phenomena. These have been overwhelming for businesses with very large impacts on the economies of the countries. It is a complex phenomenon, widely confirmed in the literature, where a variety of studies point to strategic capacity and business model design as key factors for business resilience. The ability to design products or services and deliver them competitively in the market requires a clear strategic definition, as well as the design, implementation, and management of new business models. The wine sector also suffered major impacts during the pandemic crisis, especially in 2020, however its recovery shows the resilience of this entrepreneurial sector. During this crisis, many business models proved to be obsolete, but others have shown great resilience, proving that it is possible to resist and even thrive in a crisis context. On the other hand, in a globalized market, intense competition in the wine sector leads to critical management issues for wine producers. Due to the unique characteristics of the product, entrepreneurs, and managers, in this sector, need to critically review their business models, establish strategies, and measure their performance. Considering the crisis on business wine sector caused by pandemic situation, this study aims to answer the questions "What strategies have been implemented in the wine sector of Setúbal Peninsula that have contributed to the survival and prosperity of the sector?"; Is there an ideal business model for this sector on the Setúbal Peninsula?" The aim of this study is to identify successful strategies of wine sector in a context of crise as well as propose a robust business model for wine sector in Setúbal Peninsula. Both quantitative (questionnaires) and qualitative methods (focus group) were used. As result of the research, we highlight the identification of some competitive behaviors that may contribute to suggest possible critical success factors in the business models of the Portuguese wine sector.

Keywords: crisis, business resilience, business plan, wine sector

1. Literature review

1.1 Crisis, disasters and management models

Crisis is described as one or a sort of events that disrupt the operation and threaten the capability of an organization, industry, nation, or society (Novelli et al., 2018). According with Prideaux et al. (2003) there is a difference between crises from disasters according with their root causes. Generally, crisis is caused by human errors and internal management failures. Based on this idea Reddy et al. (2020) refers that crisis can be predictable and minimized. As some examples of crises Prideaux et al. (2003) point out, financial meltdown, terrorism and political unrest, and an oil). On the other hand, disaster is described by Faulkner (2001) as unexpected and not predictable catastrophic change caused by an external environment.

Huang et al. (2008) identified eleven crisis and disaster management models in literature and them organized into four approaches: 1) life cycle approach, this approach divides crisis/disaster management into phases, for example, three phases (pre-event, emergency, post-event) or six phases (pre-event, prodromal, emergency, intermediate, long-term, and resolution); 2) strategic management model (describes generic steps of managing and recovering from a crisis or disaster); 3) action-oriented approach (list crisis management activities under the

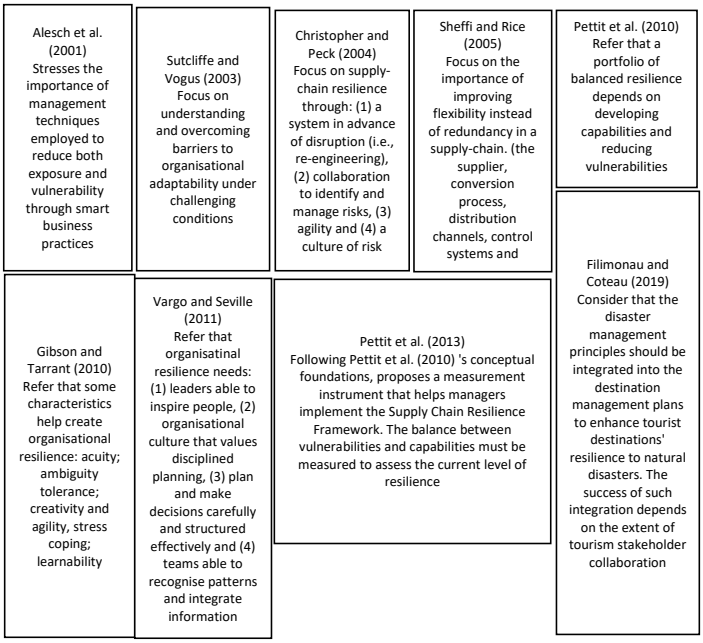
four Rs: reduction, readiness, response, and recovery); 4) integrated approach (divides crisis management activities into two types: proactive and reactive responses). These four approaches are not mutually exclusive, and they are often integrated in a comprehensive model.

In recent times, several studies related to COVID-19 have emerged, particularly in the hospitality and tourism sector, however few studies are specific to the wine sector (Section 3 provides a review on wine sector business). On the other hand, these studies focus mainly on prescriptive and generic models and few of them refer to specific strategies, such as cost reduction, revenue increase and market communication, marketing, etc. (Mair et al., 2016).

To fill the research gap, this study focuses on the response and recovery efforts of economic agents, of wine and vineyard sector, during and after the COVID-19 pandemic.

2. Business resilience

Literature on resilience in the wine sector is scarce, but there are many studies on resilience in small businesses and family businesses. In these various studies, there are several references to factors that promote company or organizational resilience during and after the crisis, namely, social capital, education and training, adaptability, creativity, knowledge, receptivity, and flexibility (Ahmed et al., 2004). For Slocum and Kline (2014) resilience is a positive adaptive response to adversity, where factors such as natural, human, cultural, social, financial, built and political capital can be relevant and generators of positive changes. Also, Seville, et al. (2015) identify seven principles of a resilient organization, including adaptive capacity, charismatic leaders, learning organizations, capital, operational excellence, resilience as a team sport, and seeing opportunities. The increase of problems complexity in business environment stresses the adaptation of systems theory. Several authors refers that the organization's ability to absorb, adapt to changing environments, survive and strengthen itself in times of crisis, as well as to anticipate, avoid and adjust to disruptions and changes are important issues related to organizational resilience (ISO, 2017; Gonçalves et al., 2019; Ortiz - de - Mandojana e Bansal, 2016). Resilience combines the organization's ability to rebuild effectiveness after a disruption in response capability development. (Burnard e Bhamra, 2011). Several studies indicate that resilience requires the organization's ability to manage the environmental requirements that are changing, implies the ability to change and learn and use new knowledge. (Gallopín, 2006; McDonald, 2006; Staber & Sydow, 2002). Over the past two decades, a great deal of effort has been made by several academics to understand and address resilience in an organizational context. Figure 1 presents a systematization of the different approaches.



Source: Burnard et al. (2018), adapted and updated by Costa et al. (2021)

Figure 1: Approaches to resilience

3. Business wine sector

E-commerce has rapidly transformed the business environment, and the very customer-oriented environment has increasingly taken precedence over the product-oriented environment. This transformation was due to the development of Web 2.0 technologies and social media, along with the introduction of wikis, blogs, communities and social networks (Petracca, 2019).

With a specific dynamic the wine sector has been a relatively slow adopter of marketing strategies on social networks, although the transition to the digital market has also had an impact on this sector (Kolb & Thach, 2016); Pucci et al., 2019). In fact, issues such as the different state laws that govern wine shipments, age verification and the significant heterogeneity of the wine industry are some of the constraints inherent to online shopping (Santos, 2012).

Despite these constraints, the consumption of wine in the world, after a few years of slight increases, is relatively stable. In 2018, 24.6 billion liters were consumed worldwide. Regarding consumption by country, the ranking of the five largest consumers is made up of the United States of America (3.3 billion liters), France (2.7 billion liters), Italy (2.2 billion liters), Germany (2 billion liters) and China (1.8 billion liters).

According to the OIV - International Organization of Vine and Wine, the world's largest wine producer in 2018 was Italy (5.5 billion liters), followed by France (4.9 billion liters) and Spain (4.4 billion liters). Portugal came in 10th place with 610 million liters, placing it as one of the higher per capita consumers internationally.

Looking at international trade, it appears that global wine exports increased by 23% between 2014 and 2018, reaching 31 billion euros in the last year of that period. The biggest exporters are Spain, Italy and France. In turn, the biggest importers are the USA, the United Kingdom and Germany.

Portugal, according to the GPP – Office of Planning and Policies, exported around 296 million liters of wine, with a total value corresponding to 803 million euros. The main destinations for Portuguese wines in 2019 were France (42 thousand hectoliters, corresponding to 114 million euros), the United States (23 thousand hectoliters, corresponding to 89.5 million euros) and the United Kingdom (22 thousand hectoliters, corresponding to 78 million euros).

The demand for quality wines has increased, which seems to reflect very relevant perspectives for this sector. If we consider the growing popularity of Portuguese wines, we see that there is an interesting opportunity to explore.

According to AICEP - Agency for Investment and Foreign Trade of Portugal, the commitment of Portuguese producers to innovation, along with the modernization of production methods, has led to the creation of high-quality wines proven by increasing prizes in international competitions.

The wide variety of grape varieties (about 250 autochthonous) allows the production of a variety of wines, marked by unique characteristics, which enhances its competitiveness in niche markets.

As a small country with small farms, Portugal is already the 11th world producer and the 8th largest exporter, increasingly asserting itself as a producer of “different wines”, but of great quality.

At the national level, there has been a growth in production over the last few years. As an illustration, a table is presented below with the annual values of production on the mainland and in the Portuguese wine regions.

Table 1: Evolution of total production by wine region (hectoliters)

Wine Region	2020/21	%	2019/20	%	2018/19	%	2017/18	%	2016/17
Minho	848 311	13	816 396	13	759 757	13	967 067	14	736 430
T. Montes	94 425	1	118 014	2	50 670	1	85 430	1	76 549
Douro	1 264 349	20	1 692 188	26	1 259 683	21	1 448 874	22	1 337 201
Atlantic Border	174 391	3	159 063	2	177 782	3	260 668	4	195 534

Wine Region	2020/21	%	2019/20	%	2018/19	%	2017/18	%	2016/17
Dão Lands	189 197	3	257 481	4	178 409	3	312 462	5	237 186
Beira Lands	219 298	3	255 658	4	162 032	3	190 394	3	255 818
Cisterman Lands	37 744	1	59 417	1	37 307	1	54 052	1	69 560
Tagus	644 153	10	615 736	9	635 514	10	648 441	10	551 300
Lisbon	1 253 303	20	987 009	15	1 170 068	19	1 225 840	18	998 804
Fr. Setúbal	475 135	7	503 579	8	472 197	8	525 049	8	463 035
Alentejo	1 159 067	18	996 290	15	1 092 617	18	954 910	14	1 050 439
Algarve	13 043	0,2	13 926	0,2	17 042	0,3	15 777	0,2	10 419
Sub-total mainland	6 372 416	99	6 474 757	99	6 013 078	99	6 661 245	99	5 982 274

Source: IVV (2022)

Although, with some oscillations in the different periods, it appears that in the last year analyzed the production value exceeds the existing in 2016/17, both on the country (mainland without the islands of Azores and Madeira) and on the Setúbal Peninsula, which is the target of this study. In addition, it appears that the Setúbal Peninsula is in sixth place nationally in terms of annual production.

Regarding the evolution of sales in the national market and considering still wine (non-carbonated) and the type of marketing channels, it appears that distribution has been compensating the drop of revenues in restaurants.

Table 2: Evolution of sales of still wines by types of distribution channels (liters)

TYPES OF CHANNELS	**2016**		**2017**		**2018**		**2019**		**2020**		**2021**	
Restaurants	73 589 682	29%	80 208 943	30%	81 369 316	31%	89 195 523	32%	49 337 607	20%	41 798 829	17%
Distribution	183 310 795	71%	187 186 441	70%	182 724 896	69%	189 094 393	68%	201 390 507	80%	206 843 716	83%
Total	**256 900 477**	**100%**	**267 395 384**	**100%**	**264 094 212**	**100 %**	**278 289 916**	**100%**	**250 728 114**	**100%**	**248 642 545**	**100%**

In terms of sales of still wines in the national market by region, the Setúbal Peninsula is in second position, only surpassed by the Alentejo region.

This highlights the importance of studying the business model of companies in this region, given that, it is increasingly as a reference in the Portuguese wine sector.

Table 3: Evolution of sales of still wines by regions (liters)

REGIONS	2016	2017	2018	2019	2020	2021
Total Certified Wines	109 737 188	112 363 732	115 103 876	124 599 625	112 002 071	115 420 759
Minho	18 625 525	19 983 662	20 334 191	21 469 566	19 721 313	19 828 643
Behind the Mountains	539 211	687 664	429 621	392 807	274 448	283 167
Douro	11 753 648	13 623 943	13 143 932	12 900 583	12 304 512	13 632 325
Biscuits	108 515	88 963	259 060	298 131	93 359	126 421
Cisterland Lands	33 870	27 242	23 820	29 584	54 417	31 020
Beira Atlântico	1 062 653	762 668	1 066 136	883 932	522 329	376 644
Dão Lands	6 243 657	5 984 241	6 482 985	6 587 279	5 490 780	5 300 953
Interior Border	372 565	415 358	770 569	903 668	848 363	969 075
Lisbon	3 895 621	4 806 982	5 482 162	5 289 946	4 587 955	5 044 984
Tagus	4 845 416	5 201 550	5 167 240	10 234 310	8 944 478	8 605 083
Setúbal Península	14 042 265	14 810 295	17 624 800	20 081 558	20 605 445	21 792 324
Alentejo	47 928 070	45 576 684	43 835 850	45 113 270	38 329 383	39 213 524

REGIONS	2016	2017	2018	2019	2020	2021
Algarve	286 172	394 480	483 510	414 991	225 289	216 596
Total Not Certified Wines	147 163 289	155 031 652	148 990 336	153 690 291	138 726 043	133 221 786
Imported	3 046 159	3 186 089	4 597 781	8 165 902	8 380 755	9 317 916
National	144 117 130	151 845 563	144 392 555	145 524 389	130 345 288	123 903 870
Total Wine	256 900 477	267 395 384	264 094 212	278 289 916	250 728 114	248 642 545

Regarding exports, there has also been a positive evolution in recent years, especially in certified wines and in countries outside the European Union.

Table 4: Exports by type of products

Intra + Extra UE	**HL - hectoliters**					**2020 /2019**
	jan-dec					
	2016	**2017**	**2018**	**2019**	**2020**	
Certified wine	981 167	1 105 731	1 118 730	1 155 086	1 351 796	**17,0%**
Wine with origin designation	550 863	596 491	618 225	606 058	688 890	**13,7%**
Wine with geographical identification	430 304	509 241	500 505	549 028	662 906	**20,7%**
Table wines	1 070 522	1 154 685	1 138 946	1 102 411	1 089 173	**-1,2%**
Wine	1 031 731	1 121 370	1 067 887	1 044 513	1 028 243	**-1,6%**
Wine with caste identification	38 792	33 315	71 059	57 898	60 931	**5,2%**
Liqueur wine with protected designation of origin / protected geographical identification	678 884	677 690	646 923	657 908	657 029	**-0,1%**
Harbor	*651 340*	*640 027*	*607 327*	*617 049*	*611 902*	**-0,8%**
Wood	*21 521*	*28 246*	*28 135*	*27 052*	*23 827*	**-11,9%**
Others	*6 023*	*9 417*	*11 461*	*13 807*	*21 300*	**54,3%**
Liqueur wine without protected designation of origin / protected geographical identification	*9 487*	*3 120*	*3 471*	*3 011*	*2 603*	**-13,6%**
Sparkling and sparkling wines	17 557	13 948	22 361	17 577	20 965	**19,3%**
Other wines	21 889	26 395	27 768	27 217	29 819	**9,6%**
Total	2 779 505	2 981 569	2 958 198	2 963 210	3 151 384	**6,4%**

Source: IVV (2022)

4. Business models

The business model is a complex adaptive resilient system (ARS). Both concepts, business models and ARS are anchored in systems theory: interconnectivity and dependence between system elements and holism (the whole, or a set of elements, is more than the sum of its parts) should therefore be considered in its conceptualization.

Several approaches have been designed to identify sets of elements, blocks, areas, or components that any business model must consider. Johnson, Christensen and Kagermann (2008) define a set of four blocks. Teece (2010) defines six essential elements to build a business model. Wikström et al. (2010), address five sets of elements. Osterwalder and Pigneur (2010) develop a model based on 4 blocks and 9 components.

This study analysis the business model for the wine sector of Setúbal Peninsula according Osterwalder and Pigneur model. According with these authors this tool allows the description, visualization, evaluation and alteration of existing business models or the creation of new models under a common and easily understandable

language. The model is composed of nine basic components divided into four blocks: customers (value proposition), value offering (customer segment, channels, and relationships), infrastructure (key resources, key activities and main partnerships) and financial viability (cost structure and revenue sources). Table 3 presents in greater detail the nine components of this model.

Table 5: The nine components of the CANVAS business model (Osterwalder and Pigneur, 2010)

Blocks/macro areas	Components	Synthetic Description
Offer (what?)	Value Proposition (VP)	Describes the set of products and services that create value for a specific customer segment.
Client (who?)	Customer segments (CS)	Various groups of people or organizations that a company aims to reach.
	Channels (CN)	Describes how a company communicates and tries to influence its customer segments to deliver a value proposition.
	Customer relationship (RC)	Describes the types of relationships a company establishes with specific customer segments.
Infrastructure (how?)	Key Resources (KR)	Describes the most important assets for the functioning of the business model.
	Key Activities (KA)	Describes the most important things a company must do to make its business model work.
	Key Partnerships (KP)	Describes the network of suppliers and partners that make the business model work.
Financial Viability (how much?)	Cost Structure (CS)	It describes all the resources involved in operating a business model, as well as their cost.
	Income flow (IF)	Represents the money that a company generates from each customer segment

Source: adapted from Osterwalder e Pigneur (2010).

In fact, in what concern wine sector, there is a need of a particular attention to the company's business models of the sector, that means, the logic of organization of the sector and their capability to sustainable create value. According with Mastroberardinoet al. (2022) the large retail giants, despite not being specialists in the wine business, were able to quickly add an online sales channel, thus managing to exploit the competitive advantages of a wide range of wines, as well as their commercial and logistical skills. On the other hand, various of 2.0 distributors specializing in wine and spirits were born from a base of high digital and communication skills.

Finally, third-party platforms have been created, mainly dedicated to satisfying the enormous demand for information from millions of wine lovers worldwide. These platforms are rapidly changing their business model from information brokers to wine distributors.

5. Research methodology

The present study is based on mixed research methods. Firstly, a quantitative approach, in the form of a questionnaire applied to group of wine producers from the Setúbal Peninsula, following a non-probability sampling method. Additionally, the opinions of a panel of experts in the wine sector were collected.

The questionnaire has two main sections. The first section refers to the sector characterization and consists of only two open-ended questions (Q1, Q2). The second part of the questionnaire, mainly composed of closed questions, refers to the characterization of producers/companies and was divided into four sections. The first one (Q3 – Q8) refers to the characterization of the company's situation in pre-pandemic (year 2019) and during the pandemic (January 2020 - October 2021). The second section (Q9 – Q14) was dedicated to the characterization of the immediate consequences in the business. The third one (Q15 – Q46) refers to the identification of mitigation actions developed during the pandemic and in the post-pandemic phases, finally in the last one (Q47 – Q61) we may find the company characterization.

The questionnaire was based on the literature, but the final version was specially designed for this study. Three producers were used for testing reasons, and afterwards, the questionnaire was fully approved.

Data collection took place between November 2021 and March 2022. The decision to use email for data collection was due to to a set of advantages enumerated by Aaker (2007), namely the possibility of resending the questionnaire the number of times deemed necessary, greater ease and speed in sending and later receiving responses and the possibility that the interviewees have to respond according to his convenience.

After the data collection, the statistical treatment was performed using the IBM SPPS 27.0 software. Statistical techniques of exploratory analysis were used to characterize the collected sample, to describe the company's situation in pre-pandemic and during the pandemic, the immediate consequences in the business and the mitigation actions developed during and after the pandemic.

6. Results and discussion

6.1 Descriptive analyses supported in questionnaires to producers

The study has collected a sample of 12 answers. According to the legal regime, eight (67%) of the companies are Private Limited Companies, there is a sole proprietorship and a limited liability company, the remaining two are cooperatives. It should be noted that the members of the two cooperatives are around 400 winegrowers. The "turnover" of wines with Denomination of Origin ("Palmela" and "Setúbal") and/or Geographical Indication (Regional Wines from the "Setúbal Peninsula") of this group of 12 respondents will be close to 50% of the total of producers of this region.

Four companies are more than 50 years old, another four are more than 30 years old and the remaining four started their activity in the 21st century and have between 4 and 13 years of activity. More than 80% of the companies have a manager aged between 42 and 65 years. Close to 60% of the companies are a partnership, 25% have a male individual as the main shareholder/partner of the company and the remaining 17% a female individual. The main manager of 92% of the companies is a male individual. In terms of the national business model, 33% of the companies said they do their own distribution, 17% use national distributors and 50% use both types of models. Only one company says its distributors are exclusive. In terms of the international business model, 25% of the companies stated that they had their own exploration team, only one resorted exclusively to trading's, agents, or brokers and 67% indicated that they use both types of models.

The manager was asked to choose from among five sentences the one that best applied to the way in which the management of his company faced the impact of COVID19 on the sector and on the company (Figure 2).

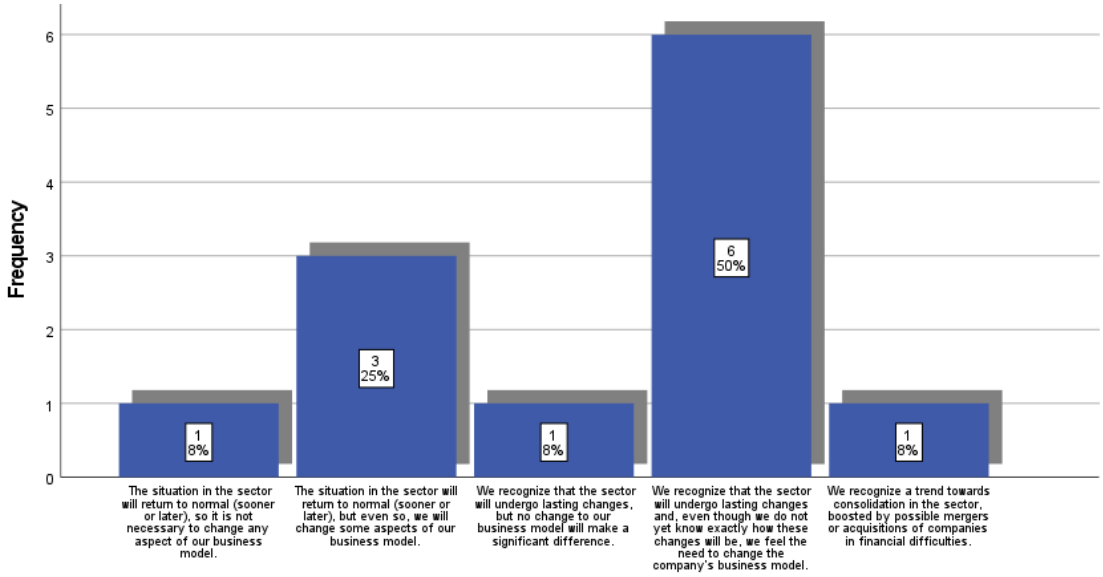


Figure 2: Which of the following phrases best applies to how your company's management views the impact of COVID19 on your industry and company?

The analysis of figure 2 shows that 50% of the companies surveyed recognize that the sector will undergo lasting changes and, even though it is not yet known exactly how these changes will be, they feel the need to change the company's business model. In addition, 25% agree that the situation in the sector will return to normal, but even so, they will change some aspects of the business model.

It was also asked if the company was part of networks (formal or informal) of partners (public or private) that helped each other in the development of their activities, 67% of the companies (8) surveyed answered no.

The analysis of the data obtained on the characterization of the situation of companies in pre-pandemic (Year 2019) showed that about 80% of companies indicated the national market as the market that most weighed on their revenues. It was also found that 75% of companies stated that the revenue generated by the business was sufficient to cover total costs and more than 80% stated that they were able to meet their commitments to financiers.

The analysis of the results regarding the situation of companies during the pandemic (January 2020 - October 2021) revealed that, regarding to the national market being the market with the greatest weight in the company's revenues, the result obtained during the pandemic was identical to the result before the pandemic. 67% of companies stated that the revenues generated by the business were sufficient to cover the total costs. Comparing with the value before the pandemic, there was a decrease of almost 10%. Also in the pandemic phase, the percentage of companies that managed to fulfill their commitments to their guarantors exceeded 80%, an identical value was obtained before the pandemic.

Finally, the company was asked in which areas it will implement or has already implemented changes in order to recover the business. We can find the results in Figure 3.

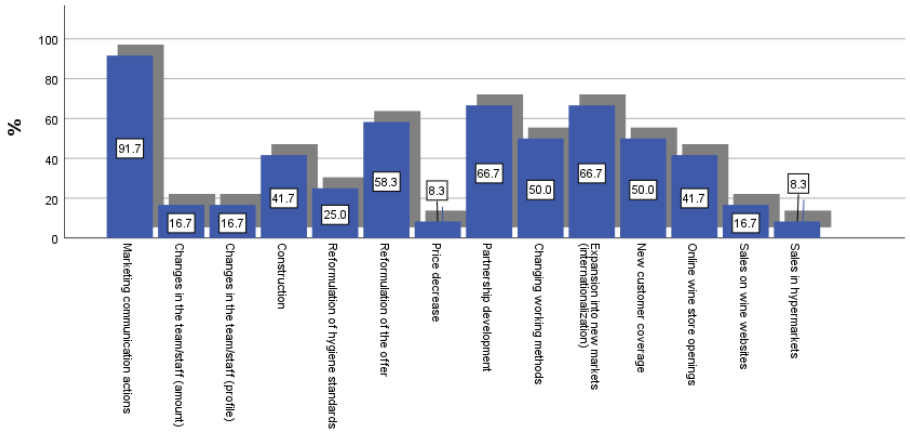


Figure 3: In which area(s) will you implement/have you already implemented changes to recover the business?

The analysis of figure 3 shows that approximately 92% of the companies surveyed, with the objective of recovering the business, implemented communication and marketing actions, strategies suggested by Mair et al., 2016, 67% developed partnerships and the same percentage expanded to new markets, 58% reformulated the offer, 50 % changed working methods and the same percentage approached new customers, 42% opened online wine stores and the same percentage carried out works.

6.2 Panel of experts: entrepreneurs of wine companies from the Setúbal Peninsula in Portugal

The opinions collected through the panel of experts show a tendency towards concentration with the emergence of producers with scale and notoriety at a national level.

As a result of the greater boosting of their activity, they have sought out large international markets with purchasing power and which value quality products. This trend is confirmed by the statistics available on the

Instituto da Vinha e do Vinho website, where is possible to verify that the region is one of the 3 with the lowest number of producers.

Thus, regarding the business model, in general terms, the companies' value propositions have sought competitive positions that capitalize the uniqueness of national varieties and traditional production processes and that contribute to the offer of high-quality products at competitive prices in the global market (consequent of cheaper production factors in relation to the main international competitors and of increasingly efficient logistical processes).

In terms of customer segments, the product and market strategy has sought to diversify into new markets and penetrate segments with greater purchasing power where uniqueness is valued, and customers are not so price sensitive. There is, therefore, a tendency to expand the supply matrix to new markets based on competitive advantages focused on product differentiation.

To reach new markets, companies have been looking for marketing channels (traders and commercial representatives) that allow access to premium segments (in the most unique wines) and mass consumption, such as large distribution retailers, for less noble wines. Such channels are also fundamental for the development of relations with the market, through the presentation of the offer of national companies, through communication materials or the organization of tasting events that contribute to the visibility and notoriety of the offer. At the same time, there has also been a strong commitment by companies in the region to participate in the main sector fairs and international competitions, despite the interruption during the period of the pandemic, as a way of reaching direct contact with end customers and developing closer relationships tailored to market needs.

Thus, revenues come mainly from higher margins, resulting from higher prices associated with the uniqueness of the products, but also from the larger scale of operations that allows reaching larger markets.

As for their internal infrastructure, the companies have tried to incorporate, over time, into their work processes, production, vine treatment and harvesting equipment that are innovative and in accordance with the best operational practices of the main international competitors, combining the tradition and innovation. Furthermore, these material resources were accompanied by the continuous hiring of qualified human resources with extensive experience in the sector. This pooling of resources contributes to companies in the region being a reference in the Portuguese wine industry. In terms of key business activities, the stage relating to the treatment and maintenance processes of the vineyard stands out, which contributes to increasing its longevity and productivity, allowing for an increase in periodic production capacity and mitigating the impact of the smaller size of the national properties compared to the capacity of competitors from other larger markets. Finally, in terms of partnerships, we highlight the relationships with associations of regional producers that allow the integration of the offer of different producers in the logistics operations associated with international markets, contributing to a lower cost per bottle exported and to more competitive sales prices. relative to external competitors.

Below is a summary table with the business model adopted by most successful companies in the Setúbal Peninsula.

Table 6: Summary of the business model implemented in the companies from the Setúbal Peninsula

Blocks/macro areas	Components	Companies from the Setúbal Peninsula
Offer (what?)	Value Proposition (VP)	Unique and high-quality wines with competitive prices
Client (who?)	Customer segments (CS)	Individuals - end consumers with purchasing power and large retailers.
	Channels (CN)	Commercial representants and traders in the international markets.
	Customer relationship (RC)	Events of wine tasting, fairs and international concourses

Blocks/macro areas	Components	Companies from the Setúbal Peninsula
Infrastructure (how?)	Key Resources (KR)	Large extension of vineyards, Innovative equipment's, and qualified human resources.
	Key Activities (KA)	innovation and brand portfolio, processes for harvesting and treating and maintaining vineyards to increase productivity.
	Key Partnerships (KP)	Industry associations to share the costs of communication and of logistic in the international markets.
Financial viability (how much?)	Cost Structure (CS)	Vine treatment equipment and Human resources.
	Income flow (IF)	Scale of the operations and high margins based on higher selling prices related with the unique quality of the wine

7. Discussion and conclusion

The results of this research, based on the questionnaire to wine producers in the Setúbal Peninsula, revealed convergence and divergence concerning some aspect. This can be related with the profile of companies and managers of the sample. As it was referred more than 80% of the companies have a manager aged between 42 and 65 years, the main manager of 92% of the companies is a male individual. In fact, as is referred in literature review, historically the wine sector is a very traditional one, and according with Kolb and Thach (2016), at least for the more traditional companies the adoption of new strategies options can be slow.

Another important factor is the uncertainty of the moment, due to Pandemic crisis. This uncertainty is present in several results. For example, 50% of the companies surveyed recognize that the sector will experience permanent changes and, even though it is not yet known exactly how these changes will be, they feel the need to change the company's business model. The results also showed that, before the pandemic crisis, about 80% of companies indicated the national market as the market that most weighed on their revenues, 75% stated that the revenue generated by the business was sufficient to cover total costs and more than 80% stated that they were able to meet their commitments to financiers. The results observed during the pandemic period did not show significant differences.

However, in general, the companies (approximately 92% of the companies), revealed resilience, and to recover their business, they implemented communication and marketing actions, strategies suggested by Mair et al., 2016, 67% developed partnerships, expanded to new markets, reformulated the offer, changed working methods and the same percentage approached new customers and opened online wine stores and the same percentage carried out works.

These results corroborate the studies that refer that resilience requires the organization's ability to manage the environmental requirements that are changing, implies the ability to change and learn and use new knowledge. (Gallopín, 2006; McDonald, 2006; Staber & Sydow, 2002).

Also, the panel of experts confirm the resilience of, at least some producers. The concentration of producers with scale and notoriety, the internationalization, and the quality strategy supported in the uniqueness of national varieties as well as in the traditional production processes added to the competitive prices in the global market, due to the cheaper production factors and increasingly efficient logistical processes, reveals a dynamic, where a new generation of human resources are important players. In fact, as show the results of the panel experts, the material resources, the continuous hiring of qualified human resources with extensive experience, a collaborative governance with different stakeholders, including associations of regional producers and other public institutions, contributes to companies in the region being a reference in the Portuguese wine industry.

In conclusion we may say that this study allowed the identification of a competitive wine sector in Peninsula de Setúbal and the identification of successful business model adopted by the most innovative and competitive companies in the Setúbal Peninsula.

Although this research work focuses on the case study of companies in the wine sector of the Setúbal Peninsula, taking into account the growing importance of the region at the national level (for example, it is in second

position in sales in the national market), it can be suggest that, in general, successful business models in the country, have in reference the articulation of competitive advantages based on differentiation, with excellent quality products, with cost efficiency, based on logistic and comparatively cheaper production factors.

References

Amed, R., Seedat, M., van Niekerk, A. and Bulbulia, S. (2004) Discerning Community Resilience in Disadvantaged Communities in the Context of Violence and Injury Prevention. S. Afr. J. Psychol, 34, 386–408.

Burnard, K. and Bhamra, R. (2011) Organisational resilience: development of a conceptual framework for organisational responses, International Journal of Production Research, Vol. 49, No. 18, pp. 5581-5599.

Gallopín, G. C. (2006) Linkages between vulnerability, resilience, adaptive capacity, Global Environmental Change, Vol. 16, pp. 293-303.

Gonçalves, L., Navarro, J. B and Sala, R. (2019) Spanish validation of the Benchmark Resilience Tool (short-form version) to evaluate organisational resilience, Safety Science, 111, 94-101,10.1016/j.ssci.2018.09.015

ISO (2017) Standard 22316 -. Security and resilience – Organisational resilience – Principles and attributes. International Organization for Standardization, Geneva, Switzerland.

Kolb, D.; andThach, L. (2016) Analyzing German winery adoption of Web 2.0 and social media. J. Wine Res., Vol. 27, pp. 226–241.

Mastroberardino, P., Calabrese, G., Cortese, F. and Petracca, M. (2022) Social Commerce in the Wine Sector: An Exploratory Research Study of the Italian Market. Sustainability, Vol. 14, 2024. https://doi.org/10.3390/ su14042024.

McDonald, N. (2006) Organisational Resilience and Industrial Risk, In E. Hollnagel, D. D. Woods, & N. Leveson (Eds.) Resilience engineering: Concepts and precepts, Ashgate Pub. Co., Hampshire, pp. 155-179.

Ortiz-de-Mandojana, N. and Bansal, P. (2016) The long-term benefits of organisational resilience through sustainable business practices, Strategic Management Journal, Vol. 37, No. 8, pp. 1615-1631.

Petracca, M. (2019) The Tourist Image In the Era of Travel 2.0. The Role Of User-Generated Content and Electronic Word-of-Mouth; FrancoAngeli: Milan, Italy.

Pucci, T., Casprini, E. , Nosi, C. and Zanni, L. (2019) Does social media usage affect online purchasing intention for wine? The moderating role of subjective and objective knowledge. Br. Food J., Vol. 121, pp. 275–288.

Santos, J.F. and Ribeiro, J.C. (2012) The Portuguese online wine buying consumer: Characteristics, motivations and behaviour. EuroMed J. Bus., Vol. 2, N0. 7, pp. 294–311.

Seville, E., Van Opstal, D. and Vargo, J. (2015) A Primer in Resiliency: Seven Principles for Managing the Unexpected. Glob. Bus. Organ. Excel, Vol. 34, pp. 6–18.

Slocum, S.L.; Kline, C. (2014) Regional resilience: Opportunities, challenges and policy messages from Western North Carolina. Anatolia Int. J. Tour. Hosp. Res, Vol. 25, pp. 403–416.

Staber, U. and Sydow, J. (2002) Organisational adaptive capacity. A structuration perspective, Journal of Management Inquiry, Vol. 11, No. 4, pp. 408-424.

Entrepreneurship Education: The International Pedagogical Project COTADAS – Co-Creation to Analyses and Development of Strategic Scenarios

Teresa Costa[1], Pedro Mares[2], William Borges[3] and Nuno Teixeira[4]
[1]Department of Economics and Management, Business School, Polytechnic Institute of Setubal, CITUR, Centre of Tourism Research, Development and Innovation, CICE, Centre for Research in Business Sciences, Portugal
[2]Department of Economics and Management, Business School, Polytechnic Institute of Setubal, Portugal
[3]Department of Management, Federal Institute of Santa Catarina, Brazil
[4]Department of Accounting and Finance, Business School, Polytechnic Institute of Setubal, CICE, Centre for Research in Business Sciences, Portugal
teresa.costa@esce.ips.pt
pedro.mares@esce.ips.pt
william.borges@ifsc.edu.br
nuno.teixeira@esce.ips.pt

Abstract: The "new normality" and the growing uncertainty that the world faces determine the development of different business and innovative ways of work. To this end, a new mindset and new competences are required to the actors that will participate in these new social and business contexts. Higher Education will certainly have its role in shaping this mindset and competences of the future managers who should be able to participate in the co-creation of value propositions for companies. The project COTADAS (CO-creation To Analyses and Development of Strategic Scenarios) aims to contribute to the training of these future managers. The project aims to analyse and develop strategic scenarios that facilitate intelligent and sustainable value propositions, through digital and intelligent tools. Supported in a multidisciplinary approach and using innovative methodologies, it is intended to facilitate the acquisition of knowledge in less attractive areas for students, namely the areas of finance, revealing how this knowledge can leverage emerging and important areas of knowledge such as innovation, entrepreneurship, and sustainability. The objective of this article is to describe and evaluate the COTADAS project, developed in two Higher Education Institutes (Polytechnic Institute of Setúbal and Federal Institute of Santa Catarina) with Portuguese and Brazilian students. This study is structured in two main parts. In the first part we present a theoretical approach and in the second part we describe the project and the results of the assessment. A questionnaire was applied to participants to evaluate the degree of satisfaction with the project and its impact on entrepreneurial skills. The results revealed a high degree of student's satisfaction, as well as a valuable impact on the acquisition and development of entrepreneurial skills. Several advantages in participating in COTADAS were pointed out as well as some possible improvements that can enrich the next project edition. Finally, the results allowed us to understand that both successes and failures were important aspects in the students' learning and personal growth.

Keywords: higher education, entrepreneurship, international education, international program

1. Introduction

The pandemic crisis has brought new challenges to companies and citizens. New ways of working, new business models, new forms of relationship were invented or reinvented to respond to the productive sector and guarantee the functioning of the economy. This renewal requires new ways of thinking and new skills. Higher Education will certainly have its role in the formation of this new mindset and skills of future managers who should be able to participate in the co-creation of value propositions for companies that generate economic, social, and environmental value.

Pedagogical innovation in the context of higher education has become a necessity and a reality that aims to improve the teaching-learning process in a sustainable way, considering the problems and challenges previously mentioned and the social and technological evolution. So, it is important an adaptation of teachers and students to this new economic and social reality.

In this context, entrepreneurial education is considered crucial for the economic and social development of nations. This education allows the training and preparation of students with the necessary competencies,

skills, and attitudes (Heinonen and Poikkijoki, 2006; Lans and Gulikers, 2010; Costa and Carvalho, 2012; Carvalho, Costa and Mares, 2015; Costa and Mares, 2016; Mares, Costa and Galina, 2017). In this sense, project COTADAS (CO-creation To Analyses and Development of Strategic Scenarios) adopt specific teaching methods and strategies, that according with several authors, contribute to the effectiveness of this entrepreneurial education (Smith et al, 2010; Ó Cinnéide, 2010; Blenker and Christensen, 2010). The project aims to analyse and develop strategic scenarios that facilitate intelligent and sustainable value propositions, through digital and intelligent tools.

In this context, the research question emerges "Does COTADAS project impact on entrepreneurial education of the students?". To answer to this question this paper describes and evaluate the project, developed in two Higher Education Institutes (Polytechnic Institute of Setúbal and Federal Institute of Santa Catarina) with Portuguese and Brazilian students, to understand its contribution to the training of the future managers.

2. Theoretical framework

2.1 International education and crisis

The internationalization of higher education institutions (HEIs) has grown significantly in terms of volume, scope, and complexity over the last few decades. Since the mid-twentieth century, the internationalization of these institutions has increased. This tendence reveals a strong concern and effort to respond to the global economy and cultural dynamics (Goby, 2007).

First, in HEIs, internationalization has evolved between contemporary business curriculum, teaching and learning strategies using international examples, case studies and cross-cultural comparisons (Marginson, 2000; Stohl, 2001). Later, these institutions began to promote exchange programs or international mobility (Hermans, 2007). Both internationalization strategies contribute to multi-cultural learning, as well as to the improvement of international perspectives and students' competences. Also, for Crossman and Clarke (2010) international experience allows the acquisition and development of essential skills and improves employability.

During the COVID-19 pandemic, the internationalization of higher education gained even more importance. The cooperation between research and development groups, laboratories, and academia to find new solutions to problems affected by pandemic, new teaching and learning methodologies was significant. Joint publications with international partners were intensified, as well as bi/multilateral funding for the development of joint research (Babbar and Gupta, 2021).

Nevertheless, the crisis that has taken hold in the educational sector has brought negative consequences for the physical mobility, and impossibility of face-to-face relationships, both for students and professors (Altbach and De Wit, 2020; Ogunode et al, 2021).

This slowdown in physical mobility triggered a search among HEIs for alternatives to these constraints (Toro, 2020), which would allow students to develop skills and achieve the goal of international learning at home (Woicolesco et al, 2021). In this sense, new processes of international and intercultural learning have proliferated trought virtual mobility programs. New collaborative online projects, webinars, scientific conferences, short courses, etc. emerge (Woicolesco et al, 2021, in press). According to Altbach and De Wit (2020), these initiatives were developed through the collaboration between partner institutions, strengthening international cooperation ties.

2.2 Entrepreneurship education

Is consensual the contribution of entrepreneurship in the economic development. As referred by Hosseini et al (2020) entrepreneurship has a significant effect on job opportunities, efficiency improvement, and welfare.

Entrepreneurial education is considered not only a way to train individuals to deal with risks, but also a way to promote a culture of associating risks with the other environments of the organization. In fact, the environment context of companies is increasingly dynamic and according with Tajpour et al (2021) these changes in companies causes changes in their attitudes.

Also other researchers, experts and practitioners considerer that the methods of entrepreneurial teaching, as group discussions, lecturing, preparing an action plan for the enterprising, case studies, mentoring by real entrepreneurs, scientific visit methods, educational workshops, storytelling from entrepreneurial experiences, role-playing method, as well as, the development of multidisciplinary projects based on real challenges or problems of companies, are recognised as important contributions in terms of student's soft and hard skills acquisition (Lonappan and Devaraj, 2011). The challenge is even greater when these projects were developed in an international context (Carvalho, Costa and Mares, 2015; Ryabova, 2020).

According with Heinonen and Poikkijoki (2006) the results of entrepreneurship education are evident and can be measured considering three dimensions: 1) Attitudes (self-confidence, initiative, risk-taking, creativity, problem solving); 2) Knowledge (technical, economic and financial literacy, management knowledge); 3) Skills (communication, presentation and transmission of ideas, teamwork, ability to explore opportunities in the various stages of the entrepreneurial process, including opportunity assessment, execution and business plan).

In this context, entrepreneurial education is considered more effective, capable of training and preparing students with the necessary competencies, skills, and attitudes for the creation of new value propositions (Heinonen and Poikkijoki, 2006; Lans and Gulikers, 2010; Ó Cinnéide, 2010; Blenker and Christensen, 2010; Costa and Carvalho, 2012; Carvalho, Costa and Mares, 2015; Costa and Mares, 2016; Costa, Mares and Galina, 2017).

Precisely due to the demands of the presented context, COTADAS (CO-creation To Analyses and Development of Strategic Scenarios) aims to contribute to the training of the future managers. The project aims to analyse and develop strategic scenarios that facilitate intelligent and sustainable value propositions, through digital and intelligent tools. Supported in a multidisciplinary approach and using innovative methodologies, it is intended to facilitate the acquisition of knowledge in less attractive areas for students, namely the areas of finance, revealing how this knowledge can leverage emerging and important areas of knowledge such as innovation, entrepreneurship, and sustainability.

3. Method

The research strategy for the present study is the case study. This option is related to the need to understand the phenomenon analyzed in a systemic way, with a high degree of depth. According to Yin (2009), the case study "is an empirical investigation that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and the context are not clearly defined". Yin (2009) also states that a case study can focus on a single case or on multiple cases. In this work, a single case study will be carried out.

The general objective of this study is to describe and evaluate the COTADAS project. The specific objectives refer to 1) understand entrepreneurial capacities and skills developed by students during COTADAS, 2) know the most positive and negative aspects of COTADAS recognized by students and 3) evaluate the students satisfaction concerning COTADAS.

The research method used is a survey method. The survey was conducted by distributing an online questionnaire to all participants at the end of the project, during March of the current year. The questionnaire employed closed-ended and open-ended questions and it was divided into three sections that followed the objective defined in this study. The first section collects general information about respondents, the second section collects information about the project's contribution to the strengthening of participants' skills and the main positive and negative aspects of the project. The last section collects information about students' degree of satisfaction with their participation in the project.

The data collected were analyzed considering descriptive and content analysis. The quantitative data were analyzed through descriptive statistics to illustrate the pattern of answers and the qualitative data were analyzed using content analysis (Mason, 2002). This approach allowed the authors to capture the general evaluation of the COTADAS project (Oppenheim, 2004).

4. COTADAS (CO-creation To Analyses and Development of Strategic Scenarios)

4.1 Project description

The COTADAS project focuses on very relevant and current topics related with performance and evaluation in the business context, allowing students to interconnect strategic analysis to the economic and financial analysis of companies. Thus, in this pedagogical innovation project, students could work with tools such as PESTEL analysis, Porter's 5 forces, SWOT analysis, the CANVAS model and economic and financial analysis, building new value propositions for companies studied, with reference to the main challenges encountered and their impact on financial performance.

The pedagogical methods were based on learning by doing methodology and problem-based learning, where the students could analyse and work on real challenges in the business context of Portugal and Brazil. Students worked in multidisciplinary and multicultural groups, where they could study real cases of listed companies of different nationalities and work with sector and management specialists, contributing to the acquisition of important complementary skills.

In addition, the work was developed in a bootcamp environment, where techniques such as brainstorming, the flipped classroom, the elaboration of frameworks, dashboards, and the realization of presentation pitches of their work were used. These techniques, together with contact with professors in bootcamps, contribute to the acquisition and strengthening of skills, abilities, and attitudes, fundamental for their competitiveness in the job market and for their ability to transfer knowledge in the business context.

The development of the project took place over several weeks through the realization of different activities that we present below.

Activity 1 - Launch of the pedagogical innovation project:
Preparation of project dissemination was carried out, to maximize the number of participants and to publicize and promote the project. In this sense, a public event was organized for the community in general, where the project, its objectives and expected impacts were presented.

Activity 2 - Preparation and organization of the pedagogical innovation project:
In this activity, materials to support pedagogical activities were prepared and tested (templates and digital frameworks, some recordings of sessions, videos).
In addition, the entire pedagogical program was planned and organized in Moodle (bootcamp activities, framing sessions, videos, among other aspects of the project).

Activity 3 - Carrying out pedagogical activities:
The activities were carried out in 8 bootcamps (BC), took place in streaming format, using adapted pedagogical tools, and in each bootcamp were done Complementary Activities (CA) and Intermediate Deliveries (ID).
Additionally, to finish the pedagogical activities of the project, was organized a Meeting, with a Final Delivery (FD). Each bootcamp lasted approximately 1h30m of face-to-face work in streaming and 2h to 3h of autonomous work by each group.

The following table presents the complementary activities and intermediate deliveries associated with each bootcamp (BC).

Table 1: Complementary activities and deliveries in each Bootcamp

BC: Day 1	Political factors: a presentation was made about the main actions, financing, relations between countries, degree of government intervention in the economy, etc. Economic factors: a presentation was made about data such as, inflation rate, exchange rate, interest rate, employment/unemployment rate and other indicators of economic growth.	CA1: Organization of teams and choice of companies to analyse. CA2: Brainstorming about opportunities from political and economic factors.
BC: Day	Social factors: a presentation was made of the different	CA3: Use of the Flipped classroom method to

2	cultural and demographic aspects of society that form the macro-environment of organizations. Technological factors: a presentation was made on how technology evolves at a fast pace, which makes companies need to be up to date with these changes.	validate ideas regarding the political and economic factors of the group and promote dialogue between teams. CA4: Brainstorming about social and technological issues that affect the businesses.
BC: Day 3	Environmental factors: a presentation was made on the influences of the environment and the impact of ecological aspects. Legal factors: a presentation was made on the legal considerations of a business, considering the territories in which they operate.	CA5: Use of the Flipped classroom method to validate ideas regarding the social and technological factors of the group's future, promoting dialogue between teams. CA6: Brainstorming about environmental and legal considerations that may affect the businesses. ID: Contextual framework.
BC: Day 4	Factors of the future: presentation of a new analytical category of the PESTEL model, inserting the item F – Future.	CA7: Use of the Flipped classroom method to validate ideas related to the group's environmental and legal factors and promote dialogue between teams. CA8: Brainstorming on questions like: Is there operational and financial capacity for the future? What are the risks in capital allocation? Is the company's vision of the future compatible with the vision discussed by the group? How does the company envision the company in the future? What is the new value proposition identified? ID: Futurologist framework
BC: Day 5	A strategic analysis was carried out and considered the Porter's (1990) conceptual model on competitive forces.	CA9: Analysis exercise based on Porter's 5 Forces. CA10: Afterwards, the teams presented the results of the discussion and defended the company's evaluation. ID: Competitive framework.
BC: Day 6	SWOT Analysis: In a mixed perspective (external and internal), a presentation was made about the elements of this tool.	CA11: Cross SWOT analysis exercise. CA12: PITCH with the presentation of the great strategic vectors. ID: SWOT Framework
BC: Day 7	Economic and financial analysis: a presentation was made on the economic and financial analysis and on various indicators.	CA13: Dashboard exercise of economic and financial indicators. CA14: PITCH with the presentation of economic and financial data.
BC: Day 8	Innovative value perception: a presentation of the CANVAS tool was made, discussing all the elements of the framework.	CA15: Identification of items on the CANVAS screen. CA16: PITCH with the presentation of value propositions for the future of the organization. ID: CANVAS screen with value propositions
Meeting : Day 9	A workshop was held to promote lectures and the presentation of the case studies.	CA17: Oral video presentation, up to five minutes long. FD: Video

During the bootcamps held each week, the professors carried out and made available in Moodle, pedagogical support materials on the different topics covered (videos, PowerPoint presentations, word templates, excel models, among other resources), which contributed to a better framing of participants in the objectives of each session. At the same time, the participants putted in the Moodle the various deliveries associated with each bootcamp.

4.2 Results and discussion

COTADAS project have the participation of 19 students from Polytechnic Institute of Setúbal and 10 students from Federal Institute of Santa Catarina that completed the project. To evaluate the project a questionnaire was carried out that sought to know the opinion of the participants about the project's contribution to the strengthening of their skills and to identify opportunities for improvement in its operation in future editions. It was received 21 responses, which represents 72.4% of the population.

The age group of respondents is between 19 and 36 years. Regarding gender, 66.7% are women and 33.3% are men (Table 2). 21 participants answered the questionnaire, of which 13 (61.9%) are from the Polytechnic Institute of Setúbal and 8 (38.1%) from the Federal Institute of Santa Catarina (Table 3).

Table 2: Respondents demographic based on gender and age

Gender	Age				Total
	19-20	21-22	23-24	≥25	
Female	3	6	4	1	14
Male	0	3	1	3	7
Total	3	9	5	4	21

As the method was based on international, interdisciplinary, and inter-institutional issues, it was natural for this characterization to exist. Including, the heterogeneity of the participants was explored in the designed method, proposing debates, studies, and creations from the work groups.

Table 3: Respondents demographic based on Higher Education Institution and gender

	Female	Male	Total
Polytechnic Institute of Setúbal	12	1	13
Federal Institute of Santa Catarina	2	6	8

In the following analysis, we examine the participation of students in the COTADAS project, the impacts of the project on the participants and the students' satisfaction.

Regarding the time that the participants dedicated to the project, in addition to participating in the weekly Bootcamps, most respondents stated that they dedicate more than two hours a week to the COTADAS project (Figure 1). Considering that the project took place during the school period, this indicator shows that the commitment of most participants was quite satisfactory.

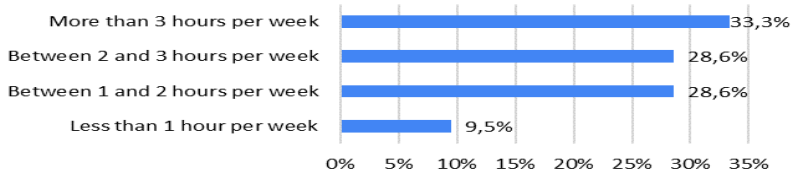


Figure 1: Average number of hours per week dedicated to the project

Figure 2 provides information about the project contributions in improving participant's capacities and skills. Most participants consider that their participation in the project contributed to the improvement of skills and competences in terms of teamwork, leadership, research and analysis of information and strategic analysis. On the other hand, participants considered that participation in the project had a smaller impact on improving skills related to market and finance analysis. Thus, the results of the pedagogical activities developed during the COTADAS project seem to meet the model of Heinonen and Poikkijoki (2006) presented in the theoretical framework.

The greater concentration of "agree" and "strongly agree" answers strengthens the thesis that the methodological design contributes to the project's objective. The analysis of environments, financial conditions and subsequent value propositions work in a complementary way. The construction of skills considers the context, in this case, understanding the theory and identifying in practice how it relates to the corporate world.

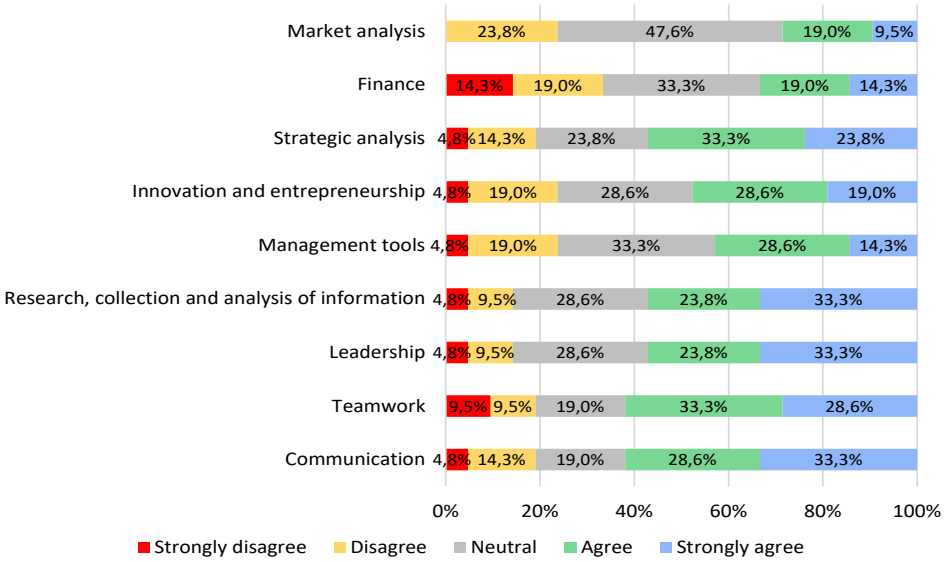


Figure 2: Project contributions in improving participant's capacities and skills

To analyse the impact of the project on the participants, they were asked to indicate the main positive and negative aspects of the project. Regarding the positive aspects of the project, the aspects most highlighted by the respondents were the development of soft skills (25.7%), such as communication, teamwork and leadership; the opportunity to have an international and intercultural experience, allowing participants to interact with people from another country and with a different culture (22.9%) and the possibility to apply the knowledge acquired during the course and to learn about other management tools (17.1%). These results confirm the statement of Crossman and Clarke (2010) concerning international experience and its contribution to the acquisition and development of essential skills. Also confirm the importance of the development of multidisciplinary projects based on real problems of companies, as well as the importance of the acquisition of soft and hard skills refered in literature review by Lonappan and Devaraj (2011).

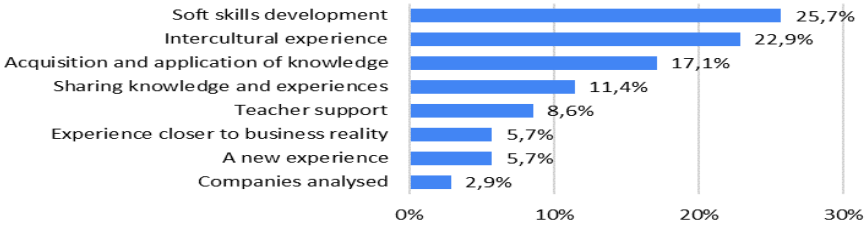


Figure 3: Positive aspects of the project

During the project, problems were observed in the functioning of some groups, namely in organizational and communication difficulties, as well as in terms of the participants' commitment.

These problems were also highlighted by the participants in the responses to the questionnaire. In the opinion of the respondents, the main negative aspects of the project are related to the lack of commitment of some participants (39.1%), the difficulty in finding compatible schedules with the other group colleagues (21.7%) and the constraints associated to the COVID-19 pandemic (17.4%). These aspects turn out to be interrelated, since the differences in the time zone between Brazil and Portugal, as well as the differences in class schedules and academic calendars, caused difficulties for the groups in carrying out the different activities. Also, literature review highlight some of these constraints (Altbach and De Wit, 2020; Jacobs et al, 2021).

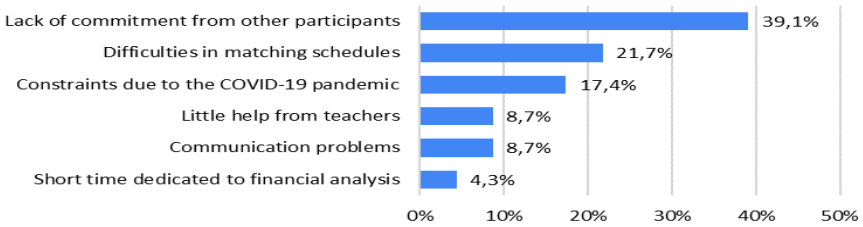


Figure 4: Negative aspects of the project

The difficulties are related to the very foundations of the project, notably with cultural issues, difficulties in higher education, difficulties in interpretation, among others. It should be noted that the satisfaction of the participants (who answered the questionnaire) can be seen in Figure 5.

The participants were asked to use a 5-point Likert scale (1=Very dissatisfied, 5=Very satisfied) to rate their overall satisfaction. As we can see in figure 5, participants reported a high level of satisfaction with their participation in the project.

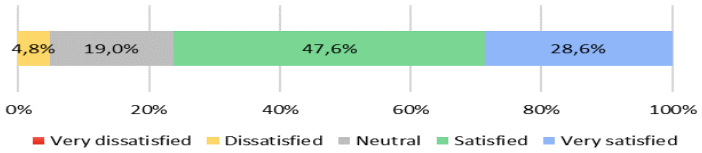


Figure 5: Students satisfaction with their participation in the project

Finally, respondents were asked if they would recommend the COTADAS project to other colleagues. As we can see in Figure 6, more than 95% answered positively. This result shows that participants enjoyed the experience of having participated in this project.

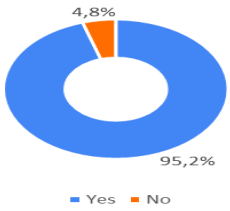


Figure 6: Would you recommend this project?

The possibility of recommending the project to other students is directly related to satisfaction with the results and confidence in the proposed teaching process. Although difficulties appeared in the work of the groups, the method designed in COTADAS was useful enough to promote qualified knowledge, preparing students with the necessary competencies, skills, and attitudes.

5. Conclusions

This study allowed to conclude that over the last few years, HEIs have been focusing on the development of multidisciplinary projects based on real challenges or problems of companies, due to the contribution of these projects to represent in terms of student's skills acquisition (hard and soft skills). Also allowed to understand that the challenge is even greater when these projects take place in an international context, as it is the case of COTADAS. The results of the study revealed that the COVID-19 pandemic has brought several constraints, leading HEIs to look for alternatives to overcome these constraints, in order to allow students to develop skills and achieve the goal of international learning at home. COTADAS allowed a new form of virtual mobility contributing to the training of future managers from Polytechnic Institute of Setúbal and Federal Institute of Santa Catarina. From the data analysis it was revealed a high degree of student's satisfaction, as well as a valuable impact on the acquisition and development of entrepreneurial skills such as leadership, communication, and teamwork. The students pointed out several advantages in participating in COTADAS, highlighting the intercultural experience and the acquisition of knowledge. On the other hand, the students also pointed out some negative aspects regarding the project, mainly associated with the availability and commitment of some participants and the constraints associated with the COVID-19 pandemic. These results

allowed us to understand the successes and failures of this project and will be very important to improve the next project edition. The findings of this study may be highly useful for academicians and teachers in shaping the international education in higher education system.

Appendix 1

Survey

I – General Issues

1.1. Age: ____

1.2. Gender:

□	Female
□	Male

1.3. Select the higher education institution to which you belong:

□	Federal Institute of Santa Catarina
□	Polytechnic Institute of Setúbal

II – COTADAS Project

2.1. Indicate the average number of hours per week you have dedicated to the project:

□	Less than 1 hour per week
□	Between 1 and 2 hours per week
□	Between 2 and 3 hours per week
□	More than 3 hours per week

2.2. How satisfied are you with your participation in the project?

	1	2	3	4	5	
Very dissatisfied	□	□	□	□	□	Very satisfied

2.3. Participation in this project has increased your capacity in:

	1 – Strongly disagree	2	3	4	5 – Strongly agree
Communication	□	□	□	□	□
Teamwork	□	□	□	□	□
Leadership	□	□	□	□	□
Research, collection and analysis of information	□	□	□	□	□
Management tools	□	□	□	□	□
Innovation and entrepreneurship	□	□	□	□	□
Strategic analysis	□	□	□	□	□
Finance	□	□	□	□	□
Market analysis	□	□	□	□	□

2.4. Considering the project, indicate what were the main positive and negative aspects.

Positive aspects: _____

Negative aspects: _____

2.5. Would you recommend this project to other students?

□	Yes
□	No

2.6. Please indicate reasons for not recommending this project: _____

Thanks for your collaboration!

References

Altbach, P. and De Wit, H. (2020) "Post pandemic outlook for HE is bleakest for the poorest", [online], University World News", https://www.universityworldnews.com/post.php?story=20200402152914362.

Babbar, M. and Gupta, T. (2021) "Response of educational institutions to COVID-19 pandemic: An inter-country comparison", *Policy Futures in Education*, pp 1–23.

Blenker, P. and Christensen, P.R. (2010) *Hunting the entrepreneurial expertise: entrepreneurs in education,* Handbook of Research in Entrepreneurship Education, Vol. 3, Edited by Alain Fayolle, Edward Elgar, Northampton, MA, USA.

Carvalho, L., Costa, T. and Mares, P. (2015) "A Success story in a partnership programme for entrepreneurship education: Outlook of students perceptions towards entrepreneurship", *International Journal of Management in Education*, Vol. 9, No. 4, pp 444-465.

Costa, T. and Carvalho, L. (2012) "A educação para o empreendedorismo como facilitador da inclusão social", *Revista Lusófona de Educação, Centro de Estudos e Intervenção em Educação e Formação (CEIEF) e Instituto de Educação – Universidade Lusófona de Humanidades e Tecnologias*, Vol. 19, pp 103-118.

Costa, T., Galina, S., Mares, P. and Alves, P. (2017) "Práticas da educação para o empreendedorismo no ensino superior: o caso da atividade pedagógica "Empreendedor por 1 dia"", Paper read at Conferência sobre Educação para o Empreendedorismo, Aveiro, Portugal, September.

Crossman, E.J. and Clarke, M. (2010) "International experience and graduate employability: stakeholder perceptions on the connection", *Higher Education*, Vol. 59, pp 599–613.

Goby, V, (2007) "Business communication needs", *Journal of Business and Technical Communication*, Vol. 21, No. 4, pp 425-437.

Heinonen, J. and Poikkijoki, S. (2006) "An entrepreneurial-directed approach to entrepreneurship education: mission impossible?", *Journal of Management Development*, Vol. 25, No. 1, pp 80-94.

Hermans, J. (2007) "High potentials: A CEO perspective", *Journal of Studies in International Education*, Vol. 11, No. 3/4, pp 510–521.

Hosseini, E., Tajpour, M. and Lashkarbooluki, M. (2020) "The impact of entrepreneurial skills on manager's job performance", *International Journal of Human Capital in Urban Management*, Vol. 5, No. 4, pp 361–72.

Lans, T. and Gulikers, J. (2010) *Assessing entrepreneurial competence in entrepreneurship education and training*, Handbook of Research in Entrepreneurship Education, Vol. 3, Edited by Alain Fayolle, Edward Elgar, Northampton, MA, USA.

Lonappan, J., and Devaraj, K. (2011) "Pedagogical Innovations in Teaching Entrepreneurship", in: Eighth AIMS International Conference on Management, pp 513-518.

Mares, P., Costa, T., and Galina, S. (2016) "Student's entrepreneurial intention: ESCE and FEA comparison", Paper read at XXVI Jornadas Luso-Espanholas de Gestão Científica, Idanha-a-Nova, Portugal, February.

Marginson, S. (2000) "Rethinking academic work in the global era", *Journal of Higher Education Policy and Management*, Vol. 22, No. 1, pp 23–35.

Mason, J. (2002) *Qualitative Researching*, 2nd edition, SAGE Publications, London.

Ó Cinnéide, B. (2010) *The creative industries and entrepreneurship education: the potential contribution of student-oriented case studies*, Handbook of Research in Entrepreneurship Education, Vol. 3, Edited by Alain Fayolle, Edward Elgar, Northampton, MA, USA.

Ogunode, N.J., Ndubuisi, A.G., Terfa, A.C. (2021) "Impact of COVID-19 Pandemic on Nigerian Educational Institutions", *Electronic Research Journal of Engineering, Computer and Applied Sciences*, Vol. 3, pp 10-20.

Oppenheim, A. N. (2004) *The Quantification of Questionnaire Data*. In C. Seale, Social Research Method, Routledge, London.

Porter, M.E. (1990) *The Competitive Advantage of Nations*, The Free Press, New York.

Ryabova, A.L. (2020) "Collaborative online international learning projects in the context of contemporary pedagogical challenge", *Pedagogical Journal*, Vol. 10, Is. 3A, pp 238-246.

Smith, B.R., Kickul, J. and Coley, L. (2010) *Using simulation to develop empathy and motivate agency: an innovative pedagogical approach for social entrepreneurship education*, Handbook of Research in Entrepreneurship Education, Vol. 3, Edited by Alain Fayolle, Edward Elgar, Northampton, MA, USA.

Stohl, C. (2001) *Globalizing organizational communication*, In F. Jablin & L. Putnam (Eds.), The new handbook of organizational communication, accessing theory, research and methods, Thousand Oaks: Sage.

Tajpour, M., Demiryurek, K. and Abaci, N.L. (2021) "Design the Pattern of Increasing Satisfaction for International Students: A Qualitative Study with the Grounded Theory Approach", *International Journal of Management in Education*, Vol. 15.

Toro, D. (2020) "Educación Superior en Latinoamérica en una economía post-COVID", *Revista de Educación Superior en América Latina*, Vol. 8 (julio-diciembre 2020), pp 45–52.

Woicolesco, V., Cassol-Silva, C. and Morosini, M. (2021) "Internationalization of Higher Education in a pandemic context: virtualization as an emerging stage in Brazil towards sustainable Internationalization", *Journal of Studies in International Education*, In press.

Yin, R.K. (2009) *Case study research: Design and methods,* 4th ed., Thousand Oaks, CA: Sage.

A Structural Equations Approach Applied to Social Innovation

Jorge Cunha[1], Carla Ferreira[1], Claúdio Vasconcelos[2], Madalena Araújo[1], Manuel Lopes Nunes[1] and Paula Ferreira[1]

[1]ALGORITMI Research Center, University of Minho, Portugal

[2]Federal University of Paraíba, Brasil

jscunha@dps.uminho.pt

b8608@algoritmi.uminho.pt

claudioruy@yahoo.com

mmaraujo@dps.uminho.pt

lnunes@dps.uminho.pt

paulaf@dps.uminho.pt

Abstract: Social innovation is a topic that has rapidly gained visibility during the last decades, where public organizations, private companies, and community groups are interested in developing more efficient and effective solutions to important societal challenges, such as poverty, demographic change, climate change, and unemployment. The University has been recognized for a long-time as a place of learning and academic research as well as a driver of economic growth, social mobility, and reducer of social inequality within and beyond its locality and region. Several researchers have advocated that the engagement of universities would foster the social innovation process, drawing on their existing resources and capabilities to benefit society at large. However, less is known about to relationship between creativity, entrepreneurial intention, and social innovation. Based on these arguments, the main aim of this study to investigate the effect of creativity and entrepreneurial intention on social innovation tendency within the academic community. The approach to empirical research adopted was a structural equation model. The sample used is comprised of students and professors or researchers from Portuguese universities. Confirmatory factor analysis supports the differentiation among the theoretical constructs, namely: self-creativity, creativity stimulated in the family, creativity stimulated in the university, entrepreneurial intention, and social innovation tendency. Results from the structural analysis support the suggestion that engagement in social innovation is positively related to self-creativity, family context, and entrepreneurial intention. Additionally, family role models seem to exert an effect on entrepreneurial intention. This study contributes to the body of social innovation literature at two levels of development: the core theoretical contributions are the research on social innovation tendency models and, at a broader level, on social innovation education. Particularly, this finding contributes to the line of research of social innovation tendency indicating that personality traits may have an essential role to play in developing theories of the entrepreneurial process.

Keywords: creativity, entrepreneurial intention, social innovation tendency, university, structural equation modeling

1. Introduction

In the last decades, social innovation has been rapidly gained visibility, where public organizations, private companies, and community groups are interested in developing more efficient and effective solutions to important societal challenges, such as poverty, demographic change, climate change, and unemployment (Bazan et al,2020). However, there is a lack of consensus on the social innovation definition. Several definitions have emerged in the literature to explain the meaning of social innovation and to understand how social innovation happens (João-Roland and Granados, 2020). The term social innovation tendency is applied to the individual's tendency toward social innovation (Bulut et al,2013). Despite the fragmentation of this field, the models proposed to explain

the social innovation process highlighted idea generation as the first stage of that process (Benneworth and Cunha, 2015; Mulgan, 2006). In this context, creativity emerges as an important driver of social innovation initiatives and projects (Cunha et al.,2021). Creativity is defined as the generation of novel and useful ideas (Benneworth and Cunha, 2015; Mulgan, 2006). Creativity comprises an important element of business entrepreneurship (Ip et al,2018), and the same about social entrepreneurship (Petkova, 2019). Zampetakis and Moustakis (2006) suggest that individual creativity is related to a capacity to think outside the box influencing an individual's decision to form a new venture. On the other hand, the literature related has been highlighting that creativity is sensitive to the context in which an individual develops (Zampetakis and Moustakis, 2006). Creativity is, therefore, described as the outcome of an interactive process in interpersonal settings (Zampetakis et al, 2011). Zampetakis and Moustakis (2006) and Zampetakis et al (2011) highlighted the role of the family environment and academic community in prompting individuals' creativity and shaping entrepreneurial attitudes. For these authors, the academic community plays an essential role in encouraging creativity. Chambers (1977) argues that discouraging student ideas or being too critical is a behavior that is likely to hamper creativity among university students. Thus, the family and educational environment on the development of creativity should be underlined.

Entrepreneurship reflects the creativity and innovative activity by which individuals and organizations create value (Biraglia and Kadile, 2019). Centered on planned behavior theory, entrepreneurial intention is usually used as a good proxy for entrepreneurial action (Meoli et al, 2020). Research on entrepreneurial intention argues that having the intention to engage in entrepreneurial behavior is a strong predictor of actually engaging in entrepreneurial behavior (Farrukh et al,2018). Zhao et al (2005) show that entrepreneurial intentions are influenced by psychological characteristics, entrepreneurship education, and familiar context. Several authors (e.g. Biraglia and Kadile, 2019; Meoli et al, 2020) argue for a positive association between personality traits and entrepreneurial intention, where the entrepreneurial intention can be employed as a proxy for entrepreneurial action within the university environment.

Universities have been emerging in literature as facilitators of the social innovation process, drawing on their existing resources and capabilities to benefit society at large (Cunha and Benneworth, 2013). Particularly, their attention focuses on promoting the entrepreneurial initiatives stemming from the university context, that is, entrepreneurship is perceived as an amplifier of economic development and inclusion, generating positive impacts on several social challenges (Shi et al2019). Therefore, to the best of our knowledge, empirical evidence considering the links between creativity, entrepreneurial intention, and social innovation tendency within the university context is scarce.

Different quantitative methodologies have been conducted among university students to investigate what factors influence intention linked to business entrepreneurship (e.g. Bazan et al, 2020, Zampetakis et al, 2011; Zampetakis and Moustakis, 2006). Particularly, these studies focus on business entrepreneurship: what leads students to start new business firms with a clear profit maximization orientation. However, few empirical studies address the relationship between creativity, entrepreneurial intention, and social innovation tendency within the academic community. In this context, one key issue emerges: How are creativity and entrepreneurial intention

affecting the social innovation tendency inside the academic community? Using the structural equation modeling approach, the current study is an attempt to provide an answer to this question. This research intends to contribute to understanding the influence of creativity on social innovation tendency as well as to investigate the effect of entrepreneurial intention on social innovation tendency.

1.1 Conceptual model and research hypotheses

A structural model is proposed incorporating the relations between creativity, entrepreneurial intention, and social innovation tendency. In concordance with models proposed by Zampetakis and Moustakis (2006), Zampetakis (2008), Zampetakis, et al (2011), and Blut et al (2013), we propose a conceptual model (Figure 1) taking into account two constructs (creativity and entrepreneurial intention) to predict social innovation tendency within the academic community.

Based on the arguments mentioned above, we suggest that when creativity is stimulated in the family, has an impact on creativity stimulated in the university and entrepreneurial intention, which in turn influences self-creativity. On the other hand, the entrepreneurial intention is a good predictor of social innovation tendency and can be considered as a mediating factor in the relationship between creativity stimulated in family and social innovation tendency. Furthermore, to answer the societal challenges, the social innovation tendency entails a positive self-creativity. Thus, we propose the following hypotheses (Figure 1):

H1: Creativity stimulated in the family context is positively related to entrepreneurial intention

H2: Entrepreneurial intention is positively related to self-creativity.

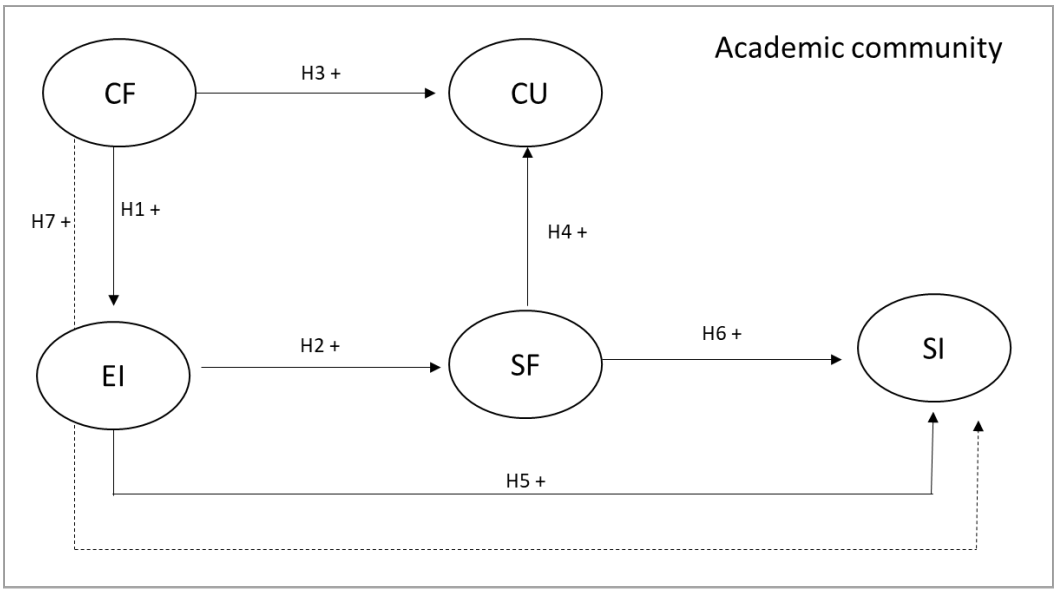
H3: Creativity stimulated in the family context is positively related to creativity stimulated in the university

H4: Self-creativity is positively related to creativity stimulated in the university

H5: Entrepreneurial intention is positively related to social innovation tendency

H6: Self-creativity is positively related to social innovation tendency

H7: Entrepreneurial intention mediates the effect of creativity stimulated in the family on social innovation tendency



Legend:
CF- Creativity stimulated in the family; CU-Creativity stimulated in the university
SF- Self-creativity; EI – Entrepreuneurial intention; SI- Social innovation tendency

Figure 1: Conceptual model

1.2 Overview of the study's aims

This study focus on three main goals: (1) to determine whether, and the extent to which, the entrepreneurial intention and individual creativity are associated with social innovation tendency; (2) to determine whether, and the extent to which, the individual creativity and the creativity supported in the family context are associated with creativity supported in the university; and (3) to investigate whether, and the extent to which the entrepreneurial intention mediates the relationship between creativity supported in the family context and social innovation tendency. To achieve these aims, a structural equations model approach was applied. This approach allows to clearly distinguish the relationship between the five constructs and verify the mediatory power of entrepreneurial intention.

2. Methodology

2.1 Participants and procedure

Participants were 301 individuals of the academic community, where 155 were students and 146 were faculty. Participation in the survey was voluntary, and there were no incentives for participants. The survey was digitally distributed between May and July of 2020. The questionnaire has been put online within the framework of a website whose address has been subsequently disseminated within the academic community in different Portuguese Universities, like a snowball effect perspective. The total sample means age was 37.55 years (Standard Deviation-SD=14.33, minimum=18 years, and maximum= 68 years). Sixty-three percent (63%) of the individuals that participated were women; Sixty percent (60%) of the participants were from the Social/Human Sciences area. The survey instrument contained the five theoretical constructs along with demographic data.

2.2 Measurement of theoretical constructs

The five theoretical constructs included in the analysis were assessed self-reported. Responses to all items were made on a five-point Likert-type scale. The specific measures of the relevant constructs are outlined.

Entrepreneurial intention (EI)

We assessed the entrepreneurial intention using a two-item scale employed by Zampetakis and Moustakis (2006) and Zampetakis et al (2011): (EI1). Probably I'll start my own firm in the near future; (EI2). I would like to be an entrepreneur. The coefficient alpha for the entrepreneurial intention scale was 0.84.

Self-Creativity (SC)

To perceive an individual's attitude toward his own creativity, a three-item scale proposed by Zampetakis and Moustakis (2006) and Zampetakis et al (2011) was used: (SC1). I think I am a very creative person; (SC2). I like to try novel things, despite failure probability; (SC3). I can easily think of a lot and different ideas. The coefficient alpha for this scale was 0.72.

Creativity stimulated in the family (CF)

To ensure a degree of compatibility (Zampetakis and Moustakis, 2006; Zampetakis et al (2011) we assessed the creativity stimulated in the family with three items: (CF1). My family members easily adapt to several circumstances; (CF2). My family members are always thinking of new ideas for making their life easier; (CF3). I can freely talk to my family members about whatever concerns me. The coefficient alpha for this construct was 0.80.

Creativity stimulated in the university (CU)

To perceive whether creativity is promoted in the university context, we applied the three-item scale employed by Zampetakis and Moustakis (2006); Zampetakis et al (2011): (CU1). In my university you learn that there is more than one solution to a problem; (CU2). In my university you learn to examine old problems with new ways; (CU3). In my university the faculty encourages students to produce and employ new ideas. The coefficient alpha for this construct was 0.81.

Social Innovation tendency (SI)

We assessed the social innovation tendency using the eight-item scale proposed by Blut et al (2013): (SI1). I would like to improve the quality of community life by developing social services and new products; (SI2). I look for solutions to create political and social changes in society; (SI3) I want to develop new training techniques to increase the innovative capacity of the community; (SI4) I would use new technologies to solve problems and find solutions to social requirements; (SI5) I look for ways to increase social participation and cooperation in the society; (SI6) I create new ideas that will generate social value and make society more effective; (SI7) I look for opportunities that will change norms and rules; (SI8) I would like to be useful to the community without expectation of any financial benefit. The coefficient alpha for the social innovation tendency was 0.79.

2.3 Data analysis

In order to assess the hypothesized relationships, the Structural Equation Modelling (SEM) was employed, using the maximum likelihood estimation method (AMOS 7.0). We used a two-stage analytic procedure: in stage 1 confirmatory factor analysis was conducted, to estimate and test the hypotheses designed to explain the relationship between observed and no observed variables in the context under analyses. This approach investigates the validity of the construct considering the set of scales in which there is a strong theoretical hypothesis related to the structural model. During the second stage, the analysis of the measurement model and the structural model were combined. The sequential $\chi 2$ differential test was performed to assess nested model comparisons. We applied several model fit statistics (RMSEA: Root Mean Square Error Approximation; CFI: Comparative Fit Index; GFI: Goodness of Fit Index; SRMR: Standardized root means square residual; PCLOSE: Tests for the closeness of fit; TLI: Tucker-Lewis index) (Byrne, 2016; Hair et al, 2014). Finally, to select among the competing structural models, we employed model selection for Structural Equation Modelling.

3. Results

3.1 Assessment of the measurement model

Table 1 shows the fit statistic for the measurement model. Construct reliability (CR), average variance extracted (AVE) and Cronbach's alpha values were higher than the threshold, which is 0.8, 0.5, and 0.7, respectively. To reach the threshold values of AVE, the item "SC2" from the construct "self-creativity" and also the items "SI1", "SI7", and "SI8" from the construct "Social innovation tendency" were eliminated. In summary, the results suggest that the proposed factor structure presents a statistically adequate and sufficient fit to the data, allowing to conduct an analysis of the structural model.

Table 1: Validity coefficients of the measurement model

	convergent validity			**discriminant validity**				
	CR	AVE	Cronbach's alpha	CU	CF	SF	SI	EI
CU	0.849	0.656	0.874	0.810				
CF	0.819	0.608	0.801	0.262***	0.780			
SC	0.725	0.569	0.723	0.127	0.225**	0.754		

SI	0.860	0.565	0.789	0.170*	0.148*	0.621***	0.751	
EI	0.817	0.698	0.841	-0.027	0.183**	0.424***	0.395***	0.836

Significance level: *p < .050; ** p < .010; *** p < .001

Legend: CU- creativity stimulated in the university; CF- creativity stimulated in the family; SC- Self-creativity; EI- Entrepreneurial Intention; SI- Social innovation tendency

3.2 Assessment of the structural models

Figure 2 displays the conceptual model with derived path coefficients from the structural equation analysis. This model revealed an excellent fit to the data: $\chi2(84) = 124.140$, $p = 0.003$; $\chi2/df=1,478$; GFI= 0.947; AGFI= 0.925; CFI= 0.979; SRMR= 0.062; RMSEA= 0.040; and PClose= 0.871. Examining Figure 2, the model postulated that all relationship between the five constructs were statistically significant, except for the relationship between the "self-creativity" and "creativity stimulated in the university" constructs.

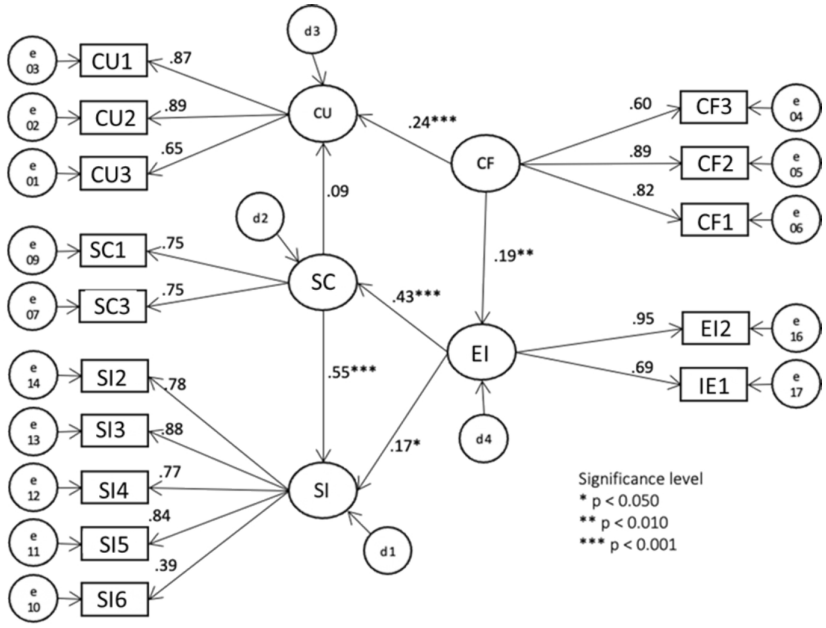


Figure 2: Standardized results of structural model assessment

4. Discussion

To our knowledge, this study is the first to analyze the combined effects of self-creativity, creativity supported in the family, and entrepreneurial intention on social innovation tendency. Table 2 presents a summary of the results against the hypotheses of this study.

Table 2: Summary of the results against the hypotheses of this study

	Hypotheses	Result
H1	Creativity stimulated in the family is positively related to entrepreneurial intention	H1 supported (p< 0.010)

H2	Entrepreneurial intention is positively related to self-creativity	H2 supported (p< 0.000)
H3	Creativity supported in the family is positively related to creativity supported in the university	H3 supported (p< 0.000)
H4	Self-creativity is positively related to creativity stimulated in the university	H4 not supported
H5	Entrepreneurial intention is positively related to social innovation tendency	H5 supported (p<0 .050)
H6	Self-creativity is positively related to social innovation tendency	H6 supported (p< 0.000)
H7	Entrepreneurial intention mediates the effect of creativity stimulated in the family on social innovation tendency	H7supported (p< .050)

The results were found to demonstrate that all hypothesized relationships proposed were supported, except for Hypothesis 4. The results do not reveal a relationship between self-creativity and creativity stimulated in the university, meaning that Hypothesis 4 is not confirmed.

The results obtained corroborate Hypothesis 1 that the creativity stimulated in the family is positively related to entrepreneurial intention (β =0,19, p< 0.01, standardized path coefficient in Figure 2). In the same line, Zampetakis and Moustakis (2006) argued that a family environment that promotes creativity has a positive effect on entrepreneurial intention. These authors suggest that a family example of entrepreneurship assumes an important role in the development of intention. Furthermore, the findings also show that entrepreneurial intentions are positively related to self-creativity, (β =0,43, p< 0.001, standardized path coefficient in Figure 2), supporting Hypothesis 2. Several authors (e.g. Zampetakis and Moustakis, 2006; Zampetakis, 2008; Zampetakis et al.2011) argue that entrepreneurship is an act of creativity. Therefore, entrepreneurial behavior promotes individual creativity to solve problems and pose new questions (Bazan et al2020; Chia and Liang, 2016). There is evidence in the literature that entrepreneurial intention precedes social behavior, particularly in the intention to solve social challenges (Prieto, 2011, Bazan et al2020). Yildirim and Ansal (2017) and Zampetakis and Moustakis (2006) argue that policymakers should be interested in understanding the creation of narratives in the academic community as a mechanism that can affect policy decisions and engagement of universities on societal challenges (Benneworth and Cunha, 2015). In this sense, the findings report that creativity stimulated in the family predicts creativity stimulated in the university, hence Hypothesis 3 is confirmed (β =0,24, p< 0.001, standardized path coefficient in Figure 2). Figure 2 displays that entrepreneurial intention is positively related to social innovation tendency, corroborating Hypothesis 5 (β =0,17, p< 0.05, standardized path coefficient in Figure 2).

Creativity is often perceived as an essential component of problem-solving and the driving force of innovation and entrepreneurship (Yildirim and Ansal, 2017). Particularly, the idea generation that involves creativity is the first stage of the social innovation process (Benneworth and Cunha, 2015). In this sense, the findings were found to corroborate that self-creativity is positively related to social innovation tendency, supporting Hypothesis 6 (β =0,555, p< 0.001, standardized path coefficient in Figure 2). According to Yildirim and Ansal (2017), Zampetakis and Moustakis, (2006), Zampetakis (2008), and Zampetakis et al (2011), the environment in which the individual lives and interacts influences interrelations and causality among creativity, innovativeness, and entrepreneurial skills.

Hypothesis 7 posits that entrepreneurial intention mediates the effect of creativity stimulated in the family on social innovation tendency. The results found to support this hypothesis, that is, the entrepreneurial intention of individuals has a mediating effect on this relationship (α =0,19*0.17= 0.03, p< 0.05, standardized path coefficient in Figure 2). Thus, the present study supports the suggestion that engagement in social innovation is positively related to self-creativity, family context, and entrepreneurial intention.

5. Conclusion

The present study analyses the effect of creativity and entrepreneurial intention on social innovation tendency within the academic community. For this, a structural equation modeling approach was conducted. Results from the structural analysis suggest that self-creativity, family context, and entrepreneurial intention have a positive effect on individuals' social innovation tendency.

In terms of implications, this study contributes to the development of social innovation tendency models indicating that personality traits may have an essential role to play in developing theories of the entrepreneurial process. Additionally, this research contributes to a broader level of social innovation education. Despite this study representing an important step in identifying factors associated with social innovation tendency additional research is required. For example, triangulation methods are recommended, to investigate the perception and attitudes regarding creativity and social innovation tendency.

Acknowledgements

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the R&D Units Project Scope: UIDB/00319/2020.

References

Bazan, C., Gaultois, H., Shaikh, A., Gillespie, K., Frederick, S., Amjad, A., Yap, S., Finn, C., Rayner, J., and Belal, N. (2020) "A systematic literature review of the influence of the university's environment and support system on the precursors of social entrepreneurial intention of students", J*ournal of Innovation and Entrepreneurship*, Vol 9, No, 1.

Benneworth, P., and Cunha, J. (2015) "Universities' contributions to social innovation: reflections in theory and practice", *European Journal of Innovation Management*, Vol 18, No. 4, pp. 508–527.

Biraglia, A., and Kadile, V. (2019) "The Role ofEntrepreneurial Passion and Creativity in Developing Entrepreneurial Intentions: Insights from American Homebrewers", Journal of Small Business Management, Vol 55, No. 1, pp. 170-188

Bulut, C., Eren, H., and Seckin-Halac, D. (2013) "Which one triggers the other? Technological or social innovation". *Creativity Research Journal*, Vol 25, pp. 436–445.

Byrne, B. M. (2016) *Structural Equation Modeling With AMOS: Basic Concepts, Applications, and Programmin*g (2nd ed.). Routledge.

Chambers, J. A. (1977) "College teachers: their effect on creativity of students", *Journal of Educational Psychology*, Vol 65, pp.326–334.

Cunha, J., and Benneworth, P. (2013) "Universities' contributions to social innovation: towards a theoretical framework", *European Urban Research Association (EURA) Conference*, pp.1–31.

Cunha, J., Ferreira, C., Araújo, M., and Nunes, M. (2021) "The mediating role of entrepreneurial intention between creativity and social innovation tendency" *Social Enterprise Journal*.

Farrukh, M., Alzubi, Y., Shahzad, I., Waheed, A., and Kanwal, N. (2018) "Entrepreneurial intentions: The role of personality traits in perspective of theory of planned behaviour", *Asia Pacific Journal of Innovation and Entrepreneurship*, Vol 12, No.3, pp. 399–414.

Hair Jr., J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2014) *Multivariate Data Analysis* (7a ed.). Pearson.

Ip, C. Y., Wu, S. C., Liu, H. C., and Liang, C. (2018) "Social entrepreneurial intentions of students from Hong Kong", *Journal of Entrepreneurship.*

João-Roland, I., and Granados, M. (2020) "Social innovation drivers in social enterprises: systematic review", Journal *of Small Business and Enterprise Development*, Vol 27, No. 5, pp. 775–795.

Meoli, A., Fini, R., Sobrero, M., and Wiklund, J. (2020) "How entrepreneurial intentions in fl uence entrepreneurial career choices: The moderating influence of social context", *Journal of Business Venturing Journal*, Vol. 35

Mulgan, G. (2006) "The process of social innovation", *Innovations: Technology, Governance, Globalization*, Vol.1, No.2, pp.145–162.

Petkova, N. (2019) "The role of innovation and creativity as key factors for the development of social entrepreneurship in Bulgaria", *Entrepreneurship*, Vol7, No.2, pp.124–132.

Prieto, L. C. (2011) "The influence of proactive personality on social entrepreneurial intentions among African-American and hispanic undergraduate students: The moderating role of hope", Academy *of Entrepreneurship Journal.*

Yildirim, N., and Ansal, H. (2017) "First domino tile in the social innovation process: Idea creation of university students", P*ICMET 2016 - Portland International Conference on Management of Engineering and Technology*, pp. 296–306.

Zampetakis, L. (2008) "The role of creativity and proactivity on perceived entrepreneurial desirability", *Thinking Skills and Creativity*, Vol 3, No.2, pp. 154–162.

Zampetakis, L., Gotsi, M., Constantine, A., and Moustakis, V. (2011) "Creativity and Entrepreneurial Intention in Young People", *The International Journal of Entrepreneurship and Innovation*, Vol 12, No. 3, pp. 189–199.

Zampetakis, L., and Moustakis, V. (2006) "Linking creativity with entrepreneurial intentions: A structural approach", *International Entrepreneurship and Management Journal*, Vol 2, pp. 413–428.

Zhao, H., Hills, G., and Seibert, S. (2005) "The mediating role of self-efficacy in the development of entrepreneurial intentions", *Journal of Applied Psychology*, Vol 9, No.6, pp. 1265–1272.

A Proposal for an Assessment Tool of Social Innovation Impact

Jorge Cunha, Wellington Alves, Fernanda Pontes and Madalena Araújo
ALGORITMI Research Center, University of Minho, Portugal
jscunha@dps.uminho.pt
wellingtonbn@gmail.com
larissa.fernanda23@gmail.com
mmaraujo@dps.uminho.pt

Abstract: In response to the urgent need for an inclusive society, the demand for metrics to evaluate the impact of different types and scales of organizations has grown significantly in recent years. The challenge of how to evaluate the impact coming from social innovation (SI) has emerged as an important question posed by various actors, such as academic researchers, students, project managers, leaders of organizations, and policymakers. To find an answer to this question, this research seeks to contribute to bridging the gap between SI initiatives and the evaluation of their impacts. Despite the interest and popularity of the topic of SI, this gap can be justified due to the lack of tools and frameworks to help organizations approach SI impact assessment. Although indicators have been widely used by researchers in different fields of study, the current literature has failed to develop indicators, frameworks or methodologies to assess the impact of SI initiatives. The research includes an investigation of the state of the art in terms of measuring the impact of SI, based on both scientific literature and practitioners' reports. Based on this analysis, a set of thirty-eight indicators was identified to assess the impact of SI. From the literature consulted, it can be seen that the results highlight the gap in the literature regarding the lack of instruments and frameworks. Regarding the set of thirty-eight indicators identified, if applied as a complement to a measurement tool, the indicators can be used as a first attempt to help organizations address the evaluation and effectiveness of the SI impact on their actions. The proposal may contribute to bring to light new evidence in the SI domain for policymakers, researchers and governments, then contributing to a better understanding of the impact of SI.

Keywords: social innovation, impact assessment, indicators, metrics, assessment tool

1. Introduction

The last decade has been contributing to increasing awareness about the social problems faced by society, as well as the society's change process. These changes involve aspects such as social exclusion problems, lack of community access to markets and public sector services, like health, education, and transport (Benneworth & Cunha, 2015). Aiming to overcome these challenges, the development of initiatives to help governments and organizations to solve social problems has become imperative (Stypińska, Franke & Myrczik, 2019, OECD, 2011). To accomplish this aim, Social Innovation (SI) approaches have appeared as an alternative to respond to the challenges related to social problems and needs (Benneworth, Cunha & Cinar, 2020).

Addressing a largely and still unexplored research field, the increasing interest for SI has been supporting a growing list of scientific researches on this subject, as well as addressing global issues to deal with social problems (Dainienė & Dagilienė, 2016; Krlev et al., 2014). Yet, despite SI can be seen as an emergent approach to overcoming barriers to social problems, one of the main challenges faced by researchers and practitioners working in this area remains: how to apply this approach by different organizations, but, at the same time, how to assess the impact of SI on community and stakeholders? According to Antadze & Westley (2012), current measurement tools and approaches tend to focus on the evaluation of the impact of new products and services, mainly evaluating their economic performance. However, SI has a broader impact which implies that other kinds of impact dimensions have to be taken into account. But this poses a particular challenge when it comes to the development of metrics for these other dimensions, beyond the economic ones.
This quest for the development of metrics for SI is precisely the focus of this research. Thus, we aim to answer the following research question: How can the impact of SI be measured?

SI has emerged as an innovative approach with the potential to solve social problems, but at the same time, the development of metrics for this purpose has not yet been fully researched, debated and understood by both organizations and academia. This research attempts to contribute to bridging the gap between SI initiatives and the assessment of their impacts. To this end, this research brings together a set of indicators that can be used by different organizations to assess the impact of their SI initiatives or projects. It should be noted that, as the impact of SI can be measured at the micro, meso and macro-scale (Cunha & Benneworth,

2020), the indicators gathered in this paper fall within a meso perspective, as it focuses on measuring the impact of SI developed by organizations (e.g. NGOs, civil society organizations, universities, companies).

2. Literature review on social innovation impact assessment

The dissatisfaction with the difficulty of technological innovation to capture and fully solve the real needs of society has contributed to the fast development experienced by academia and researchers in the field of SI (Cunha & Benneworth, 2013; Edwards-Schachter & Wallace, 2017). It has led to consider SI as a recent phenomenon that can create roots to respond to the real needs of the society as well as to deliver social benefits and produce important improvements in society with relatively low costs (Reeder et al., 2012).

SI can be seen as new ideas, institutions, or ways of working to support society to meet its social needs (Dainienė & Dagilienė, 2016). Cunha and Benneworth (2015: 512) define SI as "*a socially innovative practice that delivers socially just outcomes by developing novel solutions in border spanning learning communities thereby creating social value by promoting community development, hence forming wider collaborative networks and challenging existing social institutions through this collaborative action*".

From the several SI definitions presented in the literature, it is clear that all of them are concerned with the social needs of contemporary society. Yet, according to Unceta et al. (2016), there are no clear limits defining the impacts of SI on society. The authors claim that defining metrics that allow for assessing the causal relations between SI and its benefits has become a complex task.

From this point of view, the development of indicators, metrics, and tools to assess the impact of SI poses the scientific community a new challenge, not only related to that development but also regarding the complexity of selecting criteria for gathering indicators of different types, forms and sources (Bund et al., 2015). Yet, despite the complexity of this task, there is a strong demand from policy-making and organizations regarding the development of indicators to measure the impact of SI initiatives, which configures, clearly, a gap in the current literature around SI (Spila et al., 2016). The identified gap can be justified for different aspects, such as lack of consensus on what SI is about, difficulties to address the appropriate methodologies to select indicators and their metrics, and which organizations should be assessed, among others (see, for example, Antadze & Westley, 2012a; Bund et al., 2015; Spila et al., 2016; Vilarinho et al., 2018). In this context, the identification of indicators and the development of metrics for SI impact assessment must be capable to collect and make available data at various dimensions where SI may occur, for instance, social, geographical, cultural, political, economic, educational and environmental. According to Krlev et al. (2014), these aspects reflect traits that may support researchers in building measures and indicators tailored to SI.

2.1 Social innovation impact assessment through indicators

To guide organizations to measure the impacts of their performance, different strategies have been suggested in the literature, each has its own purpose for the use, which means that choosing one of them, claims the necessity for designing a plan which best fits the proposed objective (Dziallas & Blind, 2019).

Regarding social development, there are several metrics available devoted to this aim. For instance, measures developed by the Global Report Initiative (GRI), Organisation for Economic Co-operation and Development (OECD) and World Bank have been widely used for measuring economic and social development in different contexts (Dainienė & Dagilienė, 2015).

Regarding which methodologies have been adopted for impact assessment, scenario tool, participatory tool, Multicriteria Analysis, Cost-benefit Analysis, accounting tools and indicators sets are examples of the main tools available and used for impact assessment presented in the current literature. Aiming for a better understanding of the impact of SI, it calls on researchers, governments and practitioners to develop metrics for this particular aim. The current literature has shown that the use of indicators and metrics to assess the impact of different sectors of the economy has been increasing over the years (Alves et al., 2016). According to Puig et al. (2014), the use of indicators to assess the performance of organizations or projects is toughly recommended twofold, firstly because it can be able to screen progress and provide trends and changes over time, secondly, as metrics and indicators can clearly show not only how individual organizations and projects are performing, but can also assess national and regional benchmarking performance. Although indicators have been largely used by researchers in different fields of study, the current literature has failed regarding the

development of indicators, frameworks or methodologies for SI impact assessment (Cunha & Benneworth, 2020). Several scholars have been discussing the need to and highlighting the importance of measuring the impact of SI. For instance, Antadze & Westley (2012b) have discussed the barriers to developing impact metrics for SI. Bund et al. (2013) present a set of challenges and opportunities for SI measurement. Dainienė & Dagilienė (2016) show a review of the theoretical background for SI and also propose a conceptual model for measuring the value of SI at an organisational level. Finally, Schmitz et al. (2013) present an attempt to measure SI at the national level using an indicator system. However, what has been missing in the literature is how this should be done in practice, that is what kind of specific indicators should be used and how those indicators can be measured (i.e. metrics to use) for SI impact assessment. This screening collaborates with the idea that most researchers mentioning SI impact assessment focus on conceptual models, frameworks or methodologies. Few of them present quantitative indicators or metrics for measuring the impact of SI. According to Jacobi & Chiappero-Martinetti (2017), the development of quantitative or qualitative metrics to measure the impact of SI should consider two key aspects, namely: (i) the benefits which will be generated at both social and individual levels and (ii) the importance to provide a broader account of the potential impact generated by SI, focusing tangible and intangible effects. The regional context and attitudes of the population regarding SI initiatives are also aspects highlighted by Kleverbeck et al. (2019), which need to be considered when developing indicators for SI. Based on these characteristics, Figure 1 summarizes a set of criteria established by Alonso et al. (2015) and the work developed by the Ministry of Social Development (2016), which lists a set of criteria that should be considered when selecting indicators for SI impact assessment. When considering the criteria presented in Figure 1, different perspectives should be assessed, for instance, the innovation performance of projects and the innovativeness of the organizations (Bund et al., 2015). Furthermore, the innovativeness of spatial units, such as the societies as a whole, should be accounted for, which can be analysed at national (macro), regional (meso) or municipal (micro) levels.

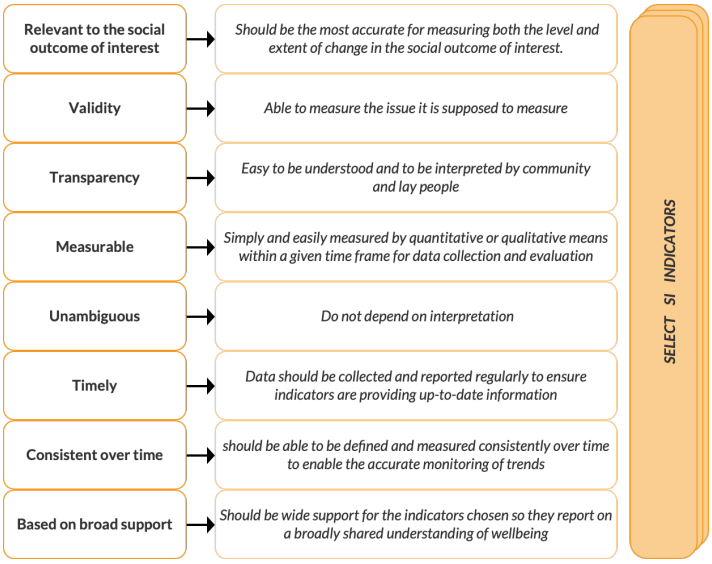


Figure 1: Criteria for selection of indicators. Source: Adapted from Alonso et al. (2015) and Ministry of Social Development (2016)

Nonetheless, as mentioned before, it is also important to highlight that while indicators have been presented in the current literature as useful measures to reduce the complexity when tackling relevant data, one should bear in mind that every process of selection or aggregation is not considered as an easy task (Alves et al., 2016). In this sense, Falck & Spangenberg (2014) emphasize the importance of the selection of indicators that balance the needs for reducing complexity, being relevant to the social outcome of interest, easily understandable, consistent over time, resonating with clearly target audience and being limited in number.

3. Research design

According to Mulgan et al. (2014), traditionally the literature on SI impact assessment falls short of developing indicators to assess the real impact of this approach. To address this gap, the methodology proposed in this paper aims to result in the construction of a model for SI impact assessment, comprising a set of indicators classified according to different dimensions. To achieve this objective, despite being scarce, the relevant

literature related to SI impact assessment was reviewed in the previous section, and an understanding of the indicators to be used to assess the impact of SI was attempted.

For the easiness of understanding, Figure 2 summarizes the methodological approach adopted for this research, which can be summarized in five main stages.

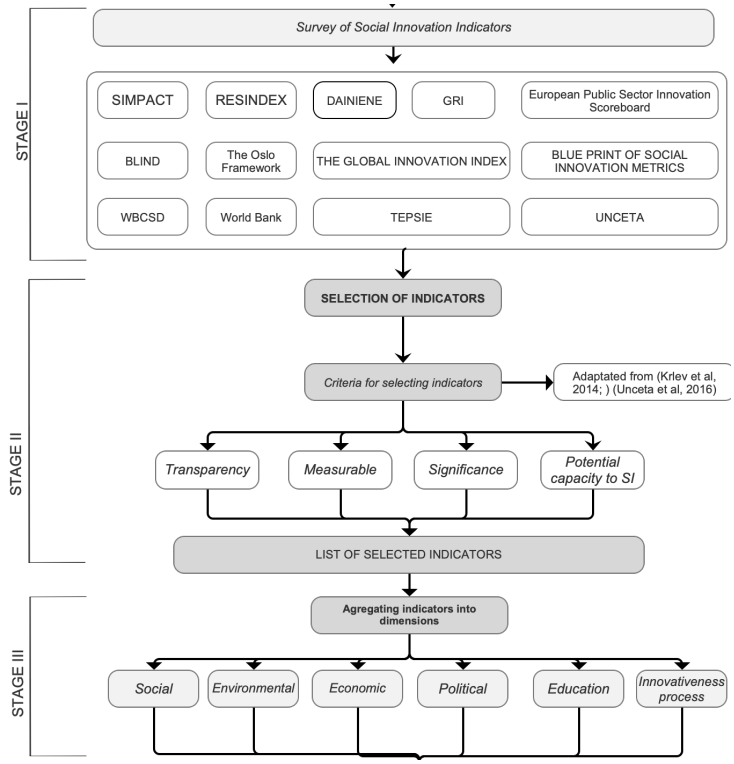


Figure 2: Methodological approach of the research

Stage I – a survey of SI indicators based on a literature review that provides the fundamentals of the research. The main sources of data were scientific articles, research projects and governmental reports. In particular, reports from different organizations (e.g. European Public Sector Innovation Scoreboard, Global Innovation Index, Blueprint of Social Innovation Metrics, Global Report Initiative, World Bank) were used to analyse which indicators have been adopted and applied in the field of SI.

Stage II – in this stage, due to the large number of indicators identified in the previous stage, it was necessary to select a set of usable indicators. For that purpose, the criteria identified in Figure 1 were used, namely, relevance to the social outcome of interest, validity, transparency, measurability, unambiguity, timely, consistency over time, and base for broad support (Alonso et al., 2015, Ministry of Social Development, 2016).

Stage III – this stage focused on the aggregation of the list of selected indicators, based on the dimensions suggested by Cunha and Benneworth (2020), namely social, environmental, economic, political, education, and innovativeness.

In summary, this research brings together a set of indicators, based on the literature reviewed, aiming to propose a SI impact assessment model based on six distinct dimensions, namely social, political, economic, educational, environmental and innovative processes. The ultimate goal of this model would be that target users can better assess the impact of their SI initiatives or projects, enabling SI development. In addition, it can be seen as a reference tool for other potential social innovators.

4. Measuring social innovation

Based on the results from the literature review, Tables 1-6 present the selected indicators for each of the six dimensions previously identified, namely social, environmental, economic, political, educational and innovative processes dimensions. For each dimension (table), the name of the indicator, how it can be measured (i.e. the metric), and the source base are provided. For the social dimension (Table 1), the indicators

selected address concerns related to SI initiatives focused on social responsibility, professionalization of the workforce in the social field, the existence of social networks, local workers working in the SI field, and employment. The SI indicators related to the environmental dimension (Table 2), show that SI initiatives go beyond economic and social actions. The indicators selected for the environmental dimension developed within SI are the following: environmental management for SI, environmental actions, sustainable actions, and eco-innovation. The innovative process dimension presents the greatest number of indicators (Table 3). The selected indicators address different aspects, such as the capacity to develop knowledge for SI, the impact of SI projects, SI services and available SI resources, among others. The indicators selected for the political dimension (Table 4) focus on SI initiatives supported by public organizations and seek to analyse the awareness of public organizations on developing or supporting initiatives in the field of SI. The indicators included are: social innovation relevant networks, legislative background for social organisations, legislative reforms in favour of SI, policy awareness about SI, stakeholders' assessment, and SI public investment. For the case of the educational dimension (Table 5), the indicators were mainly related to the development of initiatives to professionalise the workforce for SI. The specific indicators included in this dimension are: academic resources used in social innovation, professionalization/creative workforce in social fields, and professional qualification in social innovation.

Finally, for the economic dimension (Table 6), the selected indicators address several aspects, ranging from investments in SI initiatives to actions undertaken. In particular, the indicators are: investment in SI initiatives by the organisation, research and development, investment in innovation by the public sector, monetary variables of social economy, investment in collaboration, innovative organizations collaborating with others, and economic inclusion for vulnerable groups.

Table 1: Social indicators selected for SI assessment

SOCIAL INDICATORS		HOW TO MEASURE	REFERENCES
S1	S1Social Responsibility (%)	Percentage of organizations' turnover (PT) invested in socio-responsibility actions, including both compulsory and voluntarily actions (S1.1 + S1.2)	(GRI, 2016), (Boratto, 2012) (Azapagic, 2012)
		S 1.1 -Percentage of organizations' turnover (PT) invested compulsory (Yearly - last five years)	
		S1.2- Percentage of organizations' turnover (PT) invested on voluntary actions (Yearly - last five years)	
S2	Professionalization / creative workforce in social fields (Ordinal)	Initiatives to assess the workforce who report wanting to act 'socially entrepreneurially'	(TEPSIE, 2013)
S3	Social networks (Ordinal)	Existence of social network support by the organization	(TEPSIE, 2013) (The European Innovation Scoreboard, 2019)
S4	Local workers working in SI field	Ratio between number of workers from local community and total number of workers of organization	(Resindex, 2016) (TEPSIE, 2013)
S6	Employment	S7.1 - Number of direct jobs	(GRI, 2016), (WBCSD, 2008), (World Bank, 2008)
	(%)	S7.2 - Number of temporary jobs	
		S7.3 - Ratio between created jobs (CJ) by company and total city population	
S7	Employees involvement in SI (%)	Share of employees involved in groups that meet regularly to develop SI initiatives	(European Public Sector Innovation Scoreboard, 2013) (Blind, 2019)

Table 2: Environmental indicators selected for SI assessment

ENVIRONMENTAL INDICATORS (EN)		HOW TO MEASURE	REFERENCES
EN1	Environmental management for SI (Ordinal)	Existence of SI initiatives contemplating environmental management systems	(GRI, 2016)
EN2	Environmental Actions (%)	Percentage turnover of organizations investing in environmental actions	GRI, 2016), (World Bank, 2008)
EN3	SI and sustainable Actions (%)	Percentage turnover of organization investing in operational sustainability; spending on SI projects	(The Oslo Framework,)
EN5	Eco-innovation (Ordinal)	Development of SI initiatives to assess awareness of Sustainability	Blueprint (2015)

Table 3: Innovative process indicators for SI assessment

INNOVATIVE PROCESS INDICATORS (IP)		HOW TO MEASURE	REFERENCES
IP1	Knowledge Capacity	Percentage of contracted personnel dedicated to research activities on SI	(RESINDEX, 2013)
IP2	Capacity for Socialisation (Ordinal)	Lelvel of implantation of regular mechanisms for the exchange of ideas, knowledge and relevant information of SI for the organisation's activities	(RESINDEX, 2013)
IP3	Capacity for Association (Ordinal)	Level of association with external agents for the exchange of information and knowledge	(RESINDEX, 2013)
IP4	Access to knowledge for social projects (%)	Existence of individuals or units intended to identify needs / social demands.	(RESINDEX, 2013) (The European Innovation Scoreboard, 2019)
IP5	Partners cooperation (Ordinal)	Actions in cooperating with partners for the development of SI projects	(RESINDEX, 2013) (Unceta, 2019) (The Oslo Framework,)
IP6	Impact of projects of SI (Ordinal)	Development of actions to assess the improvement within organisations as a result of carrying out social projects	(RESINDEX, 2013)
IP7	SI services (Ordinal)	Share of service innovators that contributes to innovate in-house	(European Public Sector Innovation Scoreboard, 2013)
IP8	Impact of SI in public services (Ordinal)	Development of actions to provide services to local community	(European Public Sector Innovation Scoreboard, 2013)
IP9	Organization's SI orientation (%)	Amount of time that managers spent with innovations compared to normal tasks	(Blind, 2019)

		HOW TO MEASURE	REFERENCES
IP10	Willingness to invest in SI	Share of research budget from total organization budget SI	(Blind, 2019)
IP11	SI Resources (Ordinal)	Diversity of technological resources available in the organization to develop social innovation	(Unceta, 2019)
IP12	Efficiency to meet SI objectives (Ordinal)	Initiatives to measure the efficiency achieved in the implementation of SI actions	(Unceta, 2019)
IP12	Regional impact (Ordinal)	Analysis of the diversity of geographical areas in which SI has been scaled	(Unceta, 2019)

Table 4: Political indicators selected for SI assessment

POLITICAL INDICATORS		HOW TO MEASURE	REFERENCES
P1	Social innovation relevant networks (%)	Number of Foundation of SI per region	(TEPSIE, 2013) (Blueprint (2015)
		S 1.1 Number and size of other social innovation networks, called 'hubs' or 'labs' (Yearly - last five years)	
		S1.2- Number of Social Innovation Exchange members (Yearly - last five years)	
P2	Legislative background for social organisations (Ordinal)	Legislative background for starting a social organisation (national analysis)	(TEPSIE, 2013)
P3	Legislative reforms in favour of social innovation (Ordinal)	Number of new laws and regulations enhancing social innovation or social economy	(TEPSIE, 2013)
P4	Policy awareness about social innovation (Ordinal)	Development of programs (national sources and analytics) to ident social need of the community	(TEPSIE, 2013)
P5	Stakeholders assessment (Ordinal)	Number of actions to assess external/internal barriers to develop SI innovation	(TEPSIE, 2013)
P6	SI public investment (Ordinal)	Development of national innovation strategies to social innovation projects funded by government	(TEPSIE, 2013) (Blueprint (2015)

Table 5: Educational indicators for SI assessment

SOCIAL INDICATORS		HOW TO MEASURE	REFERENCES
ED1	Academic resources deployed	Number of articles/reports/projects with the	(TEPSIE, 2013) (THE

	on social innovation	keyword "social innovation" per	GLOBAL INNOVATION INDEX, 2018)
ED2	Professionalization/ creative workforce in social fields (Ordinal)	Facilities offering educational programs for staff in social economy organisations	(TEPSIE, 2013) (Dainiene, 2015)
ED3	Professional qualification on social innovation (%)	Percentage turnover of organization invested in professional qualification in SI	(GRI, 2016), (WBCSD, 2008), (World Bank, 2008)

Table 6: Economic indicators selected for SI assessment

ECONOMIC INDICATORS		HOW TO MEASURE	REFERENCES
E1	Investment in SI initiatives by organisations	Expenditure in social innovation initiatives by organization size (Community Innovation Survey)	(TEPSIE, 2013)
			(GRI, 2016)
E2	Research and development (%)	Percentage turnover (PT) of companies invested in research and development (R&D), including geological and social-environmental one. (Yearly - last five years)	(THE GLOBAL INNOVATION INDEX, 2018) (GRI, 2016) (The European Innovation Scoreboard, 2019)
E3	Investment in innovation by public sector	Expenditure in innovation by public sector	(TEPSIE, 2013)
E5	Monetary variables of social economy (Ordinal)	Private/ Public social expenditure of the organization	(TEPSIE, 2013)
E6	Investment collaboration (Ordinal)	Expenditure in innovation by social economy /stat-ups to social purpose	Blueprint (2015)
E7	Innovative organizations collaborating with others (%)	Percentage of organizations collaborating with others (%)	(The European Innovation Scoreboard, 2019)
E8	Economic inclusion of vulnerable groups (Ordinal)	Implementation of actions in the objective of inclusion and economic empowerment of the target population (reduction of the economic vulnerability)	(Unceta, 2019)

The results presented in Tables 1 to 6 describe in detail the proposed indicators and their metrics to evaluate the impact of SI initiatives in the target groups. The results were based on the steps described in Figure 2. As summarised in these tables, the set of meaningful indicators presented can be considered relevant and should contribute significantly to their acceptance and recognition among researchers, organizations and policymakers working in the SI field.

As such, the final result presented in this section is a list aggregating thirty-eight indicators, which can be useful as a first attempt to measure the impact of SI. If applicable by the targeted groups, it should lead to significant results for SI impact assessment.

5. Concluding remarks and future research

This section presents a summary of the main findings of the research conducted and some reflections on measuring the impact of SI. The evaluation of the impact of SI was discussed along six indicators' dimensions, namely social, political, economic, educational, environmental, and innovative processes while taking into account the importance of these dimensions to measure the impact of SI. In this research, an explorative scoping research strategy was used, to outline pathways for a simple but effective SI impact measurement. The research was based on a review of the limited available literature concerning metrics for SI. This research has sought to answer the following research question: how can the impact of SI be measured. Analysis of the current literature has revealed that organizations have failed on measuring the impact of their SI initiatives.

Despite the interest and popularity of the topic of SI, this can be justified due to a lack of tools and frameworks to assist organizations in addressing SI impact assessment. Future research envisages building an assessment model (or tool) based on the identified set of indicators for SI impact assessment and then demonstrating and testing this model using a real case study. This would contribute to the learning process of SI impact assessment.

Acknowledgements

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the Project Scope: PTDC/EGE-OGE/31635/2017.

References

Alonso, A., Monzón, A. and Cascajo, R. (2015) "Comparative analysis of passenger transport sustainability in European cities", *Ecological Indicators*, *48*, 578–592. https://doi.org/10.1016/j.ecolind.2014.09.022..

Alves, W., Ferreira, P. V., and Araújo, M. (2016) "Sustainability assessment of the mining sector in Brazil", 24th World Mining Congress.

Antadze, N. and Westley, F. R. (2012a) "Impact Metrics for Social Innovation: Barriers or Bridges to Radical Change?", Journal of Social Entrepreneurship, 3(2), 133–150. https://doi.org/10.1080/19420676.2012.726005.

Antadze, N. and Westley, F. R. (2012b) "Impact Metrics for Social Innovation: Barriers or Bridges to Radical Change?", Journal of Social Entrepreneurship, 3(2), 133–150. https://doi.org/10.1080/19420676.2012.726005.

Benneworth, P. and Cunha, J. (2015) "Universities' contributions to social innovation: reflections in theory & practice", European Journal of Innovation Management, 18(4), 508–527. https://doi.org/10.1108/EJIM-10-2013-0099.

Benneworth, P., Cunha, J. and Cinar, R. (2020) "Between Good Intentions and Enthusiastic Professors: The Missing Middle of University Social Innovation Structures in the Quadruple Helix" (pp. 31–44). https://doi.org/10.1007/978-3-030-47697-7_3.

Bund, E., Gerhard, U., Hoelscher, M. and Mildenberger, G. (2015) "A methodological framework for measuring social innovation", *Historical Social Research*, *40*(3), 48–78. https://doi.org/10.12759/hsr.40.2015.3.48-78.

Bund, E., Hubrich, D.-K., Schmitz, B., Mildenberger, G. and Krlev, G. (2013) "Blueprint of social innovation metrics – contributions to an understanding of opportunities and challenges of social innovation measurement", Proyecto TEPSIE, June. http://www.tepsie.eu/images/documents/D2.4_final.pdf.

Cunha, J. and Benneworth, P. (2020) "How to measure the impact of social innovation initiatives?", International Review on Public and Nonprofit Marketing, 17(1), 59–75. https://doi.org/10.1007/s12208-019-00240-4.

Dainienė, R. and Dagilienė, L. (2016) "Measurement of Social Innovation at Organisation's Level: Theoretical Issues", *Economics and Business*, *29*(1), 96–103. https://doi.org/10.1515/eb-2016-0027.

Dainienė, R. and Dagilienė, L. (2015) "A TBL Approach Based Theoretical Framework for Measuring Social Innovations" Procedia - Social and Behavioral Sciences, 213, 275–280. https://doi.org/10.1016/j.sbspro.2015.11.537.

Dziallas, M. and Blind, K. (2019) "Innovation indicators throughout the innovation process: An extensive literature analysis", Technovation, 80–81(July 2018), 3–29. https://doi.org/10.1016/j.technovation.2018.05.005.

Edwards-Schachter, M. and Wallace, M. L. (2017) "Shaken, but not stirred': Sixty years of defining social innovation", Technological Forecasting and Social Change, 119, 64–79. https://doi.org/10.1016/j.techfore.2017.03.012.

Falck, W. E. and Spangenberg, J. H. (2014 "Selection of social demand-based indicators: EO-based indicators for mining", Journal of Cleaner Production, 84, 193–203. https://doi.org/10.1016/j.jclepro.2014.02.021.

Krlev, G., Bund, E. and Mildenberger, G. (2014) "Measuring What Matters-Indicators of Social Innovativeness on the National Level", Information Systems Management, 31(3), 200–224. https://doi.org/10.1080/10580530.2014.923265.

Kleverbeck, M., Krlev, G., Mildenberger, G., Strambach, S., Thurmann, J.-F., Terstriep, J. and Wloka, L. (2019). "Indicators for measuring social innovation"(pp. 98–101).

Ministry of Social Development. (2016) "The Social Report 2016", http://socialreport.msd.govt.nz/documents/2016/msd-the-social-report-2016.pdf.

Mulgan, G., Joseph, K. and Norman, W. (2014) "Indicators for social innovation", In Handbook of Innovation Indicators and Measurement (Issue Reeder, pp. 420–438). Edward Elgar Publishing. https://doi.org/10.4337/9780857933652.00030.

OECD. (2011) "Fostering Innovation to Address Social Challenges".

Puig, M., Wooldridge, C., and Darbra, R. M. (2014) "Identification and selection of Environmental Performance Indicators for sustainable port development", Marine Pollution Bulletin, 81(1), 124–130. https://doi.org/10.1016/j.marpolbul.2014.02.006.

Reeder, N., O'Sullivan, C., Tucker, S., Ramsden, P. and Mulgan, G. (2012) "Strenghthening Social innovation in Europe Journey to effective assessment and metrics", In European Union. https://doi.org/10.2769/53098.

Schmitz, B., Krlev, G., Mildenberger, G., Bund, E. and Hubrich, D. (2013) "Paving the Way to Measurement – a Blueprint for Social Innovation Metrics", In Anais do II Simpósio de Minerais Industriais do Nordeste (Issue June). http://www.tepsie.eu/index.php/publications.

Stypińska, J., Franke, A. and Myrczik, J. (2019) "Senior Entrepreneurship: The Unrevealed Driver for Social Innovation. *Frontiers in Sociology*, *4*. https://doi.org/10.3389/fsoc.2019.00030.

Spila, J. C., Luna, Á., Unceta, A. and Castro Spila, J. (2016) "Social Innovation Regimes: an exploratory framework to measure social innovation", (Vol. 2016, Issue 1).

TEPSIE (2013) "European Commission – 7th Framework Programme", Brussels: European Commission, DG Research.

Unceta, A., Castro-Spila, J. and García Fronti, J. (2016) "Social innovation indicators", Innovation, 29(2), 192–204. https://doi.org/10.1080/13511610.2015.1127137.

Vilarinho, T., Floch, J., Oliveira, M., Dinant, I., Pappas, I. O. and Mora, S. (2018) "Developing a Social Innovation Methodology in the Web 2.0 Era", Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 10750 LNCS, 168–183. https://doi.org/10.1007/978-3-319-77547-0_13.

von Jacobi, N. and Chiappero-Martinetti, E. (2017) "Social Innovation, Individuals and Societies: An Empirical Investigation of Multi-layered Effects", Journal of Social Entrepreneurship, 8(3), 271–301. https://doi.org/10.1080/19420676.2017.1364288.

The Entrepreneurial Perspective in Impact Investing Research: A Research Agenda

Christin Eckerle, Sarah Manthey and Orestis Terzidis
Karlsruhe Institute of Technology, Germany
christin.eckerle@kit.edu
sarah.manthey@kit.edu
orestis.terzidis@kit.edu

Abstract: The Covid-19 pandemic, climate crises, and regulatory changes are only a few reasons for the growing public alertness regarding environmental and social problems. This has caused a shift in the mindset of companies and investors in terms of sustainability and the long-term impact of innovation. Thus, sustainable investments, particularly impact investments, have continued to grow in importance and momentum to shift the focus on rebuilding the economy more sustainable and future-oriented. The current state of research in this field indicates that most academic contributions are mainly about theoretical considerations and deal with various areas. There is no aggregated state of the art in academia with a focus point on impact investment for entrepreneurship. Yet, entrepreneurs are seen as key actors to drive sustainable innovation. Compared to the current growing impact investment practices and the necessity of a strategy to get financing, the topic is still relatively unexplored scientifically. In this research, a systematic literature review is conducted to further review, evaluate, and analyze the current research agenda on impact investment and show how it relates to entrepreneurship research. In particular, impact investment-related decision criteria, as well as challenges associated with this, will be presented. This contributes to the nascent literature on impact investing by documenting how impact investors stand in relation to entrepreneurial ventures and what measurement frameworks and models are already scientifically analyzed, which has practical implications for both impact investors and entrepreneurs.

Keywords: impact investing, startup, entrepreneurship, SLR, sustainability

1. Introduction

The immediate consequences of global crises can be seen as a major reason for the growing public awareness regarding environmental and social problems (Kubatova and Krocil, 2020). In addition, the adoption of the United Nations` 17 Sustainable Development Goals (UN SDGs) in 2015 has led to sustainability and impact gaining urgency, and momentum (Rizzello and Kabli, 2020). Furthermore, this significant awareness has caused a shift in the mindset of companies and investors towards more sustainable business models and making a positive impact (Bengo, Borrello, Chiodo, 2021).

Particularly impact investments have grown in importance and can be seen as a unique opportunity to shift the focus to rebuilding the economy more sustainable and future-oriented (Kabli, Rizzello, and Trotta, 2021). Impact investments go beyond currently dominant sustainable investment types (Bose, Dong, and Simpson, 2019). Impact investments are "investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return" (GIIN, 2020). In entrepreneurship, sustainability, profitability, and growth are considered more and more compatible goals (Santos, Pache, and Birkholz, 2015). Therefore, start-ups must develop a strategy to position themselves in the best possible way for their impact investment readiness (Cetindamar and Ozkazanc-Pan, 2017). Moreover, the focus is on a strategy that allows companies to measure, report, and verify their environmental or social benefits (Brandstetter and Lehner, 2015).

Despite the growing interest in impact investing on the practitioner's side and in academia, there has been limited literature in this field. Literature reviews focusing on general impact investing implications have been conducted by Hoechstaedter and Scheck (2015), Daggers and Nicholls (2016), Clarkin and Cangioni (2016), Calderini, Chiodo, and Michelucci (2018), Kubatova and Krocil (2020), and Agrawal and Hockerts (2021). The focus of these studies is mainly on similarities and inconsistencies in definitions, terminology, and on a strategic level (Hoechstaedter and Scheck, 2015; Daggers and Nicholls, 2016), only a minority focuses on research or outcome (Clarkin and Cangioni, 2016). Additionally, the literature mainly addressed opportunities and potential (Calderini, Chiodo, and Michelucci, 2018; Kubatova and Krocil, 2020). The associated research topics like social impact assessment models and frameworks, social return on investment, and early-stage impact investments have been covered by e.g., Grieco (2015) and Maier et al. (2015). Further research has been conducted in a variety of areas. Fichter, Widrat, and Olteanu (2021) have published a guide on managing

the impact of public and private start-up supporters. It gives insights into possible approaches for impact planning, analysis, improvement, and communication. In addition, Block, Hirschmann, and Fisch (2021) evaluate specific investment criteria applied by 179 impact investors.

The current state of research indicates that most academic contributions are mainly about theoretical considerations and deal with various areas. There is no aggregated state of the art in academia in the field of impact investment covering the years after 2015 with regard to the entrepreneur-impact investor relation. To close that research gap, this research project conducts a systematic analysis of the current research to answer the following question: What is the current research agenda on impact investment, and how is it related to entrepreneurship? Consequently, this paper should serve as a foundation to determine how start-ups that do not only want to build up their company profit-oriented but also think about ecological and/or social engagement should position themselves strategically to get this kind of financing.

Thereby, this paper contributes to the growing literature in the impact investing field by connecting two highly interdependent research streams. Based on the findings, challenges, opportunities, and also research gaps are identified, which in turn provide further direction for future research. The remaining sections are organized as follows: Section 2 describes the research methodology, and Section 3 presents the results of the analysis. The paper concludes with a critical discussion and identification of limitations and future research directions.

2. Method

A systematic literature review is mandatory to systematically evaluate the existing body of literature and answer the research question (Kitchenham and Charters, 2007). According to Tranfield, Denyer, and Smart (2003), systematic literature reviews employ a comprehensible and transparent procedure to enhance the quality of the conducted study. The overall aim of this review is to collect relevant literature covering a period of search between January 2015 and December 2021. The year 2015 was chosen because the UN SDGs were adopted in that year, signifying a shift in scientific literature. Then, based on the found body of literature, the literature will be reviewed and evaluated to survey the status quo in research, answer the research question, and develop research gaps.

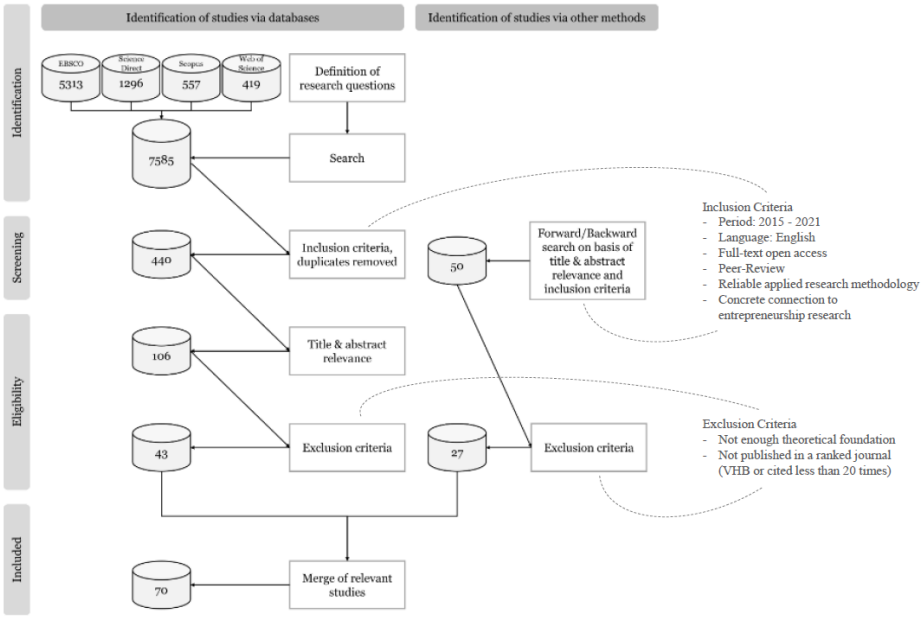


Figure 1: Search protocol, own illustration

To perform a first-stage search, the following databases were selected: EBSCO (Academic Search Premier and Business Source Premier), Scopus, Science Direct, and Web of Science. To find the desired literature, the following search string was used: “Impact Investment*” OR “Impact Investing” OR “Impact Investor*”. The search string was adjusted slightly to meet the search requirements of the four databases. After conducting the first-stage search, the citation list was extended by doing a forward and backward search. The citation list before and after the forward and backward search was then reviewed in the following sequence: 1. Title relevance; 2. Abstract relevance; 3. Full article scan; 4. Full article read.

To achieve the highest possible quality of the SLR, clear inclusion criteria were defined: Period: January 2015 - December 2021; Language: English; Full-text open access; Peer-Review; Reliable applied research methodology; Contains concrete connection to entrepreneurship research. Exclusion criteria were not enough theoretical fundamentals, and not published in a ranked journal. A journal is considered ranked if it is listed in the VHB journal ranking or has been cited less than 20 times, to ensure that highly-relevant papers are included in the final set despite being published in a not-ranked journal. In total, this led to 70 articles and book chapters. Due to the limited scope of this paper, the focus lies on the distinct relationship between entrepreneurs and impact investors and the criteria underlying an investment decision, which reduces the number of included sources to 40. The complete list of references can be obtained per request to the authors.

3. Results

3.1 Investor-investee relationship

The basis of the impact investment process is the relationship between the investor and the investee.

Table 1: Classification of the literature focusing on the impact actors "investor" and "investee", Source: Own table

Investors	Agrawal and Hockerts (2021), Agrawal and Hockerts (2019), Bengo et al. (2021), Block et al. (2021), Boni et al. (2021), Bose et al. (2019), Calderini et al. (2018), Castellas et al. (2018), Cetindamar and Ozkazanc-Pan (2017), Glänzel and Scheuerle (2016), Höchstädter and Scheck (2015), Ormiston et al. (2015), Roundy et al. (2017)
Investees	Agrawal and Hockerts (2019), Arena et al. (2018), Block et al. (2021), Bocken (2015), Brandstetter and Lehner (2015), Castellas et al. (2018), Gidron et al. (2021), Glänzel and Scheuerle (2016), Hazenberg et al. (2015), Lall (2019), Martin (2015), Molecke and Pinkse (2017), Phillips and Johnson (2021), Santos et al. (2015), Tabares (2021)

Impact investors differ from traditional investors in terms of motivation: They seek to make both a financial return and a social and/or ecological impact (Roundy, Holzhauer, and Dai, 2017). The literature distinguishes between two types: 1) "impact-first" investors focus on reaching social or environmental goals while only requiring a minimum financial return; 2) "finance-first" impact investors pursue investments with market-competitive rates which generate positive social or environmental impact in addition (Barman, 2015; Cetindamar and Ozkazanc-Pan, 2017; Hoechstaedter and Scheck, 2015; Ormiston et al., 2015).

Impact investors apparently are driven by their personal values and beliefs. Typically, impact investors invest in enterprises with an explicit social and ecological mission, a transparent and well-defined theory of change, and a well-established track record at a growth stage (Castellas, Ormiston, and Findlay, 2018). If they decide to invest, impact investors have a strong involvement due to "high engagement, tailored financing, extensive support, organizational capacity building, and performance measurement" (Agrawal and Hockerts, 2021, p. 161). They operate mainly in markets where the public sector cannot meet the needs, with a more distinct focus on countries where more significant social inequalities prevail (Boni, Toschi, and Fini, 2021).

Among impact investors, high-net-worth individuals and family offices are the most famous investors (Glanzel and Scheuerle, 2016), alongside Social Venture Capitalist (VC) organizations (Bocken, 2015). The analysis showed that impact investors apply similar investment strategies to traditional investors (Arena et al., 2018), focusing mainly on financial ratios and classical VC metrics (Castellas, Ormiston, and Findlay, 2018). Hence, Glanzel and Scheuerle (2016) conclude that "social returns rather have a tick-box character" (p. 1653). This can be partly explained by the difficulties of adequate theorizing of impact approaches (Bengo, Borrello, and Chiodo, 2021) as well as assessing the drivers and impact itself, and the high transactions costs for additional due diligence (Castellas, Ormiston and Findlay, 2018).

The analysis of existing literature has shown that the focus is on the investors' perspective. The literature on investees often discusses them in a way that is decoupled from impact investing. It mainly deals with investment readiness and measuring the impact (Agrawal and Hockerts, 2019). The definition of an investee applies to companies that demonstrate either a "mission primacy" or are a "social enterprise or social purpose organization" that is "unlisted" and can be "for-profit or not-for-profit" (Hoechstaedter and Scheck, 2015, p. 459). These hybrid organizations create value for society and the environment by developing advanced business models and employing entrepreneurial and very innovative approaches (Agrawal and Hockerts, 2021).

Literature focuses on social or sustainable enterprises in general, or on impact tech start-ups. Social entrepreneurship's primary goal is to solve social challenges (Lall, 2019). Instead of maximizing profits, social enterprises try to optimize their impact (Martin, 2015). As the social and economic impact is pursued with the effectiveness and efficiency employed for commercial activities, entrepreneurs can attract both traditional investors and impact investing entrepreneurs (Tekula and Andersen, 2019; Viviani and Maurel, 2019), if they set up their business models accordingly (Cetindamar and Ozkazanc-Pan, 2017).

Yet, social entrepreneurs face several challenges since investments are assumed to be riskier due to the high complexity of the business models, the third sector, the lack of a track record, the small market size, and the associated small portfolio (Brandstetter and Lehner, 2015). Due to their hybridity of achieving both financial return and sustainable positive impact, there is a high risk of mission drift to either side (Hazenberg, Seddon and Denny, 2015). Also, their collaborative and personal focus can limit them from properly extending and scaling their activities (Gidron et al., 2021).

Most literature only focuses on describing these aforementioned challenges and barriers yet does not provide many recommendations on how to overcome those. However, two studies give an overview of success factors to overcome these barriers. Bocken (2015) identified three top reasons for success for impact start-ups: business model innovation, the formation and usage of reliable collaborations and networks, and the focus on a reliable business model. In addition, she identified key traits and principles of entrepreneurs: Key traits incorporate promoting interdisciplinarity and diversity, thinking ahead, and soft skills. Principles are based on an organizational goal and mission to maximize the usage of human and ecological sources, exploiting synergies between sustainable impact and financial return to meet the needs of several stakeholders, and on quality over quantity (Bocken, 2015). Moreover, Hazenberg, Seddon, and Denny (2015) identified a series of characteristics that allow social entrepreneurs to demonstrate their impact investment readiness. First, organizational persistence, resilience, and adaptability are regarded as decisive. This allows for a quick adaption to changes in the market and revenue to secure financial sustainability. Second, a social entrepreneur should be able to demonstrate a clear vision and have the experience and a suitable plan for implementation. Third, they should show irrepressible will and desire to embrace organizational change in order to move towards investment readiness (Hazenberg, Seddon and Denny, 2015).

Arena et al. (2018) and Gidron et al. (2021) address social tech start-ups and impact tech start-ups. Tech-focused start-ups use advanced technology to address current dominant social and economic challenges. Impact investors seem to prefer tech-focused over purely social enterprises because they are credited with being able to generate higher impact due to their global market orientation (Gidron et al., 2021). Yet, they often operate in the social sector and due to their hybrid mission, they often do not have the ability to charge market prices. Therefore, these start-ups are regarded as riskier compared to normal tech start-ups (Arena et al., 2018). Further, they also have problems demonstrating their impact due to the absence of meaningful impact assessment frameworks and metrics. This leads to increased costs of financing (Arena et al., 2018). Often, not until the growth stage do they become attractive to social impact investors. Still, investors seem to

understand that it takes longer to reach the break-even point and generate social impact at the same time. Hence, they are willing to accept longer repayment periods (Arena et al., 2018; Gidron et al., 2021).

3.2 Impact investment criteria and associated challenges

The fundamental basis of every investment decision-making is evaluating promising investment projects. Researchers have analyzed the investment criteria of impact investors, yet there is only a limited amount.

Since the impact is complex to quantify, non-financial criteria play a major role in decision-making. Investors seem to assess especially four dimensions: 1) the sector in which an organization is operating in, 2) the geographic location, 3) the mission, and 4) the management's governance and skills (Islam, 2021). Despite the different investors' preferences, the main focus of the investment decision is on the social impact a company wants to deliver, the scalability, and associated innovativeness (Hazenberg, Seddon, and Denny, 2015). Impact investors favor "social entrepreneurs who have a strong passion for social change, high professionalism, a clear vision and ambition, and strong community-based social networks" (Islam, 2021, p. 5). Hazenberg, Seddon, and Denny (2015) also add that personal relationship greatly influences investment decision. The analysis showed that impact investors mostly use the same financial criteria as traditional investments, as well as build on the overall business proposal (Block, Hirschmann and Fisch, 2021; Hazenberg, Seddon, and Denny, 2015). Still, some investors are willing to accept a lower rate of return if social impact is pursued (Block, Hirschmann, and Fisch, 2021).

Investors often try to quantify and monetize the social impact (Roundy, Holzhauer, and Dai, 2017). A better nderstanding of impact generation and the related accountability can help investors prevent investees from mission drift (Ormiston, 2019). Yet, there are associated challenges with the measurement and assessment of impact, which are mostly of conceptual, methodological, and practical nature and are based on a cause-and-effect relationship (Spiess-Knafl and Scheck, 2017).

Impact investors and investees have different visions, preferences, and priorities of impact and its value leading to subjectivity (Clarkin and Cangioni, 2016). No common understanding of impact is making it difficult to collect and document outcome data fully (Moody, Littlepage, and Paydar, 2015). This leads to the fundamental need to better comprehend and incorporate the characteristics and evolution of impact (Aschari-Lincoln and Jacobs, 2018).

Still, research shows that the UN SDGs as universal goals are crucial as a reference framework for impact investors in terms of impact target setting (Castellas, Ormiston, and Findlay, 2018; Santamarta et al., 2021). Nevertheless, the applicability of the SDGs remains demanding for companies, as their contribution depends on the ability to quantify outcomes that are tied to the SDGs' targets and indicators outlined (Tabares, 2021). Secondly, most indicators try to quantify or monetize impact, which is perceived as questionable (Costa and Pesci, 2016; Spiess-Knafl and Scheck, 2017). Furthermore, despite the attempt and motivation to set up standardized impact assessment and management frameworks, there is still no sufficient universal framework with appropriate and valuable indicators (Bengo et al., 2016). A closer look at these frameworks reveals that they are output-based instead of being outcome/impact-based (Bose, Dong, and Simpson, 2019). In addition, they mainly employ an ex-post view that is only useful if enterprises have an established track record. An ex-ante view is required to evaluate potential impact investments (Brandstetter and Lehner, 2015). The most popular standardized frameworks, e.g., IRIS and GIIRS, are made for investors and, consequently, cannot assess the true impact achieved by young ventures (Costa and Pesci, 2016).

Because of scepticism about the effectiveness to accelerate outcomes, entrepreneurs mostly have not adopted a standardized framework (Phillips and Johnson, 2021). This absence of meaningful standards, on the one hand, promotes entrepreneurs to develop and use their own set of indicators but with which they do not feel comfortable to adequately communicating their impact (Castellas, Ormiston and Findlay, 2018; Moody, Littlepage, and Paydar, 2015). On the other hand, if investors determine the impact, they prefer to use a transaction-based approach leading to different methods among different investors and deals (Bengo, Borrello, and Chiodo, 2021). Nevertheless, investors also struggle to determine impact leading to confusion among investees as to what investors want other than financial return (Phillips and Johnson, 2021). An excellent ability to measure and communicate the impact is the prerequisite for financial support (Clarkin and Cangioni, 2016). Finally, data collection is challenging due to the previous causes and effects, possibly causing

data quality issues like inaccurate and unreliable data (Molecke and Pinkse, 2017). Consequently, the impact assessment and management are limited and, additionally, very resource-intensive and costly (Bengo, Borrello and Chiodo, 2021; Castellas, Ormiston and Findlay, 2018; Phillips and Johnson, 2021; Spiess-Knafl and Scheck, 2017). This results in a permanent trade-off between utility, cost, and accuracy and a great need for expertise and knowledge to determine the impact (Spiess-Knafl and Scheck, 2017).

Summed up, the challenges to set up a universal framework with meaningful and comparable indicators that captures the actual value of impact is still unsolved (Clarkin and Cangioni, 2016). It needs to be resolved urgently to promote the impact investing field and adequately represent social and environmental impact (Moody, Littlepage, and Paydar, 2015). A potential improvement should include that impact assessment should be incorporated as early as possible to develop a meaningful roadmap for impact management and assessment, including indicators and required information (Courtney, 2018).

4. Discussion

The review shows that the field of impact investing literature is continuously growing. Nevertheless, there are topics like impact measurement and management with only a few contributions. Also, the focus of the conducted research is mainly on investors. The existing research shows that despite impact being the elementary component of impact investments, financial criteria play a predominant role. It can be concluded that investors either do not have a sufficient understanding of impact, do not know how to consider it sufficiently in the investment process, or financial return is more important to them. Furthermore, the analysis of investing criteria per paper is only focused on one type of investor. Therefore, there is no overview of investing criteria possibly varying across investors. This makes it difficult for investees to align with investors' expectations and requirements to improve their chance of getting financed. This paper concludes that researching and theorizing the frameworks for impact measurememt is a good starting point for introducing investors and companies to impact investing and improving their impact understanding and orientation. These models or frameworks can each be used for goal setting, internal and external impact measurement, and management. They are necessary to develop impact business models further and reach a certain minimum standard in social and environmental issues. However, for example for investors, they offer little possibility to distinguish whether companies only avoid negative impacts in the context of sustainability or have the intention to generate a positive impact. For investees, no model or framework can be used to fully and transparently map the impact investing and business process. In addition, little is known about how these models are applied in practice. Therefore, this paper ultimately concludes that there is a greater need for a framework that can be applied explicitly in the impact investing process and unites both investor and investee needs.

This paper provides comprehensive insights into the impact investor-investee relation, the investing criteria, and impact measurement and management. It differs from previous SLRs in that it reviews the field of impact investing more comprehensively and in a more entrepreneurial research direction.

Nevertheless, this review has several limitations. First, a considerable high number of potentially relevant publications had to be scanned. To handle this well, inclusion and exclusion criteria were defined which may have been applied subjectively. In particular, because of the limited publication period 2015-2021 and the paywall, essential findings may have been missed. Finally, it is a comprehensive but not complete review of the research streams since not all models, and actors have been part of the review.

In terms of future research, closing the research gaps would help impact investing unfold its true meaning and generate the impact that companies envision. This includes that young entrepreneurs should not only be looked at from the investors' point of view. In addition, more should be known about the investing criteria. On the one hand, young entrepreneurs can then better adjust to the expectations and requirements. On the other hand, investors might be able to include more non-financial criteria in their investment and decision-making process. This would be beneficial for all actors involved, as impact investments are not only characterized by their financial return. Finally, impact measurement and management should have a fundamental role in researching, theorizing, and conceptualizing models and frameworks. This kind of future research seems to be the way to meet the actual intention of generating impact by making the topic more accessible and inclusive. It might determine whether more companies, particularly young social enterprises and other hybrid organizations, get such funding. More research could even trigger a chain reaction so that more funding can

become available. An enhanced understanding might close the gap between demand and supply as well as prevent green and impact washing.

References

Agrawal, A. and Hockerts, K. (2019) "Impact investing strategy: Managing conflicts between impact investor and investee social enterprise", *Sustainability*, Vol 11, No. 15, p 4117.

Agrawal, A. and Hockerts, K. (2021) "Impact investing: Review and research agenda", *Journal of Small Business & Entrepreneurship*, Vol 33, No. 2, pp 153–181.

Arena, M., Bengo, I., Calderini, M. and Chiodo, V. (2018) "Unlocking finance for social tech start-ups: Is there a new opportunity space?", *Technological Forecasting and Social Change*, Vol 127, pp 154–165.

Aschari-Lincoln, J. and Jacobs, C. D. (2018) "Enabling effective social impact: Towards a model for impact scaling agreements", *Sustainability*, Vol 10, No. 12, p 4669.

Barman, E. (2015) "Of principle and principal: Value plurality in the market of impact investing", *Valuation Studies,* Vol 3, No. 1, pp 9–44.

Bengo, I., Arena, M., Azzone, G. and Calderini, M. (2016) "Indicators and metrics for social business: A review of current approaches", *Journal of Social Entrepreneurship*, Vol 7, No. 1, pp 1–24.

Bengo, I., Borrello, A. and Chiodo, V. (2021) "Preserving the integrity of social impact investing: Towards a distinctive implementation strategy", *Sustainability*, Vol 13, No. 5, p 2852.

Block, J. H., Hirschmann, M. and Fisch, C. (2021) "Which criteria matter when impact investors screen social enterprises?", *Journal of Corporate Finance*, Vol 66.

Bocken, N. (2015) "Sustainable venture capital – catalyst for sustainable start-up success?", *Journal of Cleaner Production*, Vol 108, pp 647–658.

Boni, L., Toschi, L. and Fini, R. (2021) "Investors' aspirations toward social impact: A portfolio-based analysis", *Sustainability*, Vol 13, No. 9, p 5293.

Bose, S., Dong, G. and Simpson, A. (2019). Impact investing. In S. Bose, G. Dong, & A. Simpson (Eds.), The financial ecosystem: The role of finance in achieving sustainability (pp. 253–282). Springer International Publishing.

Brandstetter, L. and Lehner, O. M. (2015) "Opening the market for impact investments: The need for adapted portfolio tools", *Entrepreneurship Research Journal*, Vol 5, No. 2.

Calderini, M., Chiodo, V. and Michelucci, F. V. (2018) "The social impact investment race: Toward an interpretative framework", *European Business Review*, Vol 30, No. 1, pp 66–81.

Castellas, E. I.-P., Ormiston, J. and Findlay, S. (2018) "Financing social entrepreneurship: The role of impact investment in shaping social enterprise in Australia", *Social Enterprise Journal*, Vol 14, No. 2, pp 130–155.

Cetindamar, D. and Ozkazanc-Pan, B. (2017) "Assessing mission drift at venture capital impact investors", *Business Ethics: A European Review*, Vol 26, No. 3, pp 257–270.

Clarkin, J. E. and Cangioni, C. L. (2016) "Impact investing: A primer and review of the literature", *Entrepreneurship Research Journal*, Vol 6, No. 2, pp 135–173.

Costa, E. and Pesci, C. (2016) "Social impact measurement: Why do stakeholders matter?", *Sustainability Accounting, Management and Policy Journal*, Vol 7 No. 1, pp 99–124.

Courtney, P. (2018) "Conceptualising social value for the third sector and developing methods for its assessment", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol 29, No. 3, pp 541–557.

Daggers, J. and Nicholls, A. (2016) "The status quo and future research", *Routledge handbook of social and sustainable finance*, pp 68–82.

Fichter, K., Widrat, A. and Olteanu, Y. (2021) *Impact guide: Moving from evaluation to impact management of startup support programmes*, Borderstep Insitute.

Gidron, B., Israel-Cohen, Y., Bar, K., Silberstein, D., Lustig, M. and Kandel, D. (2021) "Impact tech startups: A conceptual framework, machine-learning-based methodology and future research directions", *Sustainability*, Vol 13, No. 18, p 10048.

GIIN. (2020). "Annual Impact Investor Survey 2020" *Global Impact Investing Network*, available on: https://thegiin.org/research/publication/impinv-survey-2020 [last accessed 30.09.2021].

Glänzel, G. and Scheuerle, T. (2016) "Social impact investing in Germany: Current impediments from investors' and social entrepreneurs' perspectives", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol 27, No. 4, pp 1638–1668.

Grieco, C. (2015) "Assessing social impact of social enterprises", Springer International Publishing.

Hazenberg, R., Seddon, F. and Denny, S. (2015) „Intermediary perceptions of investment readiness in the uk social investment market", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol 26 No. 3, pp 846–871.

Hoechstaedter, A. K. and Scheck, B. (2015) „What's in a name: An analysis of impact investing understandings by academics and practitioners", *Journal of Business Ethics*, Vol 132, No. 2, pp 449–475.

Islam, S. M. (2021) "Impact investing in social sector organisations: A systematic review and research agenda", *Accounting & Finance*, Vol 62, No. 1, pp 709–737.

Kabli, A., Rizzello, A., & Trotta, A. (2021). „Roadmapping new impact bonds in a post-covid world: Insights from case studies in the education sector". *Sustainability*, 13 (8), 4121.

Kitchenham, B., and Charters, S. (2007). "Guidelines for performing systematic literature reviews in software engineering" (Version 2.3).

Kubatova, J. and Krocil, O. (2020) "The potential of impact and integral investing for sustainable social development and the role of academia in their dissemination", *Sustainability*, Vol 12, No. 17, p 6939.

Lall, S. A. (2019) "From legitimacy to learning: How impact measurement perceptions and practices evolve in social enterprise–social finance organization relationships", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol 30, No.3, pp 562–577.

Maier, F., Schober, C., Simsa, R. and Millner, R. (2015) „Sroi as a method for evaluation research: Understanding merits and limitations", *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, Vol 26, No. 5, pp 1805-1830.

Martin, M. (2015) "Building impact businesses through hybrid financing", *Entrepreneurship Research Journal*, Vol 5, No. 2.

Molecke, G. and Pinkse, J. (2017) "Accountability for social impact: A bricolage perspective on impact measurement in social enterprises", *Journal of Business Venturing*, Vol 32, No. 5, pp 550–568.

Moody, M., Littlepage, L. and Paydar, N. (2015) "Measuring social return on investment: Lessons from organizational implementation of sroi in the Netherlands and the United States", *Nonprofit Management and Leadership*, Vol 26, No. 1, pp 19–37.

Ormiston, J. (2019) "Blending practice worlds: Impact assessment as a transdisciplinary practice", *Business Ethics: A European Review*, Vol 28, No. 4, pp 423–440.

Ormiston, J., Charlton, K., Donald, M. S. and Seymour, R. G. (2015) "Overcoming the challenges of impact investing: Insights from leading investors", *Journal of Social Entrepreneurship*, Vol 6, No. 3, pp 352–378.

Phillips, S. D. and Johnson, B. (2021) "Inching to impact: The demand side of social impact investing", *Journal of Business Ethics*, Vol 168, No. 3, pp 615–629.

Rizzello, A. and Kabli, A. (2020) "Sustainable financial partnerships for the sdgs: The case of social impact bonds", *Sustainability*, Vol 12, No. 13, p 5362.

Roundy, P., Holzhauer, H. and Dai, Y. (2017) "Finance or philanthropy? exploring the motivations and criteria of impact investors", *Social Responsibility Journal*, Vol 13, No. 3, pp 491–512.

Santamarta, J. C., Storch de Gracia, M. D., Carrascosa, M. A. H., Martinez-Nunez, M., Garcia, C. d. l. H. and Cruz-Perez, N. (2021) "Characterisation of impact funds and their potential in the context of the 2030 agenda", *Sustainability*, Vol 13, No. 11, p 6476.

Santos, F., Pache, A.-C. and Birkholz, C. (2015) "Making hybrids work: Aligning business models and organizational design for social enterprises", *California Management Review*, Vol 57, No. 3, pp 36–58.

Spiess-Knafl, W. and Scheck, B. (Eds.). (2017). Impact investing: Instruments, mechanisms and actors. Springer International Publishing.

Tabares, S. (2021) "Do hybrid organizations contribute to sustainable development goals? evidence from b corps in Colombia", Journal of Cleaner Production, Vol 280, p 124615.

Tekula, R. and Andersen, K. (2019) "The role of government, nonprofit, and private facilitation of the impact investing marketplace", Public Performance & Management Review, Vol 42, No. 1, p 142–161.

Tranfield, D., Denyer, D. and Smart, P. (2003) "Towards a methodology for developing evidence-informed management knowledge by means of systematic review", British journal of management, Vol 14, No. 3, pp 207–222.

Webster, J. and Watson, R. T. (2002) "Analyzing the past to prepare for the future: Writing a literature review", MIS Quarterly, Vol 26, No. 2, pp 13–23.

Do we Practice What we Preach? Applying Startup Practice to Entrepreneurship Education

Gali Einav[1] and Maria Blekher[2]
[1]International Undergraduate Program, Adelson School of Entrepreneurship, Reichman University (IDC), Herzliya, Israel
[2]YU Innovation Lab. Yeshiva University, New York, USA
einav.gali@idc.ac.il
maria.blekher@yu.edu

Abstract: Definitions of the term "entrepreneurship education" vary from the process of passing the necessary skills and concepts to individuals to identifying new business opportunities and to reach high levels of self-confidence to benefit from such opportunities. Some scholars refer to entrepreneurship education as more of skill building and leadership programs, focused on new product development, creative thinking and technology innovation. This study set out to examine the entrepreneurship faculty perspective on applying venture creation methods to entrepreneurship courses. Through interviews with 15 entrepreneurship faculty in two entrepreneurship programs, in Israel and the United States, it examines their professional and academic backgrounds, thought processes and best practices for teaching entrepreneurship. Building on the Lean Startup Methodology, it mostly looks at the extent that lean startup guidelines such as iterations, customer feedback and product development are applied to their teaching methods and curriculum. The study found that many of these guidelines were applied by the professors, especially among those with an industry oriented professional background.

Keywords: entrepreneurship education, startups, lean startup, higher education, agile development

1. Introduction

"The course from my perspective is a business" (Dr. R.H, entrepreneurship faculty member)

In today's world, entrepreneurs are the new Superheroes trying to solve the world's biggest problems. The space mission became another technological assignment for Elon Musk, while startups offered solutions for remote health and learning during the Covid-19 pandemic. No wonder entrepreneurship studies are gaining attention- students are looking to be the game changers, and higher education institutions are looking to be the Alma Maters.

Is it possible to teach entrepreneurship? Of course. Naturally, some are more inclined to the field. Nevertheless, entrepreneurship education allows one to develop tools and tactics to provide an edge in a competitive world. Students learn to develop skills needed by the future workforce, such as judgment and decision making, fluency of ideas, active learning, and originality, and working in multidisciplinary teams. They learn to navigate uncertainty, deal with disruptive change, accommodate failure, and implement structural change.

Researchers from the European 2020 Initiative found that students participating in entrepreneurship programs are much more likely to launch their own companies. Furthermore, these businesses tend to be more innovative and successful than those led by individuals without an entrepreneurship background. Graduates of entrepreneurship programs are less likely to be jobless and more likely to have steady employment.

As leaders of two programs whose aim is to educate the entrepreneurs of tomorrow, we asked the question, do we act like a startup when we teach students to build them? To answer this question, our research team interviewed 15 entrepreneurship faculty members from two leading academic institutions in Israel and the US. We asked them to reflect on their curriculum, teaching style by applying frameworks from the startup world, such as Lean Startup. Our focus was on understanding the value proposition of entrepreneurship studies to its students, and how we can provide it while maintaining academic standards.

2. Literature review

2.1 Entrepreneurship education

We are living in times of unprecedented technological and societal changes. The past two years of the Covid 19 pandemic have demonstrated significant challenges shared worldwide. These challenges and the changing needs of society demand closer collaboration between universities (Wilson, 2012). As a result, many forward-looking universities have reevaluated their core activities and research capabilities. This requires a wide range of modes of university knowledge transfer and business engagement which is responsive to the needs of industry (Bercovitz and Feldman, 2006; Fitzgerald and Cunningham, 2015; Miller et al., 2016).

Definitions of the term "entrepreneurship education" vary from the process of passing the necessary skills and concepts to individuals to identifying new business opportunities and to reach high levels of self-confidence to benefit from such opportunities. McMullen et al. (2012) refer to skill building and leadership programs, new product development, creative thinking, and technology innovation.

Mcintyre and Roche (1999) define entrepreneurship education as the process of passing the necessary skills and concepts to individuals to identify new business opportunities and to reach high levels of self-confidence to benefit from such opportunities. McMullen and Long (1987) and Mcmullan et al (2002) state that entrepreneurship education should include skill building and leadership programs, new product development, creative thinking and technology innovation . Entrepreneurial education may include activities which allow students to gain direct experience with entrepreneurial practices through "learning by doing". This angle corresponds with project-based learning (PBL) educational approach, which helps students realize they can develop useful skills, knowledge and attitudes to solving challenges and "real life" problems (Barrows, 2012). PBL is a significant component of entrepreneurial thought and action which Igwe et al describe as a new mental model for leadership approach (Igwe *et al.,* 2018).

Another substantial emphasis in entrepreneurial studies is on teamwork. As such, entrepreneurial education curriculum emphasizes practical exercises that build skills by teaching how to efficiently navigate uncertainty, introduce creative solutions, accommodate failure, and execute change (Reis, 2011) The entrepreneurship curriculum provides students with tools to help build skills determined as necessary for the future workforce by teaching how to efficiently navigate uncertainty, introduce creative solutions, accommodate failure and execute change. Learning is designed to encourage sound judgment and decision making, fluency of ideas, using creative problem solving within multidisciplinary teams, (Bakhshi etal, 2017). According to Brown & Stubbings, (2017) traditional current educational methodologies many times fall behind these changes. There are many ways to teach entrepreneurial skills and tools. The rapid increase in entrepreneurship programs, which combine theory with a strong emphasis on "hands-on experience", cater to the expectations of Gen Y and Z for a more practical learning experience that prepares them for an uncertain work environment.

2.2 Entrepreneurship faculty

There is an existing body of literature related to entrepreneurship and the concept of entrepreneurial university. Martin (2016) argues that as universities respond to external economic and social drivers and policy pressure there is a need for them to be more entrepreneurial and this has consequences for the academic role. Universities are now expected to be both innovative and entrepreneurial which demands both institutional and cultural change to embrace a much wider range of knowledge transfer activities to help achieve this mission (Etzkowitz, 2003). Leih and Teece (2016) suggest that in addition to simply providing support and enabling legitimacy of entrepreneurial activities among academics, to be truly entrepreneurial universities must develop their dynamic capabilities. Particularly they should be sensing opportunities, seizing them by relying on strong university leadership and be able to transform policies, strategies and practices whenever changes call for it.

A main factor in transforming a university to be more entrepreneurial is the faculty itself. The uniqueness of Entrepreneurship faculty has been referenced in several studies. For example, Kamariah et al (2015) look at entrepreneurial intention and entrepreneurial orientation of faculty and students towards commercialization of research. The study results indicate that the faculty and students have a strong entrepreneurial mindset. According to Miller et al (2018) Universities are now viewed as key economic actors within regions and are

central actors in shaping and influencing entrepreneurial ecosystems. The consensus was that the key objective of an academic entrepreneur is to engage in activities which lead to the commercialization of technology. This is in essence defining them by their actions where the activity of an academic entrepreneur can take the form of patents, licenses, and new venture start-ups. However, the researchers point out that there are key distinctions between entrepreneurial academics and academic entrepreneurs. Understanding this distinction also helps identify the value of varying types of academics in helping achieve the entrepreneurial mission of a university.

Alexander et al. (2015) note that only in recent years has the term entrepreneurial academic emerged The entrepreneurial academic emerged as a term used to describe academics who engage in wider forms of knowledge transfer which involves personal interactions with industry. Martinelli et al. (2008) identify that an entrepreneurial academic is an 'innovative' faculty member who differs from the archetypical start-up academic entrepreneur. Furthermore, Alexander et al. (Ibid) identify an entrepreneurial academic as someone that adopts an entrepreneurial outlook and who readily seeks engagement with industrial partners, often through the less formal modes of engagement. They also note that engaging in entrepreneurship does not always result in an academic becoming an academic entrepreneur.

This study looks at the entrepreneurship faculty in terms of the lean startup methodology (Blank, 2013) . A methodology that emphasizes "the "learning by doing" approach. As such it resembles the PBL educational model described above. It questions if faculty, both academic entrepreneurs and entrepreneurial academics, incorporate concepts as product development, agile iterations and pivoting, all part of Blank's methodology, when teaching entrepreneurship to undergraduate students.

3. Methodology

3.1 Study background and methods

The current study explored the relationship between entrepreneurship studies curriculum and teaching practices to frameworks and methodologies from the "real world" of startups. To achieve this goal, the research team interviewed 15 entrepreneurship faculty members from two leading academic institutions in Israel and the US. In this study, we examined how faculty members deployed entrepreneurship principles in their teaching methods. This includes understanding the target audience and value proposition as well as constantly adjusting, iterating, and pivoting to provide the best value to the students.

3.2 Interview questions

To collect the relevant data, we've developed a set of questions, aimed to explore the professional and academic backgrounds, and teaching methodologies of entrepreneurship faculty in two academic institutions. The questions were focused on a deeper understanding of the professor's thought processes and the implementation of the "practice what we preach" concept. The interview questions can be found in Appendix A: Interview Questions. The interviews, each lasting 30-40 minutes, focused on the entrepreneurship studies curriculum, as well as how it compares to various frameworks from the startup world, such as Lean Startup.

3.3 Participant recruitment

A total of 15 faculty members from two leading academic institutions in Israel and the US who volunteered to participate in an interview exploring their experience teaching entrepreneurship to college students were interviewed. Interviews were held via Zoom between September and December 2021.

3.4 Data analysis

The interviews were transcribed. Content analysis was applied to the transcripts. The results were categorized under main themes corresponding with the interview questionnaire.

4. Entrepreneurship education in action

4.1 Customer discovery

> *"For me my course is a business and until the business stabilizes, I do not have a product, and I do not have a course!" (R.H Entrepreneurship faculty member)*

According to the lean startup methodology, (Blank, 2013) to reach product market fit, startups should continuously test their assumptions regarding their product. This is done by constantly receiving feedback, through various stages of product development, through the customer discovery process.

Customer Discovery is a key process that incorporates customer feedback into product or service design to create a better fitted solution. It is based on hypothesis development, validation, testing with potential customers, evaluating customer feedback, and implementing changes if needed. When it comes to entrepreneurship studies, the academic framework challenges the concept of customer discovery; as previously mentioned, courses are expected to have a certain structure; cover specific predetermined material and include student assessment. The question is what kind of customer discovery is possible when the customer is also the one being assessed as part of the (educational) consumption process? Or as part of a larger question; should we treat education as a product, students as consumers and professors as service providers?

In this study most lecturers referred to their course as a product and the students as customers/target audience. However only about half- agreed that there was a clear parallel between the lean methodology and academic product development. Students are referred to more as users than customers, as the interchange is less transactional and more focused on knowledge transfer.

"Education and teaching are not necessarily aligned with customer service," states a faculty member teaching product development, "better to find a market that needs the product or educate the market."

That said, most lecturers take the customer discovery approach, keep checking constantly what works and what doesn't work with this target audience to "fix" the product which is the course. Using the student's constant feedback as "market research" used for product development, in this sense the course as in any product iterates until it reaches its ultimate form. As the feedback in most cases will be applicable for next semester or next year, it is a slower development cycle. But there is a thought of a product and how it adheres to the needs and demands of the target audience.

"As time goes by, I learn my audience better and try to adapt my product to my audience. Over time I learned their needs, I have a book and methodologies I have developed. I have learned how these future entrepreneurs think **and how you as an educator can push them forward with the things they do."**

4.2 Product development

> *"Ultimately, the course is a product; you don't want them (students) to love you. You want them to grow from the product. So, if they didn't receive it well it means there was something wrong with how it was presented. So, you have to rethink it."*

According to Lean startup methodology, startups are launching an MVP that is being refined based on user feedback, creating a ground for experimentation. However, students in higher education institutions are expecting to receive the best version of the "product" to begin with. As opposed to the traditional business transaction where the responsibilities of all parties are clear, the teaching process includes "customer" (students) assessment by the "service provider" (professor).

This unique structure makes it more difficult to apply the traditional customer discovery model, as students might be interested in getting a good assessment without putting in the required effort, and students who are unhappy with their assessment (grades) might be pushing to change the "product" (education style) or assessment method. In this case, the customers cannot always be right.

"We've done so much changing. We try to keep what works, we try new things, but it's constantly evolving. It's like a startup on a deck. The second you present your deck it needs to be changed. We're always iterating."

Nonetheless, within the academic framework of entrepreneurial studies, we've found that professors are open for "customer" feedback, and eager to improve their "product" when possible. Many of them mentioned that entrepreneurship is a state of mind; therefore, professors with a strong entrepreneurial background are applying the same state of mind in the classroom. Similarly to the customer discovery process, they welcome student feedback and make changes accordingly *"I do make a lot of changes. I ask for feedback and based on that feedback I will make changes. I usually have students do feedback mid semester. And I also try to do informal feedback before that, as well."* and adjust classes to the audience *"…every semester is different, based on the students. Sometimes I will have students who are more engaged and do their work, sometimes I don't. So all that goes into having to change the structure of the class."*

Despite the fundamental differences between the structure of higher education and the startup environment, entrepreneurship professors are navigating their teaching experience by applying entrepreneurial fundamentals into their teaching methods. *"I rarely use 100% of my previous outline or syllabus. I'm always adjusting as I go along, week to week. For example, I don't want to cut the students off if we're into a topic and it takes more time than I planned. "*

As in previous examples, here too the traditional academic structure and environment is to some extent "anti-lean". Main points are the following:

- 1. Students paying full tuition do not appreciate being tested along the way. They demand a perfect product from day one. Tuition paying students demand an excellent course from the get- go and not wait for the product to develop. "
- 2.Students many times see their goal as getting a good grade. It is inherently not constructive to build the product with knowledge and tools. In this sense they are not a typical client. The customer is not always right, and development cannot be all around the students.
- 3. Academic courses adhere to the syllabus, the contract between students and faculty. Constant change does not work well with pre-determined syllabi. Professors were divided on this issue; some said they adhere strongly to the syllabus, as not doing so creates instability for the students that may affect their grades and satisfaction levels. Some said they adhere strongly to the syllabus but change within the confinements of the syllabus. For example, simplify the presentations or add recitations to adapt the product/course to different audiences as they have different needs. A few respondents believe that clients should be met where they are. As such the class, including the syllabus, must be dynamic. "If we had a static class, we would be doing students and education in general a disservice. The beauty of the course is that it is constantly changing and that sense mimics the workplace. We define our syllabus as a "Dynamic cloud"

As entrepreneurship related topics change constantly and are in constant flux, faculty emphasized the flexibility and emphasis on including practical examples and updated case studies in their classes. " I don't want the students sitting there like deer in headlights, we are in constant iteration". Stated a lecturer.

In this sense entrepreneurship studies may provide a benchmark for structuring and teaching academic courses. The inherent flexibility was emphasized when dealing with the Covid 19 crisis and the transfer to online learning via Zoom.

4.3 Entrepreneurial teachers and feedback

Overall, we found that certain teachers adjusted more to student feedback than others. The teacher's previous profession played a major role in determining this. Teachers who had not worked as teachers originally and were more doing it to share their knowledge with students had a great chance at taking in student feedback. They seemed to recognize that they don't know everything and are more open to suggestions. Since they are not teachers by trade and are only doing this for the sake of the students, they seem to take feedback very seriously to provide students with the best experience possible. However, teachers who were teachers by trade do not as highly regard student feedback. Overall, they felt that student feedback was too biased as it was mostly grade related.

4.4 Agility and pivot under crisis - zoom semester

..." We are totally agile….. reiterate and go back... we are constantly in this feedback loop"

According to the Lean Startup methodology, startups should emphasize *agile development* that includes iterative approach and optimization. Agility is about flexibility and placing more value on adapting to developments. It encounters growth by continuously embracing changing demands and preferences, in a rapidly changing and turbulent environment. How does this concept play out in a classroom of entrepreneurship studies?

First, we must acknowledge that the traditional academic environment to some extent contradicts the idea of agility. While the startup world consists of uncertainties and the Lean methodology is based on quick development testing and adjusting, in academic teaching (until Covid- 19 crisis hit) most factors were expected or predictable. Academic classes are planned, structured, have a predetermined, detailed syllabus and a clear set of expectations. The fact that tenure track faculty incentive models are based on research rather than on teaching evaluations makes it even more challenging to implement the agile approach among these faculty members. As indicated in one of the interviews: *“as long as our teaching scores are above a certain threshold, there's no incentive for somebody who's spent ten years almost completely on research to put in a tremendous amount of time in teaching”.*

We’ve discovered that faculty who are deeply rooted in the entrepreneurial ecosystem and the business world, find space for agility within the framework of the academic course. It comes across in their reaction to student feedback, pivoting course structure from lecture to workshop when needed, adjusting content and assignments to current events, innovative teaching strategies and more. As several professors in this study indicated, there is a framework, and within this framework we can be agile *“We're constantly doing that. Whether it's the speaker's themselves or the topics they are talking about; we're online, I can get the most dynamic speakers on the planet. We're constantly bringing in new talent; we're constantly looking at new materials. “*

While the differences between the academic and business settings are clear, startup bred entrepreneurship faculty tend to exploit agile development while maintaining the academic core structure. Agility played a fundamental role during the changes caused by Covid-19 in March 2020.

> *"Covid made me make many changes – the emphasis was a product that will give the students tools for life." (L.M Entrepreneurship Faculty)*
>
> *"We changed our class, we did it before, maybe we do it a little more now. Our assumption is that it's going to stay the same for a while"*

In March 2020 Universities transferred studies online without much preparation time. As a result, faculty did not have time to adjust their teaching methods to Zoom and did so on the fly. In this case we suggest that entrepreneurship courses were better equipped to make these changes on the fly as they keep changing constantly and adhere to the constant iteration guidelines offered by the lean startup methodology.

The Covid 19 crisis provides an interesting test of the academic structure which was forced to rethink and recalibrate as it attempted to adapt quickly to the changing situation.

For the most part most instructors said that the zoom semester passed well. However, the majority agreed that overall, in-class-in person teaching is preferable, especially entrepreneurship education which is hands-on and practical in nature. Most faculty members looked at the "Zoom semester" as a learning experience.

Thinking ahead, several faculty members decided to continue to incorporate digital features within a physical classroom environment when resumed. These may include online surveys and polls, displaying results of quantitative data, creating short interactive videos to view before class and cutting back on the lecture portion of the class.

Content wise, faculty adapted course materials to refer to the Covid 19 crisis. In one investment class, students wrote an investment memo and pitched to the investment committee based on real life portfolios. The ideas were "Covid friendly" and one of them raised $4 million during the pandemic. Students were able to receive a hand on relevant experience and added value during the crisis.

These findings correspond to those of Miller at al (2018), referring to the differences between faculty members as “Entrepreneurial academics and academic entrepreneurs". As universities are now viewed as key economic actors within regions and are central actors in shaping and influencing entrepreneurial ecosystems. This has meant that universities now must become more entrepreneurial in offerings, outlook, and culture. (Wilson 2012)

5. Discussion

This study set out to examine attitudes of Entrepreneurship programs faculty regarding methods of teaching entrepreneurship. There are various definitions of entrepreneurship education. We chose to focus on principles of the lean startup methodology, which we incorporate in our curriculum. Our faculty were asked if they felt that they “practice what they preach '' i.e. use lean startup principles such as product development, agility, iterations and customer centric approach when designing and teaching their courses.

Our interviews revealed that many faculty members did not necessarily view their work through the lean startup lens. However, while interviewed, many realized that in many cases they do incorporate them in their work. Mostly by viewing the course as a product, and practicing constant agile development, as the courses needed to be updated constantly. Despite the notion that the traditional academic structure and environment is to some extent "anti-lean”, faculty members who spent time working in the industry were navigating their teaching experience by applying entrepreneurial fundamentals into their teaching methods. For instance, when it comes to customer discovery, while the focus was on knowledge transfer rather than satisfying customer's needs, the majority of faculty members used a customer discovery approach, periodically examining what works and what doesn't in order to optimize the course. They also tended to address their course as a product, applying practices from the “Lean Startup "product development approach, including implementing frequent feedback loops, practical examples and updated case studies. Feedback loops presented a challenge to the more traditional professors, as they experienced student feedback as biased, and grade related.

Finally, when the external environment shifted during the Covid-19 crisis, many faculty members from the Entrepreneurship programs demonstrated agility and flexibility, just like startups that constantly adapt to changing demands and preferences in a rapidly changing and turbulent environment. Through this turbulent period, they adjusted their classes, made the necessary adjustments, and continued providing students with value and meaningful learning experiences.

If one agrees that universities must become more entrepreneurial in spirit this raises the question of the requirements of those who teach entrepreneurship. Should it be, in the words of Miller et al, Entrepreneurial academics and academic entrepreneurs”?. Looking at the future of higher education, and given the positive feedback received from students on the more active structure of entrepreneurship studies, it seems that academic institutions would benefit from incorporating entrepreneurial thinking and structures in their curriculum and among the faculty. Do professors who teach entrepreneurship adopt practices from startups? Although it varies depending on who you ask, it seems that most professors use iterations, flexibility and assumption testing. Based on the findings of this study, we believe that adopting some of the practices from the startup world into the academic framework will have a positive effect on the generation of entrepreneurs we educate in the future. Creating an entrepreneurial education that incorporates both deep insights rooted in extensive research and best practices from the startup industry, such as fast change, pivoting, being open to feedback, and a growth mindset, can offer the best of both worlds.

6. Appendix A: Interview questions

Questionnaire: Entrepreneurship studies as a startup – teaching startups while behaving like a startup
What is your professional background?
What brought you to teach entrepreneurship? How long have you been teaching entrepreneurship?
What course do you teach? What year are the students?
Do you have any special teaching methods? Example
On a scale of 1-5 1 being the lowest and 5 the highest , to what extent do you make changes and adjustments to your course during the semester? + Examples
On a scale of 1-5 1 being the lowest and 5 the highest , to what extent do you make changes and adjustments to your course from year to year ? + Examples

What do you feel you change the most?
Course material? Teaching method, level of collaboration with industry? Emphasis on team work vs. individual work? Presentations? Other please elaborate
Have you ever felt you failed any aspect of your course? If so, how did you respond? Please elaborate

On a scale of 1-5 one being the lowest and five the highest ; to what extent do you respond to student evaluations? Have you ever made changes to your course/teaching methods following student evaluation/feedback?
How do you react if you try to make a change to the class and it is not received well by the students? (example)
Please describe a learning experience from teaching via zoom during the Covid – 19 crises
Following your experience teaching via zoom during the Covid 19 crisis, to what extent do you intend to make changes to your course materials and/or teaching methods in class? (on a scale of 1-5 1 being the lowest and 5 the highest) + Examples
According to the "lean startup methodology" founders turn the key questions they have about their business into testable hypotheses and then build fast and cheap MVP's to test these hypotheses. If the tests show they are not correct, they should pivot and change direction modifying the product or the market they are approaching, until achieving product market fit
Thinking about the course you teach as "the business" to what extent does your work follow the lean startup methodology in regards to hypotheses, MVP's and reaching product market fit? (On a scale of 1 to 5 one being the lowest and 5 the highest . Please elaborate
According to the Lean Startup methodology, startups should emphasize agile development. Breaking complex problems into modules, developing solutions to each component through rapid prototyping and placing more value on adapting to change
On a scale of 1-5 one being the lowest and 5 the highest would you describe your teaching experience as "Agile" ? Please elaborate and provide examples

If you have been teaching entrepreneurship for more than one year:
One a scale of 1-5 one being the lowest and 5 the highest; to what degree do you agree that teaching a new entrepreneurship course is feeling today less disruptive and more like adaptive business as usual? Please provide examples
How did you feel in the beginning – did it change in your second year?

References

Alexander, A.T., Miller, K.& Fielding, S.,N. (2015) Open for Business: Universities, Entrepreneurial Academics & Open Innovation. In: CONN, S., BITRAN, I. & HUIZINGH, E. K. R. E., eds. XXVI ISPIM International Conference - Shaping the Frontiers of Innovation Management, 14-17 June, Budapest, Hungary. Wiley & Sons

Bakhshi, Downing, Osbourne& Schneider, 2017 "The Future of Skills – Employment in 2030" . published by Oxford Martin School, Pearson and Nesta. Retrieved from https://www.nesta.org.uk/report/the-future-of-skills-employment-in-2030/

Barrows, H., 2002. Is it truly possible to have such a thing as dPBL?. *Distance Education*, *23*(1), pp.119-122.

Bercovitz, J.& Feldman. M, 2006 Entrepreneurial universities and technology transfer: A conceptual framework for understanding knowledge-based economic development. The Journal of Technology Transfer, 31, 175-188.

Blank, S., 2013. Why the lean start-up changes everything. *Harvard business review*, *91*(5), pp.63-72.

Etzkowitz, H., 2003. Research groups as 'quasi-firms': the invention of the entrepreneurial university. *Research policy*, *32*(1), pp.109-121.

Fitzgerald, C & Cunningham, J.A 2015. Inside the university technology transfer office: Mission statement analysis. The Journal of Technology Transfer, 1-12. doi:10.1007/s10961-015-9419-6.

Igwe, P.A., Okolie, U.C. and Nwokoro, C.V., 2021. Towards a responsible entrepreneurship education and the future of the workforce. *The International Journal of Management Education*, *19*(1), p.100300.

Kamariah A, M.A., Omar, W.W., Aziz, A.A., Seohod, K. and Akhtar, C.S., 2015. Entrepreneurial intention, entrepreneurial orientation of faculty and students towards commercialization. *Procedia-Social and Behavioral Sciences*, *181*, pp.349-355.

Leih, S & Teece, D, 2016. Campus Leadership and the Entrepreneurial University: A Dynamic Capabilities Perspective. Academy of Management Perspectives 3 (2) May 2016, pp. 182-210

McIntyre, J., & Roche, M. 1999. *University education for entrepreneurs in the United States: A critical and retrospective analysis of trends in the 1990s*. Georgia Institute of Technology.

McMullan, W., Chrisman, J.J. and Vesper, K.H., 2002. Lessons from successful innovations in entrepreneurial support programming. *Innovation and entrepreneurship in Western Canada: From family businesses to multinationals*, pp.207-223.

Mcmullan, W.E. and Long, W.A., 1987. Entrepreneurship education in the nineties. *Journal of Business Venturing*, *2*(3), pp.261-275.

Miller, K., Alexander, A.T., Cunningham, J. and Albats, E., 2018. Entrepreneurial academics and academic entrepreneurs: A systematic literature review.

Reis, E. (2011), The Lean Startup: How Today's Entrepreneurs Use continuous Innovation to Create Radically Successful Businesses", Crown Business, NYC

Wilson, T., 2012. A review of business–university collaboration: Department for Business, I. S. (ed.). London.

Choosing Collaborative Learning Options for Preparing Innovative Entrepreneurs

Tiit Elenurm
Estonian Business School, Tallinn, Estonia
tiit.elenurm@ebs.ee

Abstract: This paper focuses on comparing and choosing online and face-to-face collaborative learning applications for preparing students to innovative entrepreneurship. The main research question is: What are the pluses and minuses of programs with different time frames and combinations of online and face-to-face teamwork for facilitating innovative entrepreneurship and international scaling readiness? Learning concepts based on collaborative learning and improving the international networking readiness of students are presented. Estonian-Finnish business in virtual networks course, online teamwork experience of students that have participated in X-Culture global teams, intensive one semester face-to-face business development projects in the Starter programme and one-week course European and Global Horizons for Start-up Entrepreneurship in the Post-COVID World at the KEDGE Business School are compared. We analyse the pros and cons of these educational practices and give recommendations on how to customise these practices to intended learning outcomes depending on the international mobility possibilities of students. The paper explains how to align collaborative learning options to the entrepreneurial orientations of students, their readiness to launch a new venture and to international scalability potential of their innovative ideas. Limitations of intensive learning by doing programmes for team-based venture development and different ways of international student team creation for collaborative project work are explained. The recent COVID-19 crisis has expanded the need to apply online learning and hybrid learning for collaborative projects. Implications of limited international mobility of students during the pandemic on scalable business idea development are highlighted. The importance of networking knowledge for international entrepreneurship and the role of team projects for other entrepreneurs before starting students' own innovative ventures is explained. Learning in higher education should not be locked to closed e-learning platforms. Online learning can support international entrepreneurial collaboration. The paper also discusses changing trends of collaborative learning to facilitate innovation and green entrepreneurship for regenerative futures in the new normality during the COVID-19 pandemic.

Keywords: innovative entrepreneurship, collaboration, knowledge co-creation, networking, online teamwork

1. Introduction

Innovative entrepreneurship assumes international scalability, especially for start-ups from small economies. For decades, learning and knowledge have been among the central components underlying the causes, processes, and early internationalisation outcomes (De Clercq et al, 2012, Renfors, 2021)). Development of innovative entrepreneurial teams that involve members and partners from different countries are implications of business globalisation. In this context, entrepreneurship educators should support learners by applying culturally inclusive educational technologies (Akinrinola et al, 2020). Thompson (2017) encouraged using digital tools such as social media in line with the flipped classroom approach to make the learning process more interactive. Online social and business networks can support international collaborative learning as enablers of learner-driven networking and cross-border knowledge sharing for entrepreneurship. Collaborative learning should prepare students for entrepreneurial team formation and combine online and face-to-face learning to develop mindset, skills and practice for starting a new venture, but its outcomes can support life skills even if learners do not start a new business (Neck and Corbett, 2018).

The recent COVID-19 crisis has facilitated both initiatives to create a better virtual environment for university-driven online and hybrid learning (Kurbakova, 2020) and student-driven informal information sharing on the internet. Different target groups involved in entrepreneurship education have diversified experience and readiness to start their own local or internationally oriented business or act as intrapreneurs in existing business organisations. Sector-specific learning by doing opportunities and the need to integrate entrepreneurship education with international business knowledge must also be considered when applying entrepreneurship education as a tool to learn through practical entrepreneurship process already during university studies or to create readiness for more innovative and internationally scalable start-up activities after university studies.

Our objective is to develop the framework for choosing and combining international collaborative entrepreneurial learning tools at universities. This paper compares different collaborative learning options from the point of view of expanding networks for entrepreneurial knowledge sharing, developing creativity for innovative entrepreneurship and supporting start-up processes. The context of online and hybrid learning is also

taken into consideration, having in mind the COVID-19 crisis and potential implications for learning in the new normality.

2. Literature review

Kedia and Englis (2011) stated that businesses' globalisation had occurred faster than business schools' internationalisation. In collaborative learning, students participate in small-group activities to share their knowledge and expertise. During the 1970s and 1980s, cooperative learning dominated as the general term for group-based learning in the research literature, but since the beginning of the 1990s, collaborative learning has become a more popular term (Strijbos and Martens, 2001). Johnson at al. (2007) explained how learning in groups is influenced by social interdependence. The increasing variety of information search and communication opportunities available through the internet leads to the need to reflect several learning modes and tools in groups and communities. Group activities can be driven by teacher-driven tasks only, but group work can also train students to find new useful information and compare their priorities with other students. Collaborative learning focuses on knowledge co-creation (Vuopala et al, 2019). In comparison with cooperative learning, collaborative learning is not so highly structured and is less teacher-centred. Collaborative learning experiences allow more delegation of decision-making to students that can use various knowledge sources. It is focused on socialising students into new communities, cultures and the Wider World (Veldman and Kostons, 2019). International collaborative learning assumes the involvement of students representing different nationalities and societies.

Dania and Griffin (2021) use the term "collaborative learning communities" when studying social media and related collaboration solutions in the classroom. Collaborative learning can be implemented in a face-to-face classroom environment, but online networking can also give input to collaborative learning. A challenge for established higher education institutions is understanding both the positive and negative social media implications for collaborative learning. Universities have to align university curriculum and instruction methods to such student-driven networking and knowledge sharing activities on social media that support students' future careers and self-development. Benson and Filippaios (2015) studied graduates from AMBA-accredited universities and highlighted skill gaps between generation Y (born between years 1980-1994) and experienced graduates in using online social networking tools. They pointed out that although online networking increases the social capital of students and improves collaborative competencies, knowledge construction and sharing skills, still only a few universities provide courses for professional use of online social networks.

Networking is a core entrepreneurial capability in attaining necessary resources, knowledge, and information (Morris et al., 2013). Elenurm (2012) explained how co-creative, individually innovative and imitative entrepreneurial orientations influence the networking needs of students. Co-creative orientation supports creative teamwork for developing innovative business ideas. Imitative orientation is focused on transferring established best business practices to a new business environment. Social media has become influential in the daily life of many students, and adoption of it for-self-development may motivate entrepreneurial intentions (Do et al, 2020). Sula and Elenurm (2018) have studied how students use online networking opportunities for entrepreneurial learning. Young students rely equally on online and offline entrepreneurial ties, but they often do not have a clear vision of using weak and strong ties in their networks at different stages of their self-development. Adner (2012) stressed the open innovation readiness to encourage new ideas from outsiders. The open innovation approach assumes collaboration and engagement with a wider variety of participants (Chesbrough, 2017). Autio et al (2013) explained how knowledge sharing in online communities could reduce demand uncertainty for new international business initiatives. In international business research, one implication of the networking focus has been revisiting the traditional Uppsala concept of step-by-step internationalisation. The original Uppsala model (Johanson and Vahlne, 1977) focused on learning from market commitment and knowledge available from neighbouring countries and, after that, from incremental internationalisation by moving towards more distant markets. In their later work (Johanson and Vahlne, 2009) the same authors, however, discussed the increasing role of network relations in internationalisation. Innovative start-up businesses apply network learning as their business intelligence tools to achieve their space in international markets (Caseiro and Coelho, 2019). Rapidly internationalising small and medium-sized enterprises from emerging countries need to use a wide range of internal and external network sources (Puthusserry et al, 2020) also during their post-entry business development stages.

Entrepreneurship education discourse has specified competing departure points of entrepreneurship education (O'Connor, 2013). Applying learning by doing through practical venture creation and business idea commercialisation processes is a suitable framework if the student enterprise team is ready to jump-start such a process and their sector-specific resource base can be created. Learning for future entrepreneurship by exploring features and role models of successful entrepreneurs in various countries, studying different types of entrepreneurship, including social entrepreneurship, and new business opportunities in the context of the green agenda for regenerative futures (Camrass, 2020) is, however also operational for these students that need to broaden their interdisciplinary knowledge base and create their international network before launching a real start-up initiative. Collaborative learning can focus on own entrepreneurial start-up development of a team or engage learners in projects where student teams solve problems faced by other entrepreneurs already operating in practice. Contributing to solving problems of practitioners enhances critical thinking (DeSimone and Buzza, 2013). Learning from the success and mistakes of others without making their own investments and long-term commitment to own enterprise development are essential at the life stage when learners are not ready for such commitments. Kwong and Thompson (2016) have pointed out the contradiction that although learning through practical entrepreneurship has been a key element of the curriculum in many universities during recent decades, students focused on long-term innovative product development often prefer at first to learn from the experience of established entrepreneurs, create some financial basis and broaden their social network before starting their own business.

Online and offline collaboration ties are mutually complementary, and collaborative university education can create synergy between these ties in entrepreneurial learning. The blended learning discourse addresses the right balance between online learning and face-to-face classroom activities. Blended learning is defined as the system combining face-to-face and computer-mediated instruction (Manwaring et al, 2017). During the COVID-19 crisis, face-to-face classes were often changed to web-based conferences using Zoom, Big Blue Button, and other synchronous online learning tools combined with asynchronous e-learning uploaded lecture content, quizzes, and discussion forums. Finding the right combination of synchronous and asynchronous knowledge sharing is vital for developing new blended learning solutions. Some researchers see online learning as a panacea in the time of the COVID-19 crisis (Dhawan, 2020). At the same time, educators face conceptual and technical challenges in the hybrid classroom, where during the COVID-19 pandemic, some students participate in classes conducted on the campus, and some are involved online (Triyason et al, 2020). It is essential to discuss the prospects of the hybrid classroom for potential entrepreneurs as the new normal after the pandemic.

3. Methodology for comparing collaborative learning options

The methodological departure point of our approach to collaborative knowledge co-creation is the comparison of learning processes, where students have contributed to international business initiatives or started their development journeys as start-up entrepreneurs focused on international business opportunities. We applied educational action research. Action research in education reveals both the potential as well as the challenges of educational practices centred on learning projects in different formats and with various internal and external partners (Mandrup and Jensen, 2017). We compare five collaborative learning projects where the author has been involved: Estonian-Finnish business in virtual networks course, the Nordic Ideation Camp, X-Culture global teams programme, intensive face-to-face business development in the Starter programme and the recent Global Horizons for Start-up Entrepreneurship course at the KEDGE Business School. The pluses and minuses of these knowledge co-creation processes for enhancing creativity, readiness for innovation and international teamwork are analysed. Comparison of programs is mainly based on observations of learning processes in the instructor role, discussions with other instructors, students' group work on lessons learnt, assignments submitted by learners, and their individual verbal feedback. The literature overview serves as the basis for formulating the following questions for comparing these collaborative learning practices.

- 1. To what extent collaborative learning supports discovering or expanding networks for international scalability of business initiatives?
- 2. To what extent creativity for innovative entrepreneurship is developed?
- 3. To what extent learning by doing through start-up development is supported?

4. Pluses and minuses of collaborative learning cases

Business in virtual networks courses have been conducted at the Estonian Business School (EBS) from the year 2008. Starting from 2014, these courses were simultaneously conducted in the Tallinn and Helsinki campuses of

EBS. At first, students were asked to find and review in the course weblog the best online network for business students that they individually identified. Online network overviews that offered new information for many students were chosen for oral presentations in group work during the course. Students formed project teams during these courses based on their networking priorities. In the next stage, online teams for course projects were created by students. The rule was that each team had to involve students from both campuses. At the end of each course, student teams presented ideas for developing new online networks that could serve the self-development needs of business students. Teams had to present a simple prototype of a new useful online social networking tool for business students and explain the mission, main features of the tool, value of the network for its members and the potential target group to engage members to this network. As the course was focused on strategies and priorities of online networking, information technology application was quite limited during this course. The primary function of prototyping was to visualise and explain the new potential network concept.

Nordic ideation camp programme that started in 2017. This programme combined a week for online team formation and ideation preparation with an intensive one-week ideation camp involving students from Denmark, Finland and Estonia. The third week was for reflection and follow-up when students were back at their universities. This was a cooperation project between Copenhagen Business Academy, Haaga-Helia School of Applied Sciences and Estonian Business School. Student teams started working online on assignments presented to them online by enterprises one week before the camp. Tasks were defined by enterprises from the country, where the ideation camp was arranged following the rotation between participating universities. Camp organisers chose these enterprises. The main ideation and idea validation were organised in the camp's face-to-face learning environment, where students during a week each day concentrated on the task of their team. The pre-camp week had an important role in identifying the competencies of team members to use online tools and collecting data from each participating country as input to ideation during the intensive face-to-face teamwork in the camp. Face-to-face ideation in the camp started from filling in the empathy canvas about potential customers, and several canvases supported ideation mainly from the point of view of design thinking and understanding clients. Students validated prototypes based on their preliminary ideas through face-to-face interviews with potential customers during the camp. During the last day of the camp, enterprise representatives gave feedback to student teams about the practical value of their reports.

The globalisation of business opportunities assumes the capability to co-operate with students as potential entrepreneurship partners all over the World. The global X-Culture https://x-culture.org consortium has been able to involve students from more than 100 universities in 40 countries on six continents. Online X-Culture projects have continued during the COVID-19 pandemic. Students must pass a pre-test to demonstrate their knowledge about online communication and knowledge sharing tools and X-Culture rules. X-Culture organisers allocate students to virtual project teams following the principle of the geographical and cultural diversity of each team. Students have to build their team consensus on the international business opportunity challenge they try to solve together by working online for two and half months. Based on consensus in their team, they can choose the project enterprise after studying written challenge descriptions compiled by enterprises for X-Culture. Creativity in X-Culture is needed for identifying new international business opportunities that match the needs of companies and aligning knowledge sharing styles of students from different cultures, and finding the best online cooperation tools in situations where team members never meet each other in a physical space. There is no direct face-to-face contact with the client enterprise during project work. Sometimes, even more than a hundred teams may choose to prepare a report for the same enterprise. X-Culture team reports are graded by lecturers representing these universities where team members study. Starting from 2015, we have used X-Culture international business courses for the whole student group.

In 2017 Estonian entrepreneurship education framework programme EETA launched pre-incubation programs StarterTech and StarterCreative that bring together to joint sessions students from several Estonian universities. These pre-incubation programs mean intensive 3-4 hours sessions after two weeks, where guest speakers and mentors assigned to each team encourage student teams to take the next steps in their business development efforts. Ideation periods during sessions are, however, only 15-20 minutes, and creative thinking outside the training room depends mainly on commitment and time arrangements in each team. At the end of the programme, there are semi-finals and final of pitching business models that have been developed by teams. Business angels are also involved in the final session at the event called Startup Day, where the best teams are rewarded based on their presentations. Although students are encouraged to develop prototypes and test these with users, the pre-incubation program time span of three months is quite limited to conduct in practice several start-up development stages that are introduced during programme sessions.

The international week of the KEDGE Business School in Bordeaux in 2021 autumn focused on regenerative futures. Collaborative learning for entrepreneurship in the regenerative futures and green thinking context was applied in the course Global Horizons for Start-up Entrepreneurship. Students were asked to use teamwork to develop start-up ideas that follow the United Nations 17 sustainable development goals and regenerative futures principles. In the COVID-19 situation, there were few international exchange students. Although online networking opportunities were introduced, the one-week cycle of classes and assignments was too intensive to expand the network for discussing the international scalability of start-up ideas. As a result, teams mainly developed business models for local green initiatives in recycling and diminishing food waste. In final reports by student teams, comparison of these initiatives with similar best practices in other countries was quite limited.

Table 1 sums up the main differences of reviewed collaborative learning cases.

Knowledge about new online networking tools is most extensively disseminated in the Business in virtual networks course. X-Culture global programme has the highest international diversity in teams and structured support for the step-by-step process for export plan development, but in this programme, students cannot choose their team members and pursue their own entrepreneurial initiative. The same limitations apply to the Nordic ideation camp, although in this programme, creativity based on design thinking and client problem validation is applied in an advanced way. The Starter pre-incubation program involves practitioners to highlight challenges at different stages of the start-up process, but the time frame is too compressed for deep learning by doing during these stages. One-week international week programme at the KEDGE Business School is even more compressed, and innovative learning in such intensive courses depends on the international composition of the study group and student involvement in online networks to increase the diversity of their knowledge sources. Learning by doing that could cover the whole start-up development cycle assumes the readiness of students to commit themselves to real entrepreneurship already during their university studies. Pursuing radically innovative entrepreneurship ideas assumes cooperation with business angels of other types of investors and also some freedom to choose start-up team members. Pre-incubation programmes such as Starter can prepare teams for further incubator or accelerator involvement.

Creativity driven by design thinking and client validation through communication with potential clients is developed in the Nordic Ideation Camp, but the face-to-face focus nature of interviews does not allow to compare client needs in different international markets for business growth.

To broaden the mindset of students in study groups, where readiness to develop their own innovative ideas and where international diversity is limited, we have used during the COVID-19 pandemic as an icebreaker discussion Global Hack for Fighting the Global Crisis https://theglobalhack.com.This online hackathon in April 2020 involved more than twelve thousand participants from more than 100 countries. Hackathon resulted in 500 business development ideas focused on overcoming the medical, economic, social, and educational crisis resulting from the COVID-19 crisis. Online hackathons as such are large-scale collaborative learning processes, where participants can recruit new members to their online teams and learn from other teams, mentors and finally from the panel that assesses business ideas and tries to identify winners. They learn how to explain their business concept in a brief written outline and in a video presentation.

Table 1: Networking, creativity and business development outcomes of collaboration

	Programmes compared				
Comparison criteria	**Business in Virtual Networks course**	**Nordic Ideation Camp**	**X-Culture global programme**	**Global Horizons for Start-up Entrepreneurship**	**Starter pre-incubation programme**
Expanding networks for international entrepreneurship	Extensive screening of online networking	Synergy of team members around the Balti Sea, online team building stage before the face-to-face ideation camp	Global diversity of online team membership but no opportunities to choose team members	During COVID-19 in 2021 more limited international networking for information search due to the limited number of exchange	Motivational presentations and mentoring by practitioners as face-to-face network expansion tools

Comparison criteria	Programmes compared				
	Business in Virtual Networks course	**Nordic Ideation Camp**	**X-Culture global programme**	**Global Horizons for Start-up Entrepreneurship**	**Starter pre-incubation programme**
				students outside France	
Developing creativity for innovative entrepreneurship	Creativity applied in developing networks for student collaboration and internship opportunity search	Creativity is driven by design thinking and potential client validation exercises	Creativity focused on customising marketing activities to new export markets	Creativity applied to local green initiatives but no radical innovation ideas	Diversified practitioner experiences. Presentations to practitioners for facilitating creativity
Supporting the start-up development process	Awareness of online networking opportunities for future start-up initiatives was raised, but no follow-up after prototyping	No own start-up but learning by doing for understanding problems of potential customers and interviews ad idea validation tools	Export plan development based on detailed written challenge description but no direct feedback from ventures to each student team	One week + one month for report finetuning allowed to specify business model but limited validation efforts.	Understanding challenges of start-up process but time frame too limited for learning by doing. Can serve as input for further incubator or accelerator involvement

However, students who are not directly involved in a hackathon can be engaged in a post-hackathon selection of ideas that are most relevant for them as potential start-up team members or investors. Screening online hackathon results inspires students to generate their own innovative ideas that may have global scalability.

5. Conclusions

An ideal collaborative learning programme for innovative and internationally scalable entrepreneurship could benefit from features of all five compared programmes. However, curriculum and course time frames, diversity of student group composition, and readiness of students to start and continue practical entrepreneurship journey already during their university studies will influence opportunities to attain international networking, learning by doing and creativity outcomes in entrepreneurial and collaborative learning. In entrepreneurial learning processes, the role of action learning through real innovative start-up activities depends on the stage of the self-development journey of a learner and assumes knowledge about networks and resources to support this journey. Collaborative learning can develop creativity for finding new business opportunities and for networking to find new knowledge sources and international partners. During the COVID-19 pandemic, many universities have more extensively applied online learning and hybrid learning. Collaborative learning for innovative entrepreneurship should not be limited to the classroom or e-learning environment of a separate university. It should initiate networking and collaboration between students from many countries and also with contributors not involved in universities. COVID-19 crisis has disrupted some established academic practices but, at the same time, created new incentives for developing virtual learning in the open university and international networking context.

The limitation of this paper is its focus on reflecting the author's experience in developing and implementing collaborative learning programmes. Comparing a larger number of academic practices and assessing the long-term results of different collaborative learning patterns for innovative entrepreneurship in post-university practice is a further research direction.

References

Adner, R. (2012) The Wide Lens. A New Strategy for Innovation, Penguin Group, London.

Agarwal, N. (2011) "Collective Learning: An Integrated Use of Social Media in Learning Environment", In B. White, I. King, and Tsang, P. (Eds.), Social Media Tools and Platforms in Learning Environments (pp. 37–51). Springer.

Acrinol, A. A., Adebayo, S. B., Orakpo, L. U. and Nwaozuru, U. C. (2020) "Toward Culturally-Inclusive Educational Technology in a Globalised World", In The Roles of Technology and Globalization in Educational Transformation (pp. 177-194). IGI Global.

Autio, E., Dahlander, L. and Frederiksen, L. (2013) "Information exposure, opportunity evaluation, and entrepreneurial action: An investigation of an online user community", Academy of Management Journal, Vol 56, No. 5, pp 1348-1371.

Benson, V. and Filippaios, F. (2015) "Collaborative competencies in professional social networking: Are students short changed by curriculum in business education?", Computers in Human Behavior, Vol 51, pp 1331-1339.

Camrass, K. (2020) Regenerative futures. Foresight, Vol 22, No. 4, pp 401-415.

Caseiro, N., & Coelho, A. (2019) "The influence of Business Intelligence capacity, network learning and innovativeness on start-ups performance", Journal of Innovation & Knowledge, Vol 4, No. 3, pp 139-145.

Chesbrough, H. (2017) "The Future of Open Innovation: The future of open innovation is more extensive, more collaborative, and more engaged with a wider variety of participants", Research-Technology Management, Vol 60, No. 1, pp 35-38.

Dania, A. and Griffin, L. L. (2021) "Using social network theory to explore a participatory action research collaboration through social media", Qualitative Research in Sport, Exercise and Health, Vol 13, No. 1 pp 41–58.

De Clercq, D., Sapienza, H. J., Yavuz, R. I. and Zhou, L. (2012) "Learning and knowledge in early internationalisation research: Past accomplishments and future directions", Journal of Business Venturing, Vol 27, No.1, pp 143-165.

DeSimone, F. and Buzza, F. (2013) "Qualitative Pedagogical Skills to Improve Critical Thinking Skills", American Journal of Business Education, Vol 6 No. 6, pp 631-639.

Dhawan, S. (2020) "Online learning: A panacea in the time of COVID-19 crisis", Journal of Educational Technology Systems, Vol 49, No.1, pp 5-22.

Do, B., Dadvari, A. and Moslehpour, M. (2020) "Exploring the mediation effect of social media acceptance on the relationship between entrepreneurial personality and entrepreneurial intention", Management Science Letters, Vol 10, No.16, pp 3801-3810.

Elenurm, T. (2012) "Entrepreneurial orientations of business students and entrepreneurs", Baltic Journal of Management, Vol 7, No 2, pp 217-231.

Johnson, D. W., Johnson, R. T. and Smith, K. (2007) "The state of cooperative learning in postsecondary and professional settings", Educational Psychology Review, Vol 19, No. 1, pp 15-29.

Johanson, J., & Vahlne, J. E. (1977). The internationalisation process of the firm—a model of knowledge development and increasing foreign market commitments. Journal of international business studies, 8(1), 23-32.

Johanson, J. and Vahlne, J. E. (2009) "The Uppsala internationalisation process model revisited: From liability of foreignness to liability of outsidership", Journal of international business studies, Vol 40, No.9, pp 1411-1431.

Kedia, B.L. and Englis, P. (2011) "Transforming business education to produce global managers", Business Horizons, Vol 54, No.4, pp 325-331.

Kurbakova, S., Volkova, Z. and Kurbakov, A. (2020) "Virtual Learning and Educational Environment: New Opportunities and Challenges under the COVID-19 Pandemic", In 2020 The 4th International Conference on Education and Multimedia Technology (pp. 167-171). ICEMT 2020.

Kwong, C. and Thompson, P. (2016) "The when and why: Student entrepreneurial aspirations", Journal of Small Business Management, Vo 54, No.1, pp 299-318.

O'Connor, A. (2013) "A conceptual framework for entrepreneurship education policy: Meeting government and economic purposes", Journal of Business Venturing, Vol 28, No.4, pp 546–563.

Mandrup, M., and Jensen, T. L. (2017) "Educational Action Research and Triple Helix principles in entrepreneurship education: introducing the EARTH design to explore individuals in Triple Helix collaboration" Triple Helix, Vol 4, No. 1, pp 1-26.

Manwaring, K. C., Larsen, R., Graham, C. R., Henrie, C. R. and Halverson, L. R. (2017) "Investigating student engagement in blended learning settings using experience sampling and structural equation modeling", The Internet and Higher Education, Vol 35, pp 21-33.

Morris, M. H., Kuratko, D. F. and Cornwall, J. R. (2013) Entrepreneurship programs and the modern university. Edward Elgar, Cheltenham.

Neck, H. M. and Corbett, A. C. (2018) "The scholarship of teaching and learning entrepreneurship", Entrepreneurship Education and Pedagogy, Vol 1, No. 1, pp 8-41.

Puthusserry, P., Khan, Z., Knight, G. and Miller, K. (2020) "How do rapidly internationalising SMEs learn? Exploring the link between network relationships, learning approaches and post-entry growth of rapidly Internationalising SMEs from Emerging Markets", Management International Review, Vol 60, No. 4, pp 515-542.

Renfors, S. M. (2021) "Internationalisation of the Curriculum in Finnish higher education: understanding lecturers' experiences. Journal of Studies in International Education, Vol 25, No.1, pp. 66-82.

Strijbos, J. W. and Martens, R. L. (2001) "Group-based learning: Dynamic interaction in groups" In European perspectives on computer-supported collaborative learning: Proceedings of the 1st European conference on computer-supported collaborative learning (pp. 569-576).

Sula, O., and Elenurm, T. (2018) "Comparing online social networks ties as tool for entrepreneurial learning readiness in small economies", Informatica Economica, Vol 22, No. 3, pp 62-74.

Thompson, P. (2017) "Communication technology use and study skills", Active learning in higher education, Vol. 18, No. 3, pp 257-270.

Triyason, T., Tassanaviboon, A. and Kanthamanon, P. (2020) "Hybrid Classroom: Designing for the New Normal after COVID-19 Pandemic", In Proceedings of the 11th International Conference on Advances in Information Technology (pp. 1-8).

Veldman, M. A. and Kostons, D. (2019) "Cooperative and collaborative learning: considering four dimensions of learning in groups", Pedagogische Studien, Vol 96, No. 2, pp 76-81.

Vuopala, E., Näykki, P., Isohätälä, J. and Järvelä, S. (2019) "Knowledge co-construction activities and task-related monitoring in scripted collaborative learning", Learning, Culture and Social Interaction, Vol. 21, pp 234-249.

Collaborate or Perish: A Conceptual Framework for Banks and FinTechs Partnerships

Alessandro Faes, Vito Gunnella and Marco Giorgino
Department of Management, Economics and Industrial Engineering (DIG), Politecnico di Milano, Milan (Italy)
alessandro.faes@polimi.it
vito.gunnella@mail.polimi.it
marco.giorgino@polimi.it

Abstract: In the Open Finance framework, collaboration of traditional incumbents (i.e., banks) with start-ups (i.e., FinTechs) is crucial for success. However, despite the frequency and relevance of such partnerships in the financial system, research in this field is rather limited, as most works address alliances regardless of the field of application. The limited number of publications related to finance shed light primarily on the motivations promoting interaction among banks and FinTech start-ups, overlooking additional aspects and players. Therefore, the aim of this work is to build a comprehensive framework allowing to properly frame alliances in the financial industry. Focusing on the Italian context, 90 public partnerships were analysed through document analysis of press releases. It emerges that the majority of the alliances do not involve investments in equity and attest strong participation and commitment of FinTech start-ups. On top of common knowledge, we uncovered other relevant variables to consider in this field when analysing each partnership: its direction, which depends on whether the relation resembles more an operative agreement or an industrial one; its field of interest, which details what the collaboration is about; and its addressees, identifying the targets of these alliances. These dimensions, along with the other ones in a comprehensive framework, will contribute to the enrichment of the literature, closing a relevant gap, and serve as a guide for practitioners in addressing these partnerships.

Keywords: FinTech, Open Finance, open banking, partnership, alliance, framework

1. Introduction

Although it continues to be a hot topic in many research and academic publications, the history of FinTech, a contraction of "Financial Technology", cannot be considered recent. According to the analysis of Skinner (2019), the global FinTech has already traversed three critical stages of its development path, from Disruption in 2010 to Partnership in 2020, where FinTech start-ups and incumbents collaborate on the creation and construction of new business models. In countries like Italy, the ecosystem is currently fully exploring this phase. Overall, the number of collaborative agreements between enterprises, as well as through incubators or API-based platforms integration, is increasing (PwC, 2020; EY, 2020). The introduction of new regulation-related measures, such as the European PSD2 and the Italian Sandbox[1], has further increased the interest of financial institutions in FinTech. COVID-19 emergency has also promoted a continuous acceleration of these collaborations (Deloitte, 2020). Given their ability to adapt and innovate rapidly, numerous FinTech players are developing new products and providing digital solutions often more in line with the "new normal" brought by the pandemic. As traditional financial institutions frequently lack such expertise, this provides an opportunity to form new alliances. More in general, new regulations and market trends in the financial services have brought about the emergence of a broad phenomenon, Open Finance, namely the application of ideas from Open Innovation in Finance (Arner et al., 2021), where collaborations beyond the boundaries of the firm and even of the sector are crucial drivers for innovation.

Despite the centrality and contemporaneity of the trend, studies on alliances are highly generic and there is a lack of financial-specific research. However, the few publications available concerning the financial industry shed light mainly on the motivations behind the interaction among banks and FinTech start-ups, overlooking additional aspects that, along with the motivating factors, could be important in shaping such alliances. Starting from current literature, the aim of the current paper is to fill these research gaps by building a comprehensive framework allowing to properly frame the alliances in Fintech and in the financial sector.

[1]The regulatory *sandbox* is a controlled environment where supervised intermediaries and FinTech players can test, for a limited period of time, technologically innovative products and services in the banking, finance and insurance sectors. In Italy, the Decree of the Ministry of Economy and Finance no. 100 of 30 April 2021, defines the "Disciplina del Comitato e della Sperimentazione FinTech", i.e., the so-called "regulatory sandbox" of FinTech activities at the supervisory authorities (source: https://www.bancaditalia.it/focus/sandbox/index.html).

2. Context and literature review

Financial innovation is closely associated with the term "FinTech", which represents the union of "Finance" and "Information Technology" (Zavolokina et al., 2016). Over the years, the word has assumed various meanings but, despite being a hot topic, there is still no consensus around a definition of FinTech (Manasov et al., 2018). In a broad sense, every technical innovation established in the industry is suitable to be regarded as FinTech. Nevertheless, in recent years, the word FinTech has often been matched to companies and, more specifically, to FinTech start-ups or FinTechs (Mention, 2019).

Headlines of financial press and papers such as *Friends or Foes?* (Navaretti et al., 2018), or *Adversaries or Partners?*[2] have become commonplace, suggesting that the relation among FinTech start-ups and banks is far from being completely clear. As a matter of fact, over the last few years sentiment towards Fintech by banks has moved from rather negative, with banks perceiving FinTech as a threat (Bunea et al., 2016; PwC, 2016; Kalmykova and Ryabova, 2016; World Economic Forum, 2017), to more positive, with incumbents considering FinTechs more as an opportunity for growth (see e.g., Navaretti et al., 2018; Suprun et al., 2020), and for gaining efficiency (Lanfranchi and Grassi, 2021).

In the last few years, many authors perceived that the relationship between banks and FinTech start-ups is shifting from a competitive relationship to a more collaborative one and headlines like *If you can't beat them, join them – How banks, fintech and tech players can win together*[3] started to appear. Potential reasons include realization that synergies arising from collaboration would lead to greater results; limitations of the legacy system of banks; increase in the perceived threats by FinTech start-ups (Nilsson and Fredholm, 2020); the potential decline of banks' revenues (Temelkov, 2018); the need of FinTech players to explore new market segments and avoid competition from banks (Li et al., 2017); as well as the new financial system that DeFi may bring about (Grassi et al., 2022).

2.1 Alliances

Traditionally, an alliance is defined as the union of forces and resources, for a definite or indeterminate period of time, to achieve a shared objective (Takac and Singh, 1992). Widespread among most of the academics in this field, the term "strategic" added an additional feature to the previous definition. The necessity of companies to take a proactive attitude to face global competition and to consider external environmental stimuli such as new markets or new technologies along with the multi-impacts that single decisions have on different business functions are some of the factors that lead to a "strategic" alliance formation (Takac and Singh, 1992). More recently, Hitt et al. (2016) referred to strategic alliances as "a cooperative strategy in which firms combine some of their resources to create a competitive advantage" whilst, Marr and Gray (2012) included alliances in the "relational resources", a subgroup of the categorization of the different types of resources that are available within an organization. These definitions reflect the idea behind the resource-based view of the company and Resource Dependence Theory (Pfeffer and Salancik, 2003; Wernerfelt, 1984) that considered alliances as means to fill resource.

In the academic literature, alliances are analysed from many different standpoints, which we aggregated in 5 main dimensions: type of alliance; drivers; motives; success factors; partner selection criteria.

As per the first dimension, classifying alliances has always been a controversial issue. However, the main differentiation that shapes the majority of the works refers to the distinction between equity alliances, occurring when one company purchases equity in another business, and nonequity alliances, when organizations create an agreement to share resources without creating a separate entity or sharing equity (Barney and Hesterly, 2010; Hitt et al., 2016). Equity alliances may be further distinguished between major equity investment, minor equity investment, and Joint Ventures.

The second dimension deals with alliances' "drivers" defined as "precursors to any strategic alliance formation; events that occur before a firm is motivated to enter in an alliance" (Hynes and Mollenkopf, 1998). Main drivers of alliance formation are increased competition (Varadarajan and Cunningham, 1995); decreased

[2] https://knowledge.wharton.upenn.edu/article/banks-fintechs-adversaries-partners/
[3] https://www.forbes.com/sites/forbescommunicationscouncil/2018/04/05/if-you-cant-beat-them-join-them-how-banks-fintech-and-tech-players-can-win-together/?sh=20b426e05ce1

performances (Cravens et al., 1993); technological developments (Varadarajan and Cunningham, 1995); and changes in political, legal, and regulatory environment (Howarth, 1994).

The third dimension describes the "motives" that encourage businesses to join forces. In particular, companies collaborate to share costs and risks (Contractor and Lorange, 1988; Glaister and Buckley, 1996) access to new technologies (Glaister and Buckley, 1996); access to partner's knowledge and expertise (Hamel, 1991); enter new markets or businesses (Glaister and Buckley, 1996); enlarge their offering (Contractor and Lorange, 1988); or gain trust and credibility, usually in the case of collaborations among incumbents and start-ups (Barringer and Harrison, 2000).

The fourth dimension focuses on alliances' "success factors". Indeed, if it is true that alliances have significant potential benefits, it is critical to understand how to achieve a "win-win" situation (Whipple and Frankel, 2000). In this regard, the main factors mentioned in the literature are trust between the partnering sides (Čirjevskis, 2021); the commitment of the top management (Čirjevskis, 2021; Whipple and Frankel, 2000); conflict management capabilities enhanced by effective communication (Čirjevskis, 2021); partner compatibility (Whipple and Frankel, 2000); and assessment of performances in relation to the alliance's short and long-term goals (Whipple and Frankel, 2000).

The fifth dimension concerns the "partner selection criteria". For choosing the right partner, usually, companies consider the partner's competencies and knowledge (Geringer, 1991; Wu et al., 2009); financial status (Geringer, 1991); reputation (Wu et al., 2009); and compatibility with the firm in terms of company's culture and top management teams (Wu et al., 2009).

Academic contributions exploring alliances in the financial industry concentrated primarily on defining the engagement models among banks and FinTech start-ups and the motivations promoting these collaborations.

Experimentation initiatives, accelerator programs, and incubation are among the engagement models cited (Bömer and Maxin, 2018; Klus et al., 2019). However, most of the scholars refer to equity investments, acquisitions, or product-related collaboration in terms of nonequity alliances (Drasch et al., 2019; Hornuf et al., 2021). Furthermore, concerning the motives of bank-FinTech interaction, the to-date literature highlighted the possibility for banks to access to FinTech start-up's technology (Drasch et al., 2019; Klus et al., 2019), which, in turn, would benefit from the banks' market knowledge (Klus et al., 2019), regulatory expertise (Svensson et al., 2019) and reputation (Klus et al., 2019). Both banks and FinTech players would expand their product offerings and customer base (Bömer and Maxin, 2018; Hornuf et al., 2021; Klus et al., 2019). Academics in this field also mentioned the possibility of increasing customer value by providing personalized products that meet the needs of the clients (Klus et al., 2019), as well as the opportunity of achieving innovation (Bömer and Maxin, 2018; Klus et al., 2019). In this regard, banks can collaborate with FinTech start-ups to benefit from their agility, speed and creativity (Bömer and Maxin, 2018; Klus et al., 2019).

3. Knowledge gaps and research question

Despite the vast number of publications and research investigating the topic from a general and theoretical viewpoint, the subject of alliances in the financial industry lacks a comprehensive framework. The literature appears to be relatively fragmented, and the variables used by academics to research the topic in general, such as drivers, motives, success factors and partner selection criteria, do not find an adequate exploration in the financial industry. In this regard, the research generally addresses the models of collaborations among banks and FinTech start-ups (Maxin, 2018; Bodek and Matinjan, 2017; Thwaits, 2017; Hatami, 2018; Hornuf et al., 2021), mainly focusing on the motives that spur these alliances (Bömer and Maxin, 2018; Klus et al., 2019; Svensson et al., 2019; Suprun et al., 2020). However, given the breadth of the topic, the exploration of further elements, in addition to motivating factors, may be crucial in accurately framing such alliances. Therefore, the exploratory research question which guides this research follows:

RQ: How can alliances among actors of financial services be framed?

The main contribution of this work is to match and harmonize the current literature dealing with alliances in general with the understanding of alliances in the financial industry, as well as to explore new aspects that might be useful in correctly outlining these collaborations.

4. Methodology

In order to properly answer to the research question and address the gaps identified in the literature review, the first step was desk research, preparing a database of public partnerships established in the last biennium by checking secondary sources such as websites, press releases and consulting reports. Our reference context for the analysis was the Italian financial industry, as: (i) the Italian market has never been specifically explored by the existing papers that have focused more on other countries (e.g. Germany: Bömer and Maxin, 2018; Bodek and Matinjan, 2017; Brandl and Hornuf, 2020) or on vast geographic areas (Hornuf et al., 2021; Drasch et al., 2018); (ii) the interest toward alliances is increasing in the Italian country (Bank of Italy, 2019; EY, 2020; PwC, 2020).

As a starting point in creating the database, we focused on major financial companies in Italy among which, the top 40 banks, either by number of agencies or by assets, the top 10 insurance companies by premiums collected in 2020, and the top 30 start-ups by funds collected. For each firm of the lists, all the partnerships it has established were searched and retrieved. As a control check, and to make sure partnerships among smaller but still innovative players were not excluded, we complemented with the examination of a wide range of consulting reports (e.g., EY, 2020; PwC, 2020) dealing with financial collaborations in the Italian market in order to make the database as robust as possible. We selected as partnership those with (i) financial focus: each partnership had to involve at least one financial player such as a bank, insurance company, FinTech or InsurTech start-up; (ii) terminology consistency: the form of the relation established as "partnership", "collaboration", "alliance" or "agreement"; (iii) time dimension: the partnership was established in 2020 or 2021; (iv) information reliability: official information available on partners' websites, press releases or authorized sources. Overall, 90 public partnerships resulted involving 109 distinct organizations, among which 39 companies have established more than one collaboration. Corporations included in the partnerships resulted in (18) banks, (17) insurance companies, (40) FinTech start-ups, (9) InsurTech start-ups, (25) other companies, comprehending mainly consulting agencies, incubators, associations and corporations involved in telecommunications or software development. Ten collaborations involved three organizations, while the vast majority was bilateral.

After creating the partnership database, all the press releases of such collaborations were gathered and analysed through a document analysis. This technique aimed at aligning the two portions of the literature, namely alliances in general and alliances in financial services, while also researching new dimensions.

4.1 Document analysis and coding methodologies

The document analysis (Bowen, 2009; Corbin and Strauss, 2008) was used to investigate the press releases of the collaborations included in the database. Documents are "unobtrusive" and "non-reactive" since they are not affected by the research process, hence, the presence of the investigator does not change what is being examined (Merriam, 1988). According to Yin (2018), the inclusion of specific names, references, and event information makes documents highly useful in the research study. The analysis of documents also allowed us to investigate a large number of collaborations that would not have been possible using only other methods (e.g., case studies and interviews). The level of detail of the provided information has contributed to the creation of robust themes (Braun and Clarke, 2012). Within the analysis, we assigned codes to portions of text using the coding technique. In qualitative research "coding is a way of indexing or categorizing the text in order to establish a framework of thematic ideas about it" (Gibbs, 2007) and "leads you from the data to the idea, and from the idea to all the data pertaining to that idea" (Richards and Morse, 2012). We opted for a blended technique, deductive from the literature review and inductive from the data (Hsieh and Shannon, 2005). This approach's objective is to conceptually validate or extend a theoretical framework of theory. More practically, this method uses theory and pertinent research findings to guide initial codes while also enabling inductive codes to develop during the analysis. After deciding on a procedure based on the thematic analysis, we followed Braun and Clarke (2012) six steps approach for data analysis.

5. Results and discussion

First, an initial theoretical framework derived from the literature review was developed. The framework is based on the literature review of business alliances in general, and is made of themes (namely, type of alliance; drivers; motives; success factors; partner selection criteria) and relative codes explicated in the first part of section 2.1. It was further enriched by codes deriving from the literature review of alliances between banks and Fintechs (i.e., last part of 2.1). Specifically, within the "motives" theme, the following codes were

added: enlarge customer base, as the alliance allows both firms' to gain more customers (Bömer and Maxin, 2018; Klus et al., 2019; Manatt, 2016; Hornuf et al., 2021); increase customer value, as according to Klus et al. (2019), banks gain a competitive advantage by working with FinTech start-ups, who provide more personalized products that are well-suited to the demands of their clientele; achieve innovation, as often banks are unable to initiate innovative operations due to cumbersome rules and outdated infrastructure, and thus partner with FinTech firms to take advantage of their agility, speed, and creativity (Bömer and Maxin, 2018; Klus et al. 2019).

Then, the analysis of the press releases highlighted portions of text that did not fit any existing themes or codes already present in the framework derived from the literature review. As a result, new themes (namely, "direction", "addressees", and "field of interest") and new codes were implemented, enriching the final structure. Furthermore, some codes derived from the literature have been reformulated to fit better the results gathered from the analysis of press releases.

Table 1 shows the resulting framework, specifying whether the mentioned code is deductively derived from the literature or inductively defined after the press releases document analysis.

Table 1: Final framework

Theme	Codes	Deductive/Inductive
Type	Major equity investment	Deductive
	Minor equity investment	
	Joint Venture	
	Nonequity alliance	
Direction	Operative agreement	Inductive
	Distribution agreement	
	Financial agreement	
	Industrial agreement	
Addressees	SMEs	Inductive
	Start-ups	
	Consumers	
	Financial firms	
	Partner of the alliance	
Drivers	Increase in competition	Deductive
	Changes in regulation	
	Change in technology	
	Decline in performances	
	Change in consumer needs	Inductive
	COVID-19 pandemic	
	Expansion of start-ups ecosystem	
Field of Interest	Payments	Inductive
	Lending	
	Cryptocurrencies	
	Insurance and bancassurance	
	Wealth and asset management	
	Personal financial management	
	Business financial management	
	Capital market and trading	
	Open Banking	
Motives	Reduce costs	Deductive
	Share risks	
	Increase customer value	
	Access to partner's technology	

Theme	Codes	Deductive/Inductive
	Access to partner's knowledge and expertise	
	Enlarge customer base	
	Achieve innovation	
	Enter a new market or business	
	Develop new products	
	Distribute partner's product	
	Gain trust and credibility	
	Optimize processes	Inductive
	Enforce firm's position in existing businesses	
	Access to a network	
Success Factors	Trust	Deductive
	Commitment	
	Conflict management	
	Partner compatibility	
	Performance assessment	
Partner Selection Criteria	Competencies and knowledge	Deductive
	Reputation	
	Financial status	
	Technical compatibility	
	Partner's market position	Inductive
	Previous collaborative relations	

Drawing from the literature, the theme "type of alliance" was associated to four codes: nonequity alliances; minor equity investment; major equity investment; and joint venture. The analysis also showed that 84 of the 90 partnerships were nonequity alliances.

The theme "direction" was added as the analysis of the press releases showed that different partnerships have different directions in terms of the relationship that will emerge between the actors. Drawing both on the related literature (Hatami, 2018; Spekman, 2000) and the empirical analysis, four codes were identified: operative agreement, if partners are linked by provider-consumer relation; distribution agreement, when a company distributes the cooperating firm's products through its own channels; financial agreement, if a firm invests in the capital of the partnering company; industrial agreement, when the businesses in the partnership dedicate resources to achieve a certain goal or develop a new product or service. It is worth noting that, such in the case of "direction", while certain notions were already existent in the literature, their combination to investigate the topic of alliances was not, and are hence denoted as inductive.

The theme "addressees" was introduced to pose the attention on the identification of partnerships' beneficiaries, in other words, to whom the partnership is addressed. It is constituted of five codes: consumers; SMEs; start-ups; financial firms; and also the partner of the collaboration. The majority of collaborations analysed are addressed to partner's clients and SMEs.

The theme "drivers" was associated to seven codes deriving either from the literature - increase in competition; changes in regulation, in particular the introduction of the PSD2; changes in technology, for example, the emergence of the blockchain; Decline in performances increasing threats of takeover – or from the empirical analysis - COVID-19 pandemic, that has put many SMEs in financial difficulty and decreased people's mobility; changes in consumer needs; the expansion of the start-up ecosystem, usually lacking of adequate resources and knowledge.

The theme "field of interest" aims at describing the core of the partnership, or what the collaboration is about. It is essential in the analysis of any type of collaboration because it aims at giving information about the particular business area that is affected by the partnership, and was not identifiable in the literature about alliances. It was detailed by eight codes, related to traditional FinTech business segments categorization (e.g., Gomber et al., 2017; Bates, 2017; PwC, 2020).

The theme "motives" was associated to eleven codes derived from the literature, enriched by three codes emerging from the empirical analysis: optimize internal processes leveraging mutual learnings; enforce firm's position in existing businesses, as opposed to just accessing new markets; access to a network promoted by the partnering organization.

The theme "success factors" was detailed by codes derived from the literature and confirmed by the empirical analysis. A more in-depth analysis through interviews might be needed to disentangle this theme from an empirical standpoint.

Lastly, the theme, "partner selection criteria" was enriched by two more codes with respect to the ones identified in the literature: previous collaborative relations, which prove to be powerful selection criteria; and the partner market's position.

6. Conclusion

A comprehensive framework on alliances in financial services has been developed based on the findings of the literature review and has been enriched by findings from the analysis of public press releases. According to the results of the investigation, the majority of the Fintech alliances in Italy do not involve investments in equity and attest a strong participation of FinTech start-ups. The initial framework, which focused on alliances' type, drivers, motives, success factors and partner selection criteria, has been enriched by adding three new themes: partnership's direction, which depends on whether the relation is similar to an operative agreement or an industrial one; its field of interest, which details what the collaboration is about, and its addressees, identifying the targets or final beneficiaries of these alliances. The main contribution of this work is shedding light on the underpinnings of alliances in the financial industry, both closing the literature gap and serving as a guide for practitioners. Main limitation of this work relies on the sole use of document analysis of press releases. Despite being a suitable methodology for addressing the research question overall, several nuances might be missed due to the public nature of the documents and the partial "marketing" objective of these publications. This study can be used as a starting point for new or supplemental research. First, case studies methodology might allow to shed light on the missing elements in the framework. Furthermore, the relationships under consideration are actively operating as they were recently created. The examination of collaborations that have already ended might be beneficial to understand the reasons and the dynamics driving these cases, as well as success factors. Lastly, given the growing number of relationships between financial and other organizations such as incubators, utilities companies, or associations, it would be enlightening to further investigate these non-financial organizations to see if new components to broaden the framework emerge or how the current ones evolve.

References

Arner, D. W., Buckley, R. P., & Zetzsche, D. A. (2021). Open Banking, Open Data and Open Finance: Lessons from the European Union. *Forthcoming in Linda Jeng (ed), Open Banking (Oxford University Press, 2021)*, 21-69.

Bank of Italy (2019). *Indagine FinTech nel sistema finanziario italiano.*

Barney, J. B., & Hesterly, W. S. (2010). *Strategic management and competitive advantage: Concepts* (p. 408). Englewood Cliffs, NJ: Prentice Hall.

Barringer, B. R., & Harrison, J. S. (2000). Walking a tightrope: Creating value through interorganizational relationships. *Journal of management*, *26*(3), 367-403.

Bodek, M. C., & Matinjan, J. (2017). Innovation durch corporate incubation. In *Innovationen und Innovationsmanagement in der Finanzbranche* (pp. 117-144). Springer Gabler, Wiesbaden.

Bömer, M., & Maxin, H. (2018). Why fintechs cooperate with banks—evidence from germany. *Zeitschrift für die gesamte Versicherungswissenschaft*, *107*(4), 359-386.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative research journal*.

Brandl, B., & Hornuf, L. (2020). Where did FinTechs come from, and where do they go? The transformation of the financial industry in Germany after digitalization. *Frontiers in Artificial Intelligence*, *3*, 8.

Braun, V., & Clarke, V. (2012). Thematic analysis.

Bunea, S., Kogan, B., & Stolin, D. (2016). Banks Versus FinTech: At Last, it's Official. *Journal of Financial Transformation*, *44*, 122-131.

Skinner, C. (2019) "Five Phases of FinTech (2005-2027)": https://thefinanser.com/2019/05/five-phases-of-fintech-2005-2027.htm

Čirjevskis, A. (2021). Exploring Critical Success Factors of Competence-Based Synergy in Strategic Alliances: The Renault–Nissan–Mitsubishi Strategic Alliance. *Journal of Risk and Financial Management*, *14*(8), 385.

Contractor, F. J., & Lorange, P. (1988). Why should firms cooperate? The strategy and economics basis for cooperative ventures. *Cooperative strategies in international business*, *1*, 3-30.

Corbin, J., & Strauss, A. (2008). Strategies for qualitative data analysis. *Basics of Qualitative Research. Techniques and procedures for developing grounded theory*, *3*.

Cravens, D. W., Shipp, S. H., & Cravens, K. S. (1993). Analysis of co-operative interorganizational relationships, strategic alliance formation, and strategic alliance effectiveness. *Journal of Strategic Marketing*, *1*(1), 55-70.

Deloitte (2020). FinTech: On the brink of further disruption.

Drasch, B. J., Schweizer, A., & Urbach, N. (2018). Integrating the 'Troublemakers': A taxonomy for cooperation between banks and fintechs. *Journal of Economics and Business*, *100*, 26-42.

EY (2020). FinTech waves. Italian FinTech ecosystem 2020.

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International journal of qualitative methods*, *5*(1), 80-92.

Geringer, J. M. (1991). Strategic determinants of partner selection criteria in international joint ventures. *Journal of international business studies*, *22*(1), 41-62.

Gibbs, G. R. (2007). Getting started with computer-assisted qualitative data analysis. Analyzing Qualitative Data, 105-124.

Glaister, K. W., & Buckley, P. J. (1996). Strategic motives for international alliance formation. *Journal of Management Studies, 33*(3), 301-332.

Grassi, L., Lanfranchi, D., Faes, A., & Renga, F. M. (2022). Do we still need financial intermediation? The case of decentralized finance–DeFi. *Qualitative Research in Accounting & Management*.

Hamel, G. (1991). Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal 12* (S1): 83-103.

Hatami, A. (2018). Bank & FinTech collaboration models. *Retrieved September*, *12*, 2019.

Hitt, M. A., Ireland, R. D., & Hoskisson, R. E. (2016). *Strategic management: Concepts and cases: Competitiveness and globalization*. Cengage Learning.

Hornuf, L., Klus, M. F., Lohwasser, T. S., & Schwienbacher, A. (2021). How do banks interact with fintech startups?. *Small Business Economics*, *57*(3), 1505-1526.

Howarth, C. S. (1994). The role of strategic alliances in the development of technology. *Technovation*, *14*(4), 243-257.

Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, *15*(9), 1277-1288.

Hynes, N., & Mollenkopf, D. A. (1998, November). Strategic alliance formation: Developing a framework for research. In *Australia/New Zealand Marketing Academy Conference* (Vol. 29).

Kalmykova, E., & Ryabova, A. (2016). FinTech market development perspectives. In *SHS Web of Conferences* (Vol. 28, p. 01051). EDP Sciences.

Klus, M. F., Lohwasser, T. S., Holotiuk, F., & Moormann, J. (2019). Strategic alliances between banks and fintechs for digital innovation: Motives to collaborate and types of interaction. *The Journal of Entrepreneurial Finance*, *21*(1), 1.

Lanfranchi, D., & Grassi, L. (2021). Translating technological innovation into efficiency: the case of US public P&C insurance companies. *Eurasian Business Review*, *11*(4), 565-585.

Li, Y., Spigt, R., & Swinkels, L. (2017). The impact of FinTech start-ups on incumbent retail banks' share prices. *Financial Innovation*, *3*(1), 1-16.

Manasov, J., Ivanovska, L. P., & Josimovski, S. (2018). COMPREHENSIVE OVERVIEW OF FINTECH INDUSTRY: DEFINITIONS, EVOLUTION AND SEGMENTS. *Knowledge International Journal*, *22*(1), 181-185.

Marr, B., & Gray, D. (2012). *Strategic performance management*. Routledge.

Maxin, H. (2018). *Corporate Venture Capital im Bankensektor: Eine Fallstudie* (No. 566). Hannover Economic Papers (HEP).

Mention, A. L. (2019). The future of fintech. *Research-Technology Management*, *62*(4), 59-63.

Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. Jossey-Bass.

Navaretti, G. B., Calzolari, G., Mansilla-Fernandez, J. M., & Pozzolo, A. F. (2018). Fintech and banking. Friends or foes?. *Friends or Foes*.

Nilsson, P., & Fredholm, L. (2020). Competitors or Collaborators? A Qualitative Study of the Evolving Relationship Between Banks and FinTech Companies in the Swedish Retail Banking Industry.

Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. Stanford University Press.

PwC. (2016). Blurred Lines: How FinTech Is Shaping Financial Services. *Global FinTech Report.*

PwC. (2020). FinTech Calls for Fuel: To exploit a great, maturing and increasing potential. *Italian FinTech Observatory 2020*

Richards, L., & Morse, J. M. (2012). Readme first for a user's guide to qualitative methods. Sage

Suprun, A., Petrishina, T., & Vasylchuk, I. (2020). Competition and cooperation between fintech companies and traditional financial institutions. In *E3S Web of Conferences* (Vol. 166, p. 13028). EDP Sciences.

Svensson, C., Udesen, J., & Webb, J. (2019). Alliances in financial ecosystems: A source of organizational legitimacy for fintech startups and incumbents. *Technology Innovation Management Review*, *9*(1).

Takac, P. F., & Singh, C. P. (1992). Strategic alliances in banking. *Management Decision*.

Temelkov, Z. (2018). Fintech firms opportunity or threat for banks?. *International journal of information, Business and Management*, *10*(1), 137-143.

Thwaits, C. (2017). *The barriers and enablers to effective fintech start-up collaboration with South African Banks* (Doctoral dissertation, University of Pretoria).

Varadarajan, P. R., & Cunningham, M. H. (1995). Strategic alliances: a synthesis of conceptual foundations. *Journal of the academy of marketing science*, *23*(4), 282-296.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management journal*, *5*(2), 171-180.
Whipple, J. M., & Frankel, R. (2000). Strategic alliance success factors. *Journal of supply chain management*, *36*(2), 21-28.
World Economic Forum (2017). Beyond FinTech: A Pragmatic Assessment of Disruptive Potential in Financial Service.
Wu, W. Y., Shih, H. A., & Chan, H. C. (2009). The analytic network process for partner selection criteria in strategic alliances. *Expert Systems with Applications, 36*(3), 4646-4653.
Yin, R. K. (2018). Case Study Research and Applications. Design and Methods. SAGE
Zavolokina, L., Dolata, M., & Schwabe, G. (2016). The FinTech phenomenon: antecedents of financial innovation perceived by the popular press. *Financial Innovation*, *2*(1), 11.

From Teachers' Innovative Practices to Students' Co-Creation: A Glimpse of the Project "Link Me Up – 1000 Ideias"

Rosina Fernandes and Susana Amante
Polytechnic Institute of Viseu and CI&DEI, Viseu, Portugal
rosina@esev.ipv.pt
susanamante@estgv.ipv.pt

Abstract: Higher Education Institutions are, more than ever, open to innovative practices, and nowadays the triple helix of University, Industry and Government is taking place through the implementation of projects such as "Link Me Up – 1000 Ideias". This project, funded by COMPETE, was created as a network bringing together thirteen Portuguese Polytechnic Institutes to promote entrepreneurship among students, called talents, in academia. In a multidisciplinary approach, a co-creation team of 4-6 students, working together with organisation partners and using teacher's innovative practices, explore a future-oriented challenge in order to design solutions, ideas and future scenarios, in an 8-week process that aims to empower students to create their own innovative companies or projects and to help them to be prepared for the transition to the world of work, developing soft skills that are required in our competitive society. This project is linked to another, entitled "Learning based on co-creation processes," funded by POCH, in a partnership with DEMOLA Global, which provides teachers (in this process, they become facilitators) with innovative methodologies that are then operationalised when implementing co-creation challenges. In this study, we aim at presenting the "Link Me Up" project from the point of view of students from the Polytechnic Institute of Viseu and local organisations, by a) reflecting upon the questionnaires applied to students and companies to assess their degree of satisfaction with their participation in the project, identifying key areas enhanced by the experience. Additionally, b) we will look at the reports written by the group of students as they summarise the work developed in partnership with companies throughout eight intensive weeks. We will conclude, not with a retrospective view, although it is important to look at the past to build the present, but with the perspective of a future that is collaborative, reflective, critical and increasingly creative.

Keywords: higher education students, co-creation, design thinking, triple helix, employability skills

1. Higher education and innovative practices

Nowadays, the responsibility of Higher Education Institutions (HEI) goes beyond the concern with the certification of graduates and the conferring of degrees to commit to the students' training, at a global level, and their preparation for the growing demands of the job market. These demands require the development of specialised technical skills, but especially transferable/soft skills, because these competencies support career development through continuous adaptation to the opportunities and challenges of the world of work (Qizi, 2020).

In light of the above, the creation of support services in HEI is of utmost importance in order to help students in their career preparation, along with the implementation of projects based on the triple helix concept of University, Industry and Government. In fact, these projects in partnership with regional companies and state entities, and making use of external funding that allows for the development of training initiatives complementary to the formal curriculum, offer opportunities for student involvement in innovative actions, with an emphasis on research in the area (Arulmani et al., 2014; Fernandes, 2013; Orteu, 2017). This interest in the adaptive transition of students to the job market is a concern of theorists, researchers, directors, and teachers. Indeed, the involvement of teachers in training based on innovative pedagogical practices, centred on the student as the main actor in the teaching-learning process, has proven to be promising in some higher education institutions (Carvalho et al., 2022).

In fact, students' active role in the construction of their academic training project and preparation for professional practice is undoubtedly an established crucial point of the responsibility of HEI in promoting a successful transition to active life. In this process, the student is recognised as a competent subject due to his/her performance of role-taking experiences (rather than role-playing, as traditionally put) in a work context, with real organisations that welcome students in a process centred on their talent, through continuous self-reflection on praxis that allows the transversality and generalisation of the knowledge developed when entering the job market (Mangas, 2020).

2. Entrepreneurship and innovation promotion in Higher Education

The COVID-19 pandemic has confirmed that technological advances allow for the emergence of new forms of work (e.g., remote work) and new professions that require different and higher levels of knowledge, so the worker is increasingly valued today because s/he is the cause of an organisations' wealth (Noutel et al., 2021).

In this sense, preparing students for the demands of the labour market and for the development of the (constantly evolving) skills needed entails changing training programmes, namely adding the dimension of innovation and entrepreneurship, not just for those who are interested in creating their own jobs, but, above all, for the students' development of entrepreneurial and creative skills, which enhance the employability of graduated youth (Mónico, 2021).

As we have seen, the ever-changing labour market implies an entrepreneurial profile in all areas (Fernandes et al., 2021). Innovation is increasingly necessary for all careers and the promotion of students' creativity and design-thinking skills that may lead to the creation of business ideas should be a priority for HEI, no matter the field of study (von Thienen et al., 2017).

In this sense, the project presented in the next section enables students to develop the skills necessary to create new and meaningful solutions to challenges faced by organisations and to discuss future scenarios in order to allow companies to be ready for future demands. In this process students redesign work processes in the light of the recent technological advances we pointed out before.

3. "Link Me Up – 1000 Ideias" Project at the Polytechnic Institute of Viseu

3.1 Project framework

The Polytechnic Institute of Viseu (IPV), committed to promoting the quality of teaching, innovation, and bringing academia closer to local organisations, has been investing in the students' training to increase the quality of employment (IPV, 2021a). In this context, according to the same source, IPV has embraced the project entitled "Link Me Up – 1000 ideas," a Support System for the co-creation of innovation, creativity and entrepreneurship (01/SIAC/2020 – Application no. 072070), led by IP Leiria, but resulting from a Consortium of 13 Polytechnic Institutes of the Network of Portuguese Public Polytechnic Institutions.

This project is co-financed by European and national funds, in a total of €5,562,774.12), through COMPETE (Operational Programme for Competitiveness and Internationalisation, cf. Project File at https://site.ipv.pt/linkmeup_proj.htm).

The project aligns with aspects of the triple helix concept previously introduced and includes novel features that have not been incorporated into other discussions of this concept, as we will mention below.

In fact, according to the Project File (IPV, 2021a), it aims to develop more than 1000 ideas, from 2021 to 2023 (6 biannual editions, the 1st and 2nd completed, the 3rd and 4th ongoing), in multidisciplinary and international co-creation processes between students and organisations, with the support of teachers/facilitators.

3.2 The Pedagogical Innovation Course at IPV

3.2.1 Course presentation

The implementation of the "Link Me Up" Project at IPV is carried out through the Pedagogical Innovation Course (non-degree course, with 6 ECTS, totalling 162 hours), closely connected to the Finnish platform DEMOLA - demola.net (IPV, 2021a). Since 2008, Demola has been a recognised international service for organisations, focused on driving forces and opportunities for the future, considering higher education students (Generation Z) as experts and promoters of change (Demola, 2022). This course is dependent on the "Learning based on co-creation processes" project (ref. no. POCH-04-5267-FSE-000818), a training course for teachers to become facilitators (IPV, 2021b).

The target audience of the Pedagogical Innovation Course includes Higher Professional Technical Courses - CTeSP, Graduation, Postgraduation and Masters' students, from all knowledge areas, integrated into

interdisciplinary work teams (maximum 6 students) that collaborate with community organisations with the support of teachers/facilitators from different IPV schools (and also from vocational schools) in co-creation projects to solve real organisational challenges (IPV, 2021a).

At the beginning of the course, a challenge proposed by each of the local organisations and designed by facilitators is presented and made available on the Demola-Portugal 20-23 platform (https://www.cocreationportugal.com/).

During 8 to 10 weeks, the teaching-learning process is enhanced by the use of active and innovative methods, focused on multidisciplinary, multinational and multicultural development and management, using the DEMOLA platform, in weekly (online) meetings between students and the organisations' representatives, aided by various stakeholders and experts that are invited to discuss the challenges, and by field trips both to research centres and to the participating partner organisations (IPV, 2021a). The process of planning the future and goals to achieve (strategic vision), along with immersion in the problem/challenge, ideation based on the insights collected and prototyping (validation of the idea), as a design-thinking process (Brown, 2009; Reche & Janissek-Muniz, 2018), are some of the strategies students use to address and explore the challenge, with the support of teachers/facilitators and Demola mentors. Ideas are brainstormed, using rapid prototyping, from the perspective of innovation and value creation for different stakeholders (IPV, 2021a).

In the end, according to IPV (2021a), students should have reached conclusions (solutions/future scenarios) and be able to effectively communicate their ideas to an audience (Final Pitch).

3.2.2 Course benefits

The course structure, complying with the prerequisites of the Bologna process, relies on student-centred teaching methodologies, as well as the co-construction of transversal competencies/soft skills, such as: i) thinking and questioning; ii) communication (namely in English) and work in multidisciplinary and (inter)national teams; iii) solving complex problems; iv) dealing with/managing uncertainty and change; v) creating and innovating in organisational contexts (IPV, 2021a).

Some course tangible benefits are: i) 6 ECTS as a diploma supplement; ii) allocation of credits to curricular units; iii) scholarship; iv) International Certificate from the Finnish Government Accreditation Agency; v) possibility of participating in a national competition (prizes of €5000, €3000 and €1500) and participation in an international event (IPV, 2021a).

Furthermore, intangible benefits are associated with this experience: i) work on a real-life challenge; ii) connection with the labour market/organisations; iii) development of skills relevant to one's professional life (*curriculum vitae* enhancement); iv) academic recognition; v) network extension; vi) ownership/copyright of the project results (creation of employment, possibility of patents and the development of prototypes with project funds). We found evidence in the literature regarding these benefits associated with the project, given its implementation in other countries, namely in Spain, a cultural context close to the Portuguese (Catalá-Perez et al., 2020).

4. Link me up – 1000 ideas Project Results: the IPV experience

So far, two editions of the project have been carried out, with 16 teams of students exploring challenges around themes such as technologies; culture and art; social and community development; health, sports and well-being; economy; sustainability and environment; tourism; and communication. The organisations involved in these two editions included technological companies/digital services, associations, museums, small companies, large local companies, municipalities, business consulting services, industry, and sports clubs, among others.

4.1 Results from the students' perspective

4.1.1 Students' profile

So far, 75 students have completed the course in the 16 IPV co-creation teams (42 in the 1st edition and 33 in the 2nd). It is worth mentioning the participation of 7 IPV students in teams from other Polytechnic Institutes (3

in the 1st edition and 4 in the 2nd), with 2 students from other Polytechnic Institutions (2nd edition) integrated into IPV teams.

International students have also participated in IPV teams (3 in each edition), mainly from China and Brazil. The contribution of these students has allowed Portuguese students to have contact with cultural specificities in addressing the challenges, as well as the opportunity to develop English language skills, so important in today's job market and often missing in Portuguese students (Amante et al., 2021).

In the student's profile, the female gender stands out (68% in the 1st edition and 57% in the 2nd), which is expected if we take into account the literature on female students' engagement with extracurricular activities in comparison with males but also surprising because the male gender is typically more represented in entrepreneurship projects, reflecting gender inequalities that we still find in the Portuguese labour market. The project has proven to be very important in training future entrepreneurial female students, countering these stereotypes rooted in the Portuguese culture (Ferreira, 2020).

The average age was 25 in the first two editions, with students ranging from 19 to 56 in the 1st edition and from 18 to 43 in the 2nd edition. The participation of older students is unexpected, as, when applying for funding, this project highlighted youth entrepreneurship as its top priority. However, the results show that everyone's contribution is welcome to this project.

Most participants are undergraduate students, and the project has so far involved 5 Master's students in each edition, with very interesting participation, given the maturity and experience that these students usually bring to the teams. CTeSP students did not participate in the first two editions.

Students come from different IPV schools, but courses in the social, education and communication areas are more highly represented, which is not very common in entrepreneurship projects, although the focus on social entrepreneurship should increasingly deserve our attention (Fernandes, 2021; Nicholls, 2008), perhaps because of the project's focus on social and societal challenges and less on profit/business issues. The areas of engineering, management and technologies follow (with an increase in the 2nd edition of the project), as expected in these kinds of projects. So far, the least represented areas in the project are art and culture, as well as sport and health. We plan to draw upon the experiences and testimonies of students from these underrepresented groups in marketing initiatives when we promote the next editions of the project as a mechanism to help increase their participation.

4.1.2 Satisfaction with participation in the project

As part of the project evaluation, which IP Portalegre is responsible for, and IP Setúbal is carrying out, we learnt from the satisfaction questionnaires that there was a degree of satisfaction of 84% in the first two editions.

Students highlighted the project's contribution to the development of these skills: i) research, information gathering and analysis (92%) and teamwork/relationships (92%); ii) digital skills (90%) and management tools (87%); iii) creativity (86%) and critical thinking (84%); iv) entrepreneurship (77%) and leadership (77%); v) training (64%) and interest (12%) in creating own employment.

From a qualitative perspective, according to the questionnaire developed by IPV, we can point out some student testimonies. They consider that this is a unique, incredible, intense, challenging, very interesting and enriching experience, which requires effort, dedication and time, but which is a fantastic opportunity for any student. Participation in the project allowed students to: i) work as a team and with colleagues from other courses, schools and countries; ii) build networks and make friends; iii) have a perspective on the world of work, as well as acquire knowledge and experience as preparation for their professional future; iv) feel active, included and needed; v) understand what they want for their professional life; vi) learn about new tools; vii) produce an innovative idea in a short time process. They highlighted the importance of the facilitator's support and his/her distinct role from the traditional teacher. Here students are not passive consumers of information, as in the traditional approach to teaching, but knowledge producers.

In addition, some students had never prepared their *curriculum vitae* and did so for the application, some had never spoken English and had to do so to communicate with international colleagues and to prepare their final pitch, and others explored their vocations in a real context.

The analysis of the students' final reports reveals that: i) 43.7% suggest the development of technological resources as a solution to the explored challenge (e.g., app, hologram, artificial intelligence device); ii) followed by the proposal of action strategies in 31.2% of cases (e.g., training program, event, social project, list of initiatives); iii) and, finally, 18.7% put forward the development of a product (e.g., game, loyalty or reward programme, food resource). The challenge exploration may also result in an alternative option, centred on the description of future scenarios (e.g., projections on changes, consumer profiles), rather than solutions, but it was less represented (6.2%) in the students' reports.

4.2 Results from the organisations' perspective

So far, 16 partner organisations have been selected to develop the same number of co-creation cases.

The analysis of the satisfaction questionnaires showed a satisfaction level of 91% in organisations. Partners highlighted collaborative work and valued creation as the main benefits of participating in the project (94%). Then, they pointed out the possibility of acquiring multidisciplinary knowledge (91%) and the construction of new solutions (89%). The opportunity for self-knowledge about the work developed by the organisation, namely the identification of opportunities and threats (86%) and critical analysis of information about the organisation and the surrounding context (77%) were also recognised as relevant aspects associated with this project. Less valued were the digital skills developed (69%) and the implementation of management tools (63%). The innovative aspect of welcoming students as talents stands out, which is different from the perspective traditionally adopted during academic internships.

5. Final remarks

At IPV, the project has attracted the interest of academia, involving 10 teachers facilitating 8 challenges and co-creation teams per edition, and boosting the motivation of hundreds of applicants. In fact, there are cases of students who repeat the experience even without access to the above-mentioned tangible benefits, therefore, proving they are intrinsically motivated.

The results are encouraging for students, with signs of entrepreneurial attitudes including in less common areas. The purpose of creating their own job has not been the focus identified by students. The project has essentially enabled, from the students' perspective, the development of soft skills/transversal competencies, rather than the training of entrepreneurs and leaders. This is a project focused on co-creation and relationships, working on crucial human competencies in today's society.

The main result pointed out by the companies is centred on the link between academia and the business world, in line with the project's objectives. The opportunity for innovation and cross-referencing of knowledge of a multidisciplinary nature is also highlighted by those responsible for the organisations.

These findings are aligned with data from initiatives of this nature in other Polytechnics of the Consortium. In fact, this project contributes to the wider knowledge, understanding and literature on university-industry/organisational/community engagement at a national level, and also due to data publication such as this paper, we hope at an international level too.

We can anticipate some difficulties regarding the continuity of the initiative arising from the end of funding, essential to student field trips and scholarships, as well as the other tangible benefits identified above. We hope that these new methodologies may find their way into regular classes and the interest of community organisations in welcoming our talents, both as students and already graduated as future workers, will remain.

In this experience, we highlighted the teacher as a facilitator of learning, along with the active role of the student at the centre of the process and the partner organisations of the academy as co-builders of knowledge. It seems to us that the future of higher education will certainly involve co-creation learning and linking all (academy and community) up. This is the aim: to put the knowledge of academia truly at the service of society.

References

Amante, S., Antunes, M. J., Dygała, M., & Gökçe, I. (2021a). Stepping up to global challenges (SGC): Empowering students across the world. Psychology of Language and Communication, 25(1), 217-239. DOI: https://doi.org/10.2478/plc-2021-0010

Arulmani, G., Bakshi, A., Leong, F., & Watts, T. (2014). Handbook of career development: International perspectives. Springer.

Brown, T. (2009). Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation. Harper Business.

Catalá-Perez, D., Rask, M. and Miguel-Molina, M. (2020). The Demola model as a public tool boosting collaboration in innovation: a comparative study between Finland and Spain. Technology in Society 63, 101358. https://doi.org/10.1016/j.techsoc.2020.101358

Carvalho, A., Teixeira, S., Olim, L., Campanella, S., & Costa, T. (2022). Pedagogical innovation in higher education and active learning methodologies – a case study. Education and Training, https://www.emerald.com/insight/publication/issn/0040-0912

Demola. (2022). Presentation. https://www.demola.net/

Fernandes, R. (2013). Bem-estar subjetivo e (des)emprego: Um estudo sobre o ajustamento pessoa-ambiente profissional [Tese de Doutoramento, Faculdade de Psicologia e de Ciências da Educação da Universidade de Coimbra]. Repositório da Universidade de Coimbra.

Fernandes, R., Sargento, J., Martins, E., & Mendes, F. (2021, julho). Empreendedorismo em estudantes de ensino superior da área social. Paper presented at International Conference on Multidisciplinary Research, Politécnico de Viseu.

Ferreira, A., Santarém, F., Silva, J., Alves, F., Machado, I., & Fernandes, R. (2020). Female leadership and entrepreneurship: between past and future. Revista Portuguesa de Marketing, 19(37), 51-61.

Instituto Politécnico de Viseu. (2021a). Projeto Link me up – 1000 ideias, Politécnico de Viseu. https://site.ipv.pt/linkmeup.htm

Instituto Politécnico de Viseu. (2021b). Projeto Co-criação, Politécnico de Viseu. https://site.ipv.pt/cocriacao.htm

Mangas, C. (2020). Active learning in higher education: pedagogical strategies for collaborative work. Millenium, 2(12). https://doi.org/10.29352/mill0212.05.00295

Mónico, L., Carvalho, C., Nejati, S., Arraya, M., & Parreira, P. (2021). Entrepreneurship Education and its Influence on Higher Education Students' Entrepreneurial Intentions and Motivation in Portugal. Brazilian Administration Review, 18(3), e190088. https://doi.org/10.1590/1807-7692bar2021190088

Nicholls, A. (2008). Social entrepreneurship: New models of sustainable social change. University Press.

Noutel, R., Araújo, P., Fernandes, R., & Arriscado, P. (2021). An employer branding strategy: developing a talent attraction model through action research. South Florida Journal of Development, 2(1), 417-431. https://doi.org/10.46932/sfjdv2n1-031

Orteu, X. (2017). Desafios en un mercado laboral en transformación. Editorial UOC.

Qizi, K. (2020). Soft Skills Development in Higher Education. Universal Journal of Educational Research, 8, 1916–1925. https://doi.org/10.13189/ujer.2020.080528

Reche, M., & Janissek-Muniz, R. (2018). Inteligência Estratégica e Design Thinking: Conceitos Complementares, Sequenciais e Recorrentes para Estratégia Inovativa. Future Studies Research Journal: Trends and Strategies, 10, 82–108. https://doi.org/10.24023/FutureJournal/2175-5825/2018.v10i1.325

von Thienen, J., Royalty, A., & Meinel, C. (2017). Design thinking in higher education: How students become dedicated creative problem solvers. https://doi.org/10.4018/978-1-5225-0643-0.ch014

Supporting Innovation in Energy Sector: The SMEs Role and DIGIFED Success Cases

Gabriele Gaffuri[1], Isabelle Chartier[2], Pablo Ribeiro[3], Sonja Nastran[4], Margherita Volpe[1], Isabelle Dor[5], Gonzalo Murillo[3], Emmanuel Chanson[6], Iñigo Gonzalez[1] and Marvin Hofer[7]
[1]Zabala Innovation Europe, Brussels, Belgium
[2]IRT Nanoelec, Grenoble, France
[3]Energiot, Barcelona, Spain
[4]Amibit, Velenje, Slovenia,
[5]CEA Leti, Grenoble, France
[6]Element, Nouméa, New Caledonia (FR)
[7]PES, Klagenfurt am Wörthersee, Austria
ggaffuri@zabala.eu
isabelle.chartier@cea.fr
pablo.ribeiro@energiot.com
sonja.nastran@amibit.si
mvolpe@zabala.eu
isabelle.dor@cea.fr
gonzalo.murillo@energiot.com
emmanuel.chanson@element.nc
igonzalez@zabala.eu
marvin.hofer@pes.co.at

Abstract: This paper aims to discuss the peculiarities of innovation approaches in the energy sector and examines success stories on how alternative sources of funding (such as cascade funding deriving from EU-financed projects) can effectively promote the role of SMEs in this environment. As digitalisation and smartification of the energy sector are key goals of the European Commission (EC), relevant legislative packages like the European Green Deal and other initiatives are actively promoting these priorities as enablers of the green transition. However, while large energy companies can afford to make substantial innovation investments, the SMEs innovation scenario is often characterised by a selected portfolio of start-ups and SMEs that get funded by large players only when functional to their business, leaving a significant portion of innovative SMEs out of this investment trend. In this context, the EU-funded DigiFed project's approach, supporting Application Experiments (AEs) for innovative products development, seems relevant to showcase alternative ways to support innovation in the energy sector. Indeed, in 2 years of implementation, DigiFed has structured and launched 3 Open Calls for AEs (cascade funding), succeeding in funding 71 companies and 46 AEs in several sectors, for an overall investment budget of € 3.6 M. The present paper focuses on two successful cases of TWIN AEs related to the energy sector, i.e., DYNAGRID and REDUXI. DYNAGRID aims at demonstrating an affordable, wireless and battery-free solution to digitise the New Caledonian electric grid, reducing maintenance and increasing grid capacity, representing a peculiar case of successful implementation with a long-distance collaboration. On the other hand, REDUXI is focused on developing a smart, plug & play building management system box, capable of forecasting energy consumption and its further redistribution, with high chances to quickly reach the market. Eventually, based on these success cases, the paper discusses the support provided by DigiFed and its benefits with respect to other forms of innovation financing.

Keywords: energy, EU funding, SMEs, cascade funding, DigiFed, cyber-physical systems (CPS)

1. Introduction

Energy has been a core sector of the European economy, shaping its financial, societal and political structure since the birth of the first European Community in 1951, when six countries decided to share the production of coal and steel to achieve economic stability and strengthen the post-war efforts (Painter, 2002). Since then, the European Economic Community (EEC) first and now the European Union (EU), guided by the non-always homogeneous agenda of the Member States, have achieved a gradually more integrated structure of the energy market that still determines the current dynamics for producers and consumers.

Today, thousands of energy companies exist in Europe, including producers, retailers, grid operators and related energy services companies. Considering the full panorama of the companies involved in the energy sector in Europe, this figure can exceed the number of 200,000 entities (D&B Hoovers, 2022). However, according to Eurostat (2019), the total number of electricity-generating companies representing at least 95% of net electricity generation at a national level is 4,730 in the EU, and 5,688 are the electricity retailers with the equivalent sum of national market shares.

Out of this amount of companies, only 86 are large companies with a market coverage higher than 5% of the total national net electricity generation in Europe, and 114 for the same share of the big retailers. In this context, it appears evident the enormous quantity of smaller companies, SMEs and start-ups that work, innovate and grow behind the spotlights, facing the numerous challenges of the traditional energy market.

In this paper, the authors therefore aim at discussing the peculiarities of innovation approaches in the Energy sector, also providing success stories on how alternative sources of funding (such as the so-called cascade funding deriving from EC financed projects) can effectively promote the role of SMEs in this sector, providing them with the necessary tools to enter the market next to the large and dominant companies.

The main research question arises from the need of understanding why it is important to support innovation and small actors in the Energy sector given their main characteristics, discussed below, and how innovation can be effectively fostered via alternative sources of funding (e.g. cascade funding) in this sector. The paper will aim to show the correlation between the main priorities of the EU regulations in terms of innovation, support to SMEs and energy, and the objectives of DigiFed project, and how this shared vision has a practical impact in bringing funded success cases close to the market, breaking the “experience paradigm”. Indeed, as shown by the success cases discussed in the fourth section, this paradigm arises when, on the one hand, it is necessary to have the most mature solution to obtain customers but, on the other, in a vicious loop scheme, it is also required to already have customers to receive the investment asset from investors in order to develop the solution.

2. Context

2.1 EU innovation targets and objectives in the energy sector

If SMEs and start-ups dedicated to the development of innovative solutions for the energy transition aim at becoming competitive in comparison with already established actors, they will need to play a major role in the achievement of a sustainable and resilient European economy. To achieve this goal, they will need to stay up to date or one step ahead on the main legislative and regulatory novelties that the EC has set. Atop of these, the *European Green Deal* is the cornerstone of the upcoming years’ policies and financial efforts (EC, 2019), with the goal of transforming the European Union into a just and prosperous society with a modern, resource-efficient, and competitive economy by 2050, and each European company can be a small piece of this bigger puzzle. Moreover, in such a delicate moment, in which the entire world finds itself under the burden of skyrocketed energy prices due to increased primary resource prices, and of a more recent dramatical geopolitical turmoil in energy critical production and transit areas, the energy sector acquires an even more strategic and essential connotation. To carry out its heightened ambition, the EC delivered the first set of adopted papers under the *Fit-for-55* package already in July 2021, with the goal of unifying the efforts aimed at reducing net greenhouse gas emissions by at least 55% by 2030 compared to the 1990 levels (EC, 2020a). The package includes legislative proposals to update the whole EU 2030 climate and energy framework. Inside it, more specific regulatory measures take place, and other relevant initiatives like the European Innovation and Technology Platforms (ETIPs) are actively promoting these priorities as enablers of the green transition.

For many years and through different innovation plans, the EU has mostly advocated for a research-led innovation policy based on a linear model of innovation, relying on a well-defined set of sequential stages: research and science, then development, production and marketing (Barbosa de Oliveira, 2014). Increasing R&D expenditure of Member States (MS), set as a policy goal at 3% of each MS’s GDP by the Lisbon Strategy in 2000 (EC, 2010) has remained a core goal across the years. This goal was reaffirmed by Europe 2020, the EU's plan for the 2010–2020 decade to address the economy's structural weaknesses and increase overall competitiveness and productivity (Hervás-Oliver *et al*, 2021). More recently, with the publication of *A Europe fit for the Digital Age* (EC, 2021), the European Commission established that the EIC, along with relevant

clusters and a new wave of public-private partnerships, will further boost innovative sectors, with a special support to SMEs as veritable backbone of European innovation. A performance indicator that will monitor this objective, particularly relevant for this paper, is the percentage of SMEs introducing innovative products and processes (EC, 2020b), which is also one of the goals of the DigiFed project, and both the cases analysed in the fourth section are noteworthy examples. At EU level, the EC primarily finances SMEs' innovation in the energy (and many other) sectors through grants within European funding programmes like the Framework Programmes, the EIC accelerator, Eurostars, Innovation Fund, Erasmus+, LIFE, CEF and Interreg among others.

Currently, Horizon Europe is the leading programme for R&D, lasting from 2021 to 2027 with a budget of € 95.5 billion spread over seven years. Horizon Europe was preceded by Horizon2020 (2014-2020, € 79 billion), the programme to which the DigiFed project belongs. As is the case for several SMEs instruments of the EC, one of the goals of DigiFed is to ensure that all the participating companies can focus on the development of their prototypes being financially covered until they can reach a successful product or service and then enter the market. However, as DigiFed more widely addresses Cyber-Physical Systems (CPS) and IoT (Internet of Things) applications, it is worth reducing the scope of the present paper to the energy funded AEs, analysing the main characteristics, trends and needs of the SMEs and start-ups involved.

2.2 Peculiar dynamics in the energy sector innovation landscape

Fostered by policy objectives and allocation of economic resources as described above, green innovation has become a main trend in the innovation ecosystem, hence driving opportunities for SMEs to create new business models, offer new services and products and cooperate with major players. Indeed, digital technologies encourage further players to profit from these opportunities, by allowing agile development (i.e. with low investments in assets and infrastructures) of IoT-based solutions, AI-based predictions, maintenance and performance optimization models. Hardware-related developments in relation with batteries optimization, renewable energy-related innovation, energy efficiency sensors for buildings and industrial facilities are other possible opportunities. As such, challenges posed by green transition offer significant opportunities for SMEs to develop new offers, both in the B2B and in the B2C domain. Yet in both cases, the major role played by big private players in the energy sector as distribution or transmission system operators (DSO/TSO), energy network operators, generators and retailers and equipment manufacturers, affects the dynamics of SMEs' innovation. Indeed, these large entities can play different roles in relation to SMEs, such as incubators or innovation ecosystems or as end-user or final customers.

In the first case, in order to address internal needs or emerging market trends not yet consolidated, big energy players can act as SMEs incubators or innovation ecosystems, and several major energy groups have created their own innovation ecosystems, such as the *EDF Pulse Croissance* (https://www.edf.fr/pulse), created to incubate SMEs and start-ups that contribute to achieve carbon neutrality, or *OpenInnovability* of Enel (https://openinnovability.enel.com/it/startup-ecosystem), that crowdsources talents, ideas and technologies in the domain of energy transition and sustainability. In these cases, the interaction can vary from pure incubation to direct investment or acquisition in the group, depending on the interest of the firm in object.

In the second case, operators of major infrastructures or providers of different energy services often represent a priority customer for the SMEs, as well as the provider of concrete requirements for the creation of ready-to-use products and services. This interaction can be mediated via open innovation initiatives (*hackathons*) or created during demonstration activities, often as an investment from the SME itself, in order to break the "experience paradigm" in which having initial results is usually required by clients.

In this ecosystem, the purpose of managers to maximize utility and minimize costs can be hard to reach, in particular for SMEs and start-ups, due to different positioning and negotiation power, as well as to other information asymmetries. Hence, while substantial innovation investments are still made by large energy companies, they mostly end up affecting and involving only a selected portfolio of start-ups and SMEs, that get to collaborate with the main players as functional to their business, or that are directly incubated within their economic control. Needless to say, this trend leaves a significant portion of innovative SMEs out of this investment trend (Franklin-Mann, 2021). Yet, collaboration is essential if a higher degree of innovation is to be achieved (Taurino, 2018). In order to create products and solutions with higher opportunities for market success, alternative solutions are therefore needed, to enable peers' collaboration beyond traditional circles.

In this context, the EU-funded DigiFed project's approach to support AEs for innovative products development seems relevant to showcase alternative ways to support SMEs innovation in the energy sector, and the next section will provide more details on the support to SMEs and the approach of DigiFed.

3. DigiFed approach supporting AEs to develop innovative products and services

In the scope of the Digitising European Industry strategy in 2016, the Smart Anything Everywhere (SAE) initiative was launched to test innovative tools to support start-ups, SMEs and midcaps digitisation across Europe, fostering cross-border collaboration between small and medium companies, research centres, universities, and large enterprises with the support of DIHs (SAE, 2018). The Financial Support to Third Party (FSTP), also called cascade funding, is the core tool that has been first tested, then widely implemented by the SAE initiative. The DigiFed project (*Digital Innovation Hubs (DIH) federation for large scale adoption of digital technologies by European SMEs*), started in January 2020, is one of the 16 SAE projects, and it has deployed the FSTP tool in three innovation pathways, the Application Experiment (AE), the Generic Experiment (GE) and the Digital Challenge (DC), in order to propose different services to boost European companies' competitive advantage by fostering their adoption of the latest digital technologies. Whatever service, the support provided by DigiFed is not limited to FSTP, but combines it with technical expertise provided by research organisations (RTOs) and large industrial providers, and innovation management and business support. In that respect, DigiFed has developed a tailored tool with customized support in order to address the wide diversity of companies in terms of size, need, digital maturity, sector of applications, etc.

Having distributed a major part of FSTP funding to innovative companies, the AE pathway has been the main instrument for DigiFed implementation. It is divided into the TWIN pathway (below) and the SINGLE one, in which a company applies alone, facilitates the collaboration with either a DigiFed research institute or a DigiFed technology supplier, granting up to € 55,000 to the company for a 12-month maximum implementation. On the other hand, by supporting the collaboration between European companies of complementary expertise, the TWIN AE pathway fosters the collaboration of transnational companies with innovative digital SMEs (up to € 110,000 and 12 months of implementation). To incite low digital company digitisation, a third AE pathway is also proposed to low digital maturity companies within the TWIN AE where additional technology expertise can be provided by a DigiFed partner.

DigiFed has also designed the GE to test new collaborations between research institutes and companies, and to develop new co-financing mechanisms between European and regional funding to foster European industry digitalisation. Each of the four GE builds a community of SMEs and Mid-caps (between 8 and 20) around a specific technical topic proposed by a DigiFed research centre. The community members have direct access to the institute's experts, share their requirements and use-cases and contribute to the technology roadmap of a leading research centre. Overall, the four DigiFed GEs account for 51 members in 15 members states and leverage € 280,000 of regional co-funding.

Thirdly, the DC is a match-funding opportunity where advanced digital technology SMEs are selected to solve sectorial industry challenges set by corporate businesses. A challenge is proposed by a large European organisation, who serves as early adopter of the accelerated innovation developed by the selected SME, and provides additional support to the programme in the form of co-funding, innovation support and pilot sites.

In two and a half years of implementation, through its three innovation pathways, DigiFed is supporting 117 start-ups, SMES and Mid-caps located in 23 EU and associated countries. In particular, it has structured and launched 3 Open Calls for AEs, succeeding in funding 71 companies and 46 AEs in most of the industrial sectors, for an overall budget of € 3.6 M investment. Within the three pathways, the energy sector is one of the most addressed with eight projects supported, five of which belonging to AE (*Touch&Heat, DYNAGRID, REDUXI: Smart Building Management System, Ovon boiler controller, MyEVCharger*) and three to the DC (GEHydro - Catie, EDF Hydro - ISYmap, ACCIONA-Instrumentation technology). After having detailed how the DigiFed project is structured, the next section provides space for describing two of its most successful and peculiar use cases, both funded under the AE pathway.

4. Success stories from the energy sector within DigiFed

In DigiFed, after the selection of the most promising AEs along the 3 AE open calls, the process of implementation and monitoring is set to follow a regular and efficient pathway. Indeed, the methodology

undertaken to monitor the implementation of each AE consists in a monthly monitoring meeting, organised by the responsible DigiFed partner in charge of the selected project. The meeting aims to assess the main progresses achieved, the help required (if any) and business, IPR and market access issues encountered. All the high and low points of implementation are then reported to the Monitoring Partners Monthly Meeting, where the advance of each AE is assessed and discussed. As reported by the interviewed AE partners after the implementation of their projects, the monitoring meeting structure was particularly "appreciated", and the attitude of the monitoring partner considered effective as "an in-between" among "rules and [ad-hoc] adaptation", that ensured the steady advancement of the projects.

The two AEs described below have been thus considered as valuable examples from the consortium partners of how DigiFed-funded projects can have a tangible impact on innovative applications for the energy sector.

DYNAGRID and REDUXI's stories of successful early implementation make up the central subject of this paper, highlighting their special features of early-commercialisation, wider-than-EU impact and an interest from clients higher than forecasted. In short, DYNAGRID aims at demonstrating an affordable, reliable, wireless and battery-free IoT solution to digitise the New Caledonian electric grid, reducing maintenance and increasing grid capacity, representing a peculiar case of successful implementation with a long-distance collaboration. REDUXI is instead focused on developing a smart, plug and play building management system box, more user-friendly and capable to forecast energy consumption and its further redistribution, with high opportunity to quickly reach the market.

4.1 DYNAGRID - Optimising smart grid application for a more sustainable planet

The inception of Dynagrid arises from a significant economic challenge related to the existing state of the art of power grids: indeed, over 20% of the electricity paid by customers is due to distribution and transmission costs (Prettico *et al*, 2019). This is mainly due to the fact that the grid operators, or DSO/TSO, usually have to guarantee a supply of clean, affordable, and secure energy at any time. However, they face costly challenges in order to handle the shifting conditions caused by decarbonization and decentralization of power generation, and to prevent power outages or damages caused by unforeseen meteorological events or wildfires, especially in isolated or remote areas. DYNAGRID applied as a TWIN AE to the DigiFed project foreseeing a potential for current IoT solutions that could thus help operators to dynamically monitor their assets' conditions to predict power faults and improve maintenance and operation. However, these solutions are still limited given their upfront costs, as they are still based on batteries or current transformers.

Aware of the challenge ahead for innovating IoT devices, Energiot and ELEMENT decided to unify their working capabilities and jointly access EU cascade funding. Their profiles seemed perfectly matched for a TWIN AE as Energiot is a high-tech startup company founded in 2017 in Barcelona (Spain) and a spin-off of the most significant innovation laboratory in the country (CSIC). It has developed a battery-free IoT device that harvests energy from the residual magnetic field of power lines using piezoelectric technology. This device uses a set of sensors such as temperature, current, vibrations, acceleration, humidity, and light to deliver a smart monitoring solution. On the other hand, ELEMENT is a startup company founded in 2018 in Nouméa (New Caledonia, France), focused on IoT solutions and integration with several types of applications, including providing analysis systems and cloud computing, and it has been working with grid operators in New Caledonia since its origin. The research background of the two companies includes the involvement for research purposes in several EU-funded projects on energy harvesting and IoT technologies for Energiot, and the development of IoT solutions for different clients from banks and industry for what concerns ELEMENT.

The two companies joined forces forming the Dynagrid project to deliver a solution to help grid operators optimize their operation and maintenance.

Its main objective was to demonstrate an affordable, reliable, wireless, and battery-free solution for massive deployment of IoT to digitize the grid that could lead to a 20% of maintenance and operation costs reduction. The following applications can be applied to grid operators:

- Detection of events, such as power faults, accidents, forestal fires, and others
- Increase the grid capacity by using Dynamic Line Rating (DLR)
- Predictive maintenance of critical asset

- Balance and integration of renewable sources on the grid

Along with the devices, the project also developed an IoT platform to manage the devices and use analysis models to deliver the use cases for the clients. The project started in May 2021 and will be concluded during the summer 2022. Nevertheless, Enercal, the main DSO/TSO in New Caledonia, has already agreed to pilot this project with Dynagrid, given the promising early-stage implementation and the stable support provided by DigiFed. The project seems thus entitled to be a successful case of self-sustainable project, also provided that New Caledonia is a smaller and isolated region which facilitates the validation and the need of the Dynagrid solution. Implementing the project in New Caledonia, a French Overseas Territory, therefore fully part of the EU, also included the peculiarity of seeing a tangible impact of EU funding for innovation broadly out of the European continent, in a country in which ad-hoc hardware modifications of the solution needed to be brought. In addition, Energiot and ELEMENT are in want of testing the use cases of the Dynamic Line Rating (DLR) and power fault detection to manage the power congestion due to the increase of renewable energy sources on the island. A more efficient grid will finally come out of the application of these two use cases, enduring the impact of the funded solution and of the scope of the DigiFed project itself.

4.2 REDUXI: Changing the way we use electricity

The second Application Experiment successfully implemented, already concluded during Spring 2022, is called REDUXI. Its starting challenge took place from the awareness that electricity is becoming an increasingly valued and expensive resource and that, in order to maintain the comfort of our lifestyle, a change in the way we consume electricity is needed.

The problem REDUXI aimed to solve, comes from the increasing consumption of electricity during peak hours in industry, households and cities, which is posing serious challenges and constraints for energy distribution related to the stability of grids. In the forthcoming scenario, without extremely high and time-consuming investments aimed at improving the capacity of the power infrastructure, it will be almost impossible to meet the needs of electricity supply in peak hours, caused by the growing number of electric vehicles (EV), heat pumps and other devices in need of electricity. REDUXI thus positions itself as the answer to the question of how to meet the increased electricity consumption on the existing electricity infrastructure and thus maintain the stability of electricity grids, changing the perception and raising awareness on the use of electricity. Indeed, by activating cooperation between suppliers and customers of electricity, the REDUXI system:

- Contributes to balanced electricity use
- Reduces electricity consumption
- Increases electricity efficiency
- Encourages the use of green energy
- Reduces costs

The development of REDUXI comes from the collaboration of two companies, AMIBIT and PES. AMIBIT is a high-tech start-up company from Slovenia that addresses the increasing trend of digital transformation in the energy sector with its self-developed innovative hardware and software solutions. PES is an Austrian start-up engineering company with extensive experience from planning to construction of electricity and power infrastructure in the energy industry, households and urban spaces. AMIBIT and PES have joined forces to develop the new version of AMIHUB (an AMIBIT hardware) to be tested by PES on pilot cases with potential clients. AMIHUB was a modular controller that served as a base design in the development of REDUXI as well as for the identification of relevant shortcomings and potential improvements that brought to the final product realised within DigiFed.

Describing the solution in its technical aspects, REDUXI is an energy management system (EMS) that includes a REDUXI controller and a REDUXI application. On one side, REDUXI modular controller is the central unit of the system. The design of the controller is based on the flexibility. Thus, the input/output part of the controller can be adjusted to individual requirements without adding external units. The controller communicates with all connected electrical devices via various protocols (LAN, Wi-Fi, RS485, etc.). Due to its modular design, REDUXI provides numerous functions for electricity efficiency, and it only needs to be connected to electricity and the internet to be used.

On the other side, the installation is user-friendly, based on "Plug & Play" approach and does not require any technical skills. The solution is highly innovative as it can be connected to various users (EV charging stations, heat pumps, washing machines, etc.), electric energy producers (solar cells) and accumulators (batteries). To ensure the largest possible number of electrical devices connected to REDUXI, special converters have been produced by AMIBIT. Moreover, the ability of REDUXI to forecast the electric production of solar power plants is crucial for suppliers and customers, and it strengthens the confidence of all actors in the stability of electricity from renewable sources.

Funding such a solution within the DigiFed project has allowed REDUXI to develop a new HW solution for Energy management, allowing AMIBIT to successfully receive ISO27001 certificate, while ISO9001 certificate is in progress. 100 units of REDUXI have already been produced and two pilot projects are in progress: one in Slovenia, and the other one in Austria (private house and business premises). 10 REDUXI units have been sold within few months from the end of the project implementation and five new potential clients are interested in REDUXI, also from the automotive sector. Large scale commercialisation is now expected during the second half of 2022, beginning with Slovene and German-speaking market and a EU-wide promotion within the DigiFed project, that will disseminate the most prominent results, as commercial and business support goes in parallel with the cascade funding provided.

5. Conclusions: Lessons learnt and specific needs in the energy sector

When entering the energy sector for developing innovative solutions, before reaching a market dimension most SMEs and start-ups require significant time, several investments, and connections to navigate the complexities of bureaucracy. Given the limited resources (in terms of time, money, decision-making, connections), the constraints become even more impacting once new ideas arise in terms of the development of a product or a service. Moreover, a further limit that prevents effective innovation in smaller companies includes an already-established market activity requirement from the clients, often resulting in what has been defined above the "experience paradigm". However, as discussed throughout the paper, aside from these barriers, SMEs and innovative startups that want to enter the energy services market today also feature peculiar traits that can project them in an advanced position compared to other market's players. Among these are flexibility, agility, fast decision-making, and consequential shorter time to be ready for entering the market are the most prominent.

The successful early-stage implementation cases of DYNAGRID and REDUXI have attempted to show how SMEs and start-ups – in both cases with two transnational companies joining forces to achieve alternative paths of growth – can more directly access significant sources of funding, fostering the execution of innovative solutions that project the four companies involved one step closer to the energy services market.

In the two cases analysed, the two TWIN AEs have both been able to obtain up to € 110,000 in cascade funding, with the 50% paid as prefinancing at the kick-off of the project, and the remaining when all deliverables and results were submitted. This implies that SMEs had liquidity upfront, allowing them to develop their prototypes without the need of making their own investments, which can hamper SMEs' effectiveness in implementing innovation. The projects also received innovation management and business support from DigiFed DIH and business partners, which further fostered their opportunity to grow.

According to the DYNAGRID developers, *"a program like DigiFed incredibly helps a startup to take a first step, as it offers the investment without collateral and assumes the risk allowing the creation of innovation"*. Moreover, as soon as DigiFed approved this grant, it was much more receptive for Enercal [the energy operator in New Caledonia] to agree to contribute and receive the pilot project. This support and push from DigiFed and Enercal were the reasons why they chose to be part of this program, adding that *"trust and risk bring innovation forward"*. Similar feedbacks come from the REDUXI team, which considers the H2020 cascade funding *"fair for small companies"* as *"if you have a good product, presented in the right way, you will be heard out and recognised"*, faster and with a higher success rate than a direct jump to the market.

For all these reasons, within DigiFed, cascade funding has proven to be a highly effective funding method given the characteristics of the sector (energy) and the dimensions (SMEs and start-ups) of the companies involved, allowing them to achieve the full development of their innovative idea, as it has been the case for several other products and services funded by DigiFed, now readier to face the market.

Acknowledgements

The current paper has received funding from the EU H2020 research and innovation programme under Grant Agreement 872088.

References

Barbosa de Oliveira, M. (2014), *Technology and basic science: the linear model of innovation*, SciELO, at: https://www.scielo.br/j/ss/a/bbXKjWR8mXdrQshGytHzHvF/?lang=en

D&B Hoovers (2022), online database, available at: https://www.dnb.com/business-directory/industry-analysis.electric_power_generation_transmission_and_distribution.html

EC (2010). *Europe 2020. A strategy For smart, Sustainable and Inclusive Growth.* Office of Publications of the European Commission, Brussels

EC (2019), *A European Green Deal, Striving to be the first climate-neutral continent*, Office of Publications of the European Commission, Brussels

EC (2020a), also COM/2020/562 Final, *Stepping up Europe's 2030 climate ambition Investing in a climate-neutral future for the benefit of our people.* Brussels

EC (2020b), *Strategic Plan 2020-2024 Research and Innovation,* Brussels

EC (2021), also COM/2021/118 Final, *2030 Digital Compass: the European way for the Digital Decade*

EUROSTAT (2019), online database, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_market_indicators

Franklin-Mann, J. (2021) *The importance of small business to the energy transition*, REVOLVE, No. 40, 29 June.

Hervás-Oliver, J.L., Parrilli, M.D., Rodríguez-Pose, A., Sempere-Ripoll, F. (2021) *The drivers of SME innovation in the regions of the EU,* Research Policy, Vol. 50, Issue 9.

Painter, D. (2002) *The Cold War: An International History*, Routledge Editions

Prettico G., Flammini, M.G., Andreadou, N., Vitiello, S., Fulli, G., Masera, M. (2019), *Distribution System Operators observatory 2018 - Overview of the electricity distribution system in Europe*, EUR 29615 EN, Publications Office of the European Union, Luxembourg.

SAE (2018), *Smart Anything Everywhere, Digital Innovation Hubs, Accelerators for the Broad Digital Transformation of the European Industry*, available at https://smartanythingeverywhere.eu/wp-content/uploads/2020/07/SAE_BROCHURE_2018b-1.pdf

Taurino, T. (2018), *Using Collaborative Management in Industrial Clusters – Case Study of Italian Energy Cluster,* Management and Production Engineering Review, Vol. 9, No. 4, pp. 138-149

Shared Stressors and Stress Coping Strategies in Start-up Teams

Liudmila Gapeyeva-Yukce[1], Juha Saukkonen[2] and Henna Kautto[3]
[1]Department of Strategic Management, School of Law, Economics and Business, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany
[2]School of Business, International Business, JAMK University of Applied Sciences, Jyväskylä, Finland
[3]Jyväskylä StartUpFactory, Jyväskylä, Finland
liudmila.gapeyeva-yukce@wiwi.uni-halle.de
juha.saukkonen@jamk.fi
henna@yritystehdas.fi

Abstract: Engaging in new entrepreneurial efforts sets many demands for individuals involved, and many of those demands impact the well-being of the people in a start-up company. One common issue linked to well-being is stress. Prior research has indicated that a majority of all entrepreneurs experience stress on a regular basis (e.g. Shepherd et al., 2010). Furthermore, a recent study by Wach et al. (2021) identified that entrepreneurial stress differs from the stress that salaried employees with no entrepreneurship responsibility face in their work. The "overall high and persistence level of stress" (Wach et al., 2021) calls for stress research focusing on entrepreneurial setup. Since entrepreneurship is a wide concept and entrepreneurs as a category includes a wide variety of entrepreneurial individuals and teams, an even tighter scoping of stress research is defendable. This study studied a sub-category of entrepreneurial organizations called early-stage start-ups. This cohort of companies faces lots of uncertainties concerning the market, technology, and competition. Thus, it can be logically argued that these companies have stressors that are typical to their stage of development as well as difficult to solve due to the scarce resources that a young start-up possesses. The research design adopted was based on treating entrepreneurial stress as a collective effort as well as putting emphasis on the dynamic and volatile nature of the presence of stress in daily start-up operations. The longitudinal approach (study period of 3 weeks) and team-based fresh (video) entries by the teams (4 start-up teams of 2 to 5 people each) were tackling some of the methodological challenges of prior research. Both the experienced stressors and the coping strategies used got recorded and subjected to thematic content analysis. The findings identified stress-related characteristics typical for team-based operating model and also communal coping strategies including those that are rarely reported in the studies of coping strategies on the individual level. The findings contribute academically to the theory-building on the well-being of entrepreneurs and on a pragmatic level for entrepreneurs acting in their typically stress-laden environment as well as for the support and educational organizations for entrepreneurship.

Keywords: entrepreneurial stress, shared stressors, communal stress coping, start-ups, teams, entrepreneurial well-being

1. Introduction

The presence of stress in entrepreneurial activity is widely accepted in the research community. An estimated 55-65% of entrepreneurs experience stress on a weekly basis (Shepherd et al, 2010). According to Salas, Driskell and Hughes (1996), "stress is a process whereby environmental demands evoke an appraisal process in which perceived demand exceeds resources, and that results in undesirable physiological, psychological, behavioural, or social outcomes". In this study we follow the recent developments in stress studies where stress can be regarded as both positive or negative phenomenon (the challenge-hindrance stressor framework) (Lerman, Munyon and Williams, 2021).

Entrepreneurs facing stress is not a surprising finding, since entrepreneurship is characterized by uncertainty, considerable risks, increased personal responsibility for survival and success, the need to work harder and longer hours than salaried employees, and no clear division between professional and private life (Grant and Ferris, 2012). Negative stress may lead to serious health problems (Stephan and Roesler, 2010), impact venture success, growth and longevity (Lechat and Torrès, 2016). The existing literature on entrepreneurial stress has already identified some core sources and consequences of stress (e.g. Thompson, van Gelderen and Keppler, 2020). The research field is still developing and some current gaps in it are addressed in this paper.

First, the scope of studies typically concentrates mostly on individuals and use the method of one-to-one interviews. However, new ventures are rarely started by solo entrepreneurs (Jin et al, 2017). Moreover, stress is also a collective phenomenon (Akgün et al, 2007, p. 628) and logically, coping with stress should be seen as a team effort (Leprince, D'Arripe-Longueville and Doron, 2018). Therefore, this study addresses entrepreneurial stressors and stress coping strategies on a team level.

Importance of coping with stress is well proven in the literature. The non-survival of a new venture may relate to a lack of the stress coping entrepreneurial activity (Cardon and Patel, 2015). Entrepreneurs skilful in coping with stress run businesses with longer life spans and have a competitive advantage over others (e.g. Dijkhuizen et al, 2016). However, entrepreneurial stress coping literature is scarce, especially on a team-level. Moreover, qualitative research to uncover coping strategies has been rare (Eager, Grant and Maritz, 2018). Another problem is that function-oriented coping taxonomies, which dominate the research on coping among entrepreneurs, ignore temporal dynamics of entrepreneurship (Bird and West, 1997).

The third gap is that the research on entrepreneurial coping lacks methods that address the dynamic nature of entrepreneurial processes and help tackle the retrospective bias (Williamson, Gish and Stephan, 2021). That is why a longitudinal approach and the experience sampling method are chosen to raise the reliability of the findings and to address the fact that entrepreneurship and stress processes are difficult to be observed at only one time. Moreover, this study operationalizes the model by Eager, Grant and Maritz (2018) that considers both functional and temporal dimensions of coping.

Research questions (RQs) developed for this study are based on the observed gaps of knowledge on the issue area and the observed pragmatic needs within the start-up community:

RQ1: What are the shared stressors for start-up teams?
RQ2: What communal stress coping strategies do start-up teams use?

The answers to the RQs contribute to the accumulation of scholarly knowledge in the field of entrepreneurship (well-being) research. The findings and conclusions derived also give entrepreneurs, entrepreneurial teams and their support organizations pragmatic knowledge on how to understand entrepreneurial stress and act on it in productive ways.

2. Theoretical framework

2.1 Start-ups and start-up teams

Start-ups are a category of their own in entrepreneurship and they are not just small copies of big companies. The authors have synthesized existing definitions of start-ups as follows (e.g. Ries, 2011; Blank and Dorf, 2012):

A temporary, rapidly changing organization that exists to develop an innovative product, find a repeatable, profitable and scalable business model in an environment of extreme uncertainty and limited resources.

There are a number of terms used in the literature to mean the teams that lead new ventures: founding teams, entrepreneurial teams, or start-up teams. To specify what a start-up team is this broad definition can be used: "… two or more individuals who commit to each other to create a new firm" (Brattström, 2019, p. 6). Here the notion of communal and interdependent process between individuals is inherent.

The overview of the team dynamics can be very well represented with the help of inputs-mediators-outcomes (IMO) framework by Klotz et al (2014) as displayed in Figure 1. Such mediator as collective (team) cognition is important for this study as it provides a theoretical background for shared stress coping strategies in start-up teams.

Team cognition refers to the knowledge architecture of the team. More specifically, "entrepreneurial team cognition is an emergent state that refers to the manner in which knowledge is mentally organized, represented and distributed within the team and allows entrepreneurial team members to approach problem-solving and make assessments, judgments or decisions…." (Mol, Khapova and Elfring, 2015, p. 243).

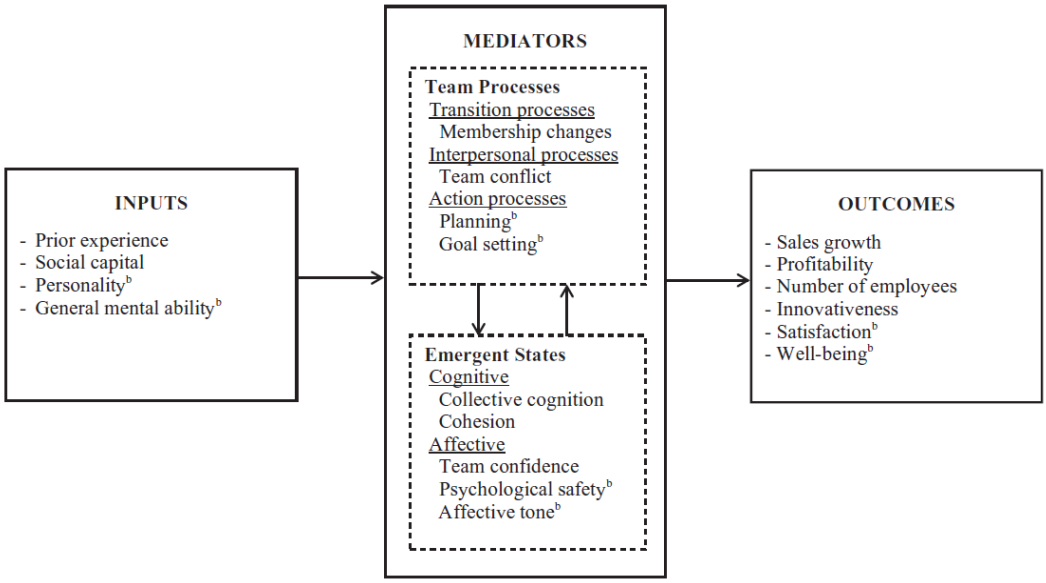


Figure 1: New Venture Team (NVT) Input-Mediators-Outcome (IMO) framework

2.2 Entrepreneurial stressors and shared stressors in teams

Entrepreneurial stressors are "specific constraints that entrepreneurs typically and frequently encounter when leading their businesses and that prevent them from doing their jobs successfully and thus from accomplishing their valued goals" (Gilboa et al, 2008). This definition should be adjusted and widened by considering stress also positively. Therefore, it is suggested to distinguish between challenges and hindrances as stressors. Challenges promote positive outcomes, such as learning and achievement and facilitate better performance by motivating individuals to engage effectively with stress. Hindrance stressors threaten personal growth and goals, and thus negatively impact performance and well-being (Lerman, Munyon and Williams, 2021).

Prior research on entrepreneurial stressors is quite unstructured. For example, according to Perry, Penney and Witt (2008) the most important stressors are: inadequate financial resources, deficiencies in equipment/tools/supplies, job-related information, help from others, and lack of time. Akande (1994) listed the main stressors to be loneliness, time demands, conflicts with partners and employees, and the need to achieve. The studies were conducted on individual level, and data collection happened via cross-sectional/static methods like interviews. The existence of team cognition and team stress and their temporal dynamic nature were not addressed.

According to Dietz et al, (2017, p. 298), teamwork stressors are "stimuli, or conditions, that influence the team's capability to interact interdependently or capacity to achieve their goals". Research on team stressors is ampler in fields of psychology, health, and sports, but less developed in entrepreneurial setting. Therefore, using more dynamic methods and studying stressors and stress coping as a communal phenomenon in start-up teams has potential to add to the knowledge pool in the field of entrepreneurship science.

2.3 Stress coping and communal coping in teams

According to Lazarus and Folkman (1984, p. 141), coping is action where cognitive and behavioral efforts are performed to manage specific external and/or internal demands. Researchers have developed categorizations of methods to cope with stress. Function-oriented coping taxonomies are based on the form and direction of reactive, present-oriented coping (e.g. Lazarus and Folkman, 1984; Carver and Connor-Smith, 2010). An important point is that these taxonomies do not consider temporal dynamics of entrepreneurial activities (Bird and West,1997).

Future-oriented coping taxonomies exist and they propagate for the idea of both preventative coping (Greenglass, 2002) and proactive coping (Schwarzer and Taubert, 2002) co-existing. Eager, Grant and Maritz (2018) state that a tandem of reactive and anticipatory coping is beneficial for entrepreneurship research, and

it can be achieved by function- and future-oriented strategies (Figure 2). Their conceptual model is based on cross-sectional qualitative research amongst 22 active entrepreneurs. Though the model still requires empirical validations in different context and timeframes, it is a relevant model of reference for this research on stress coping in teams.

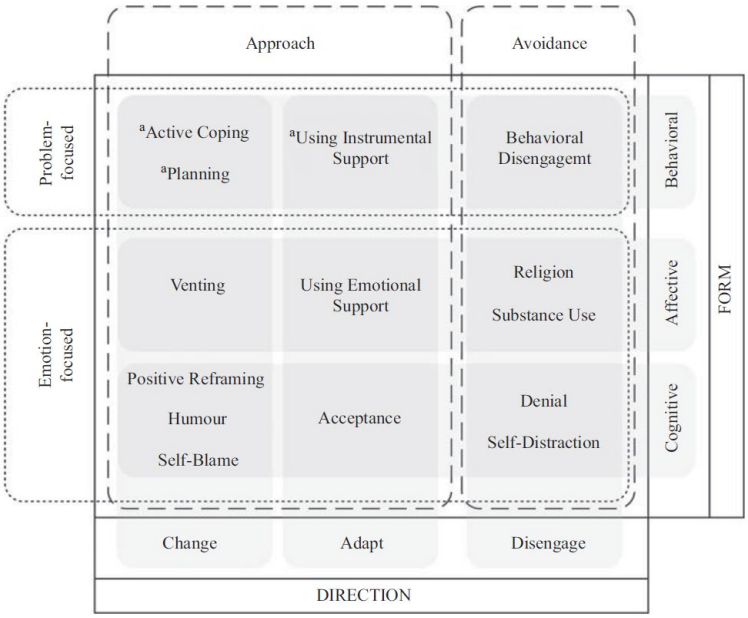


Figure 2: Conceptual model of coping strategies among individual entrepreneurs

Stress coping also emerges as a combination of individual and group efforts (Tamminen and Gaudreau, 2014). Communal coping is defined as a process when stressors are appraised and acted upon in the context of close relationships, and describes the efforts of individuals in a group as they collectively cope with stressors (Lyons et al, 1998). The studies from health psychology, disaster psychology and family psychology focus on the circumstances when people need to manage with shared stressful events (e.g. Wlodarczyk et al, 2016). From those studies it can be derived that start-up teams provide an interesting setting to research communal coping further and gain an understanding of how coping takes place in different types of teams and in different contexts.

3. Method

It is an exploratory qualitative study. Qualitative methods are particularly promoted for exploratory studies as they provide depth and richness needed when studying any human condition or experience (Gartner and Birley, 2002). Moreover, longitudinal approach is implemented, as it demonstrated value in understanding dynamic processes in business (Giaever and Smollan, 2015). In data collection Experience Sampling Methodology (ESM) was applied which "requires participants to provide reports of their thoughts, feelings, and behaviors at multiple times across situations as they happen in the natural environment" (Uy, Foo and Aguinis, 2010). First reason is that retrospective reports of emotions, beliefs, and behavior in the past can be influenced by memory errors, availability, current affect and other aspects (Schwarz, Kahneman and Xu, 2009). Second, the research on entrepreneurial coping lacks methods that would address the dynamic nature of entrepreneurial processes (Terjesen, Hessels and Li, 2016).

In our study the sample consisted of 4 early-stage Finnish startups that 1) are established as companies, not anymore teams in the planning- or project-stage 2) have minimum one and maximum five years of longevity 3) have two to seven entrepreneurs/core team members (to ensure the existence of social fabric but in a limited scope). No limitations were set on the industry nor to team member demographics. Research language was English as it facilitated the unity of data and its analysis.

The answers were provided via a video-diary, that as a method can restrict the interaction between researcher and participant, and thus might decrease researcher-imposed bias (Owens et al, 2017). The method also allows longitudinal data collection as the need for the researcher to be present is limited. Additionally, it can be

preferred by respondents who have time constraints to engage in writing memos or filling surveys (e.g. start-ups).

A mix of deductive and inductive coding approach was used in data classification. The data were first coded inductively, and then narrowed further to sub-categories. The model by Eager, Grant and Maritz (2018) was used to see if some coping strategies from individual entrepreneurs are also found in team context. As for the findings on stressors, they were coded only inductively as the research on start-up team stressors does not offer a consistent model yet. Furthermore, researcher triangulation was applied; the three researchers derived their conclusions first independently and those conclusions were later merged into a joint view.

4. Findings and discussion

Stressors

With regard to the first research question, the following model of start-up team stressors is proposed based on the findings. We distinguish between 4 work-related categories of stressors (own work of a team member, team-related stressors, stressors related to third parties like customers or suppliers and stressors that are connected to worries about future developments) and 2 non-work-related categories of stressors (own private life and other non-work-related stressors connected with friends or family).

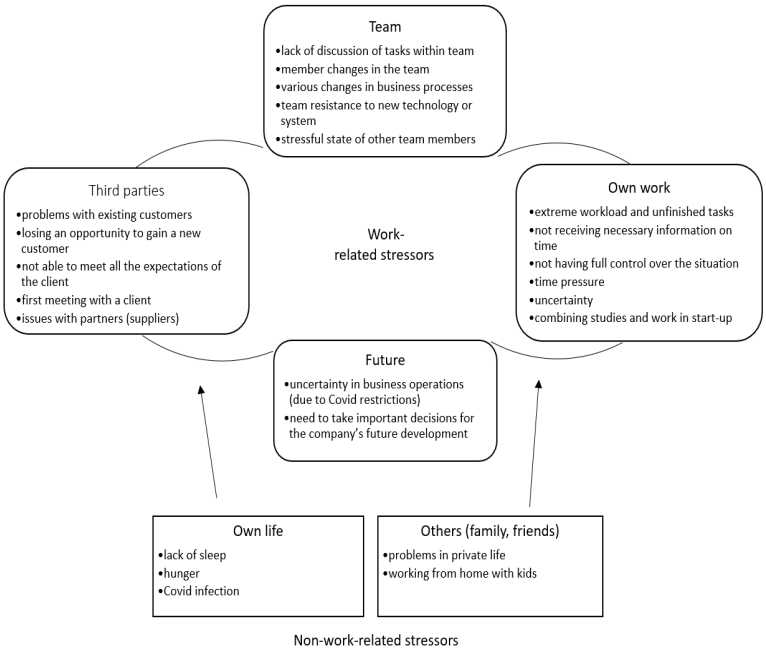


Figure 3: Conceptual model of start-up team stressors

It should be noted that *extreme workload* is the stressor that is observed almost daily in the video diaries of the teams, which goes in line with the general characteristics of entrepreneurial activity (Grant and Ferris, 2012). Among private life related stressors *working from home with kids* can be viewed as a new stressor due to pandemic. In general, issues in private life were reported quite rarely. Stressors related to physical state, such as hunger or lack of sleep, also were reported not often. This indicates the focus of team members on their tasks they need to complete to get the project going. An important finding is that start-up team members described most of the stressors as challenges and not as hindrances (Lerman, Munyon and Williams, 2021), meaning that they perceive stressful situations positively and tend to look at stress from a brighter side.

Coping strategies

As for the second research question, the following model of team coping strategies is suggested. It is based on the model by Eager, Grant and Maritz (2018), that has been developed from individual entrepreneurs' interviews.

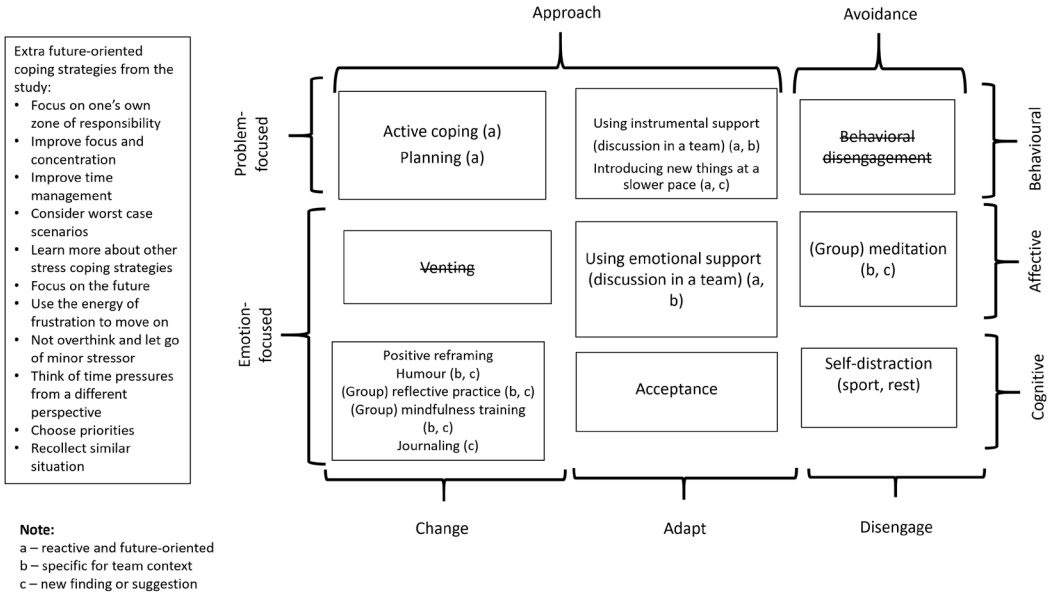


Figure 4: Conceptual model of stress coping strategies for start-up teams

With regard to behavioural coping, teams in this study mentioned different types of *planning*. Nevertheless, these solutions are quite limited. This brings about a recommendation for start-ups and for supporting organizations to introduce workshops on time and energy management techniques.

Also, *active coping* like preparing better for meetings, looking up information, making some video calls without camera on, replying emails with voice messages was reported in the study.

The coping strategy that was found as characteristic for team context is *having a discussion*. This can be viewed as the coping strategy of *using support (instrumental* - seeking advice and assistance *or emotional* – getting sympathy and understanding*).* Participants acknowledged that more proper and timely discussion in a team could have helped to avoid problems and related stress. Also, *introducing new things in a slower pace and "not pushing"* helps deal better with team resistance and related stress. This strategy can also be used as a proactive coping strategy, meaning to get ready for future instances of stress or to avoid them (Schwarzer and Taubert, 2002). It demonstrates that the notion of time in entrepreneurship studies (Bird and West, 1997) should not be neglected and inclusion of time perspective needs to be implemented in entrepreneurship research.

With regard to the cognitive form of coping strategies, *acceptance and positive reframing* were mentioned in many cases. Similar to the finding of Eager, Grant and Maritz (2018), "participants used Positive Reframing in order to reappraise stress as a sign of their contribution to achieving a higher purpose." Apart from that participants often talked about other extra future-oriented cognitive coping strategies (Figure 4).

Rest as a form of self-distraction strategy was also mentioned. Different intervals of resting were described: breaks within a day, a vacation week, short periods of rest such as walking, breathing in and out, even looking out into the window and getting distracted. Participants also talked about getting enough sleep and exercise, though just a couple of times. However, sleep is underlined as one of the important recovery approaches for entrepreneurs (Williamson, Gish and Stephan, 2021).

The only strategy mentioned regarding the affective form of coping strategies was *getting emotional support through talking to team members and sharing*. Therefore, it is recommended for start-up teams to arrange

regular meetings (similar as in this project) where they do not talk about daily tasks and routines but talk specifically about their stress and well-being issues and experiences.

Important is that venting or behavioural disengagement were not mentioned in this study of teams, therefore the respective parts of the model are crossed out.

A new finding that is inherent to the team context is that *humor and laughter* was mentioned five times in one team and observed in all the teams, while the study by Eager, Grant and Maritz (2018) found no reports of this coping strategy in individual entrepreneurs. Indeed, humor can be used as an internal way to improve group cohesiveness especially in times of stress and adversity (Gopalkrishnan, 2017). In this regard introducing regular laughter therapy or laughter yoga (within start-up team context) is one of the recommendations. "The positive psychological effect of laughter therapy includes mental alertness, increase in concentration, cooperation, creativity and self-confidence plus better ability to cope with stress" (Kaur and Walia, 2008, p. 35). The resent study by Ozturk and Tezel (2021) showed that laughter yoga reduces levels of anxiety, depression, negative self, and hostility.

Meditation is another coping strategy that was not mentioned at all neither in the study by Eager, Grant and Maritz (2018), nor in the current study on teams, although for example, Engel et al (2021) find positive relationship between meditation practices, increasing self-compassion and reducing stress in entrepreneurial context. They state that their findings can also be relevant to the studies about entrepreneurial team dynamics. In this regard we can talk about *group meditation* approach.

Journaling and *mindfulness training* can be also added to the recommendations (e.g. Shapiro et al, 2006; Dimitroff et al, 2017). These coping strategies were proved to help in dealing with stress but mostly in psychological and medical literature.

A final finding is an observed lack of stress awareness among the teams in the project. At the same time, the participating teams demonstrated improvement in their level of stress reflection on a weekly basis during the project participation. In this regard, spreading information among existing and potential entrepreneurs how stress might affect the outcomes of a venture is one of the approaches to recommend. Another recommendation deals with the studies of *reflective practice* among entrepreneurs (Tikkamäki, Heikkilä and Ainasoja, 2016). Reflection can be practiced not only on individual but also *team level* (Raelin, 2001).

5. Conclusion, further research and implications for practitioners

First, this study of shared stressors and communal stress coping in start-up teams draws attention to the concept of team. It is found and demonstrated how start-up teams have different dynamics with regard to experiencing and dealing with stress (e.g. Jin et al, 2017) as compared to solo entrepreneurs. Therefore, the models of entrepreneurial stressors and stress coping strategies (e.g. Eager, Grant and Maritz, 2018) based on studies of individual entrepreneurs have been updated with regard to the findings of this study.

Second, by using longitudinal approach, the authors managed to avoid retrospective bias, enhance general reliability of findings and consider the importance of time and process in entrepreneurial activity. Therefore, the authors support the call for using more of longitudinal research designs in the field of entrepreneurship (e.g. Giaever and Smollan, 2015; Williamson, Gish and Stephan, 2021).

It is suggested that previous findings about the effect of stress on entrepreneurial activities (e.g. Dijkhuizen et al, 2016) and the findings of this study should be considered to enhance the model of team dynamics (Klotz et al, 2014), where the team's knowledge of stress coping strategies can be added as one of the central mediators.

It is advised that further research should focus more on exploring such stress coping strategies for entrepreneurial teams as humour, group mediation, collective reflective practice, journaling and group mindfulness training that were not mentioned or rarely mentioned by the participants in this study.

Finally, further development of research about positive and negative stress in entrepreneurs is also necessary (Tikkamäki, Heikkilä and Ainasoja, 2016; Lerman, Munyon and Williams, 2021).

Stress awareness and knowledge of stress coping strategies for entrepreneurial teams should be also emphasized more on practical level. It is advised to include these topics into various support programs for entrepreneurs as well as into the teaching materials at business schools. Incubators, that provide work space and mentoring for start-up teams could also offer practical implementation of such team coping strategies that were proven to be effective in dealing with stress, as laughter therapy, group mediation, collective reflection, group mindfulness training and journaling.

References

Akande, A. (1994) "Coping with entrepreneurial stress: Evidence from Nigeria*", Journal of Small Business Management*, Vol 32, No. 1, pp 83–87.

Akgün, A. E., Byrne, J. C., Lynn, G. S. and Keskin, H. (2007) "Team stressors, management support, and project and process outcomes in new product development projects", *Technovation*, Vol 27, No. 10, pp 628–639.

Bird, B.J. and West, G. (1997) "Time and entrepreneurship", *Entrepreneurship Theory and Practice*, Vol 22, No. 2, pp 5-9.

Blank, S. and Dorf, B. (2012) *The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company*, K & S Ranch.

Brattström, A. (2019) "Working with Startups? These are the Three Things You Ought to Know about Startup Teams", *Technology Innovation Management Review*, Vol 9, No. 11, pp 5-14.

Carver, C.S. and Connor-Smith, J. (2010) "Personality and coping", *Annual Review of Psychology*, Vol 61 No. 1, pp 679-704.

Dietz, A. S., Driskell, J. E., Sierra, M. J., Weaver, S. J., Driskell, T., and Salas, E. (2017) "Teamwork under Stress". In E. Salas, R. Rico, & J. Passmore (Eds.), The Wiley Blackwell Handbook of the Psychology of Team Working and Collaborative Processes (pp. 297–315). Chichester, UK: John Wiley & Sons, Ltd.

Dijkhuizen, J., Gorgievski, M., van Veldhoven, M. and Schalk, R. (2016) "Feeling successful as an entrepreneur: a job demands-resources approach", *International Entrepreneurship and Management Journal*, Vol 12, No. 2, pp 555-573.

Dimitroff, L., Sliwoski, L., O'Brien, S. and Nichols, L. (2017) „Change your life through journaling – The benefits of journaling for registered nurses", *Journal of Nursing Education and Practice*, Vol 7, No. 2, pp 90–98.

Eager, B., Grant, S. L. and Maritz, A. (2018) "Classifying coping among entrepreneurs: is it about time?", *Journal of Small Business and Enterprise Development*, Vol 26, No. 4, pp 486–503.

Engel, Y., Noordijk, S., Spoelder, A. and van Gelderen, M., (2021) "Self-compassion when coping with venture obstacles: Loving-kindness meditation and entrepreneurial fear of failure", *Entrepreneurship Theory and Practice*, Vol 45, No. 2, pp 263-290.

Gartner, W. B. and Birley, S. (2002) "Introduction to the special issue on qualitative methods in entrepreneurship eesearch", *Journal of Business Venturing,* Vol 17, No. 5, pp 387–395.

Gilboa, S., Shirom, A., Fried, Y., and Cooper, C. (2008) "A meta-analysis of work demand stressors and job performance: Examining main and moderating effects", *Personnel Psychology*, Vol 61, No. 2, pp 227–271.

Giœver, F. and Smollan, R. (2015) "Evolving emotional experiences following organizational change: a longitudinal qualitative study", *Qualitative Research in Organizations and Management,* Vol 10, No. 2, pp 105–133.

Gopalkrishnan, S.S. (2017) "The role of humor in startup success: The mediating role of team performance", *Journal of Organizational Psychology*, Vol 17, No. 3, pp 9-23.

Grant, S. and Ferris, K. (2012) "Identifying sources of occupational stress in entrepreneurs for measurement", *International Journal of Entrepreneurial Venturing*, Vol 4, No. 4, pp 351-373.

Greenglass, E. (2002) "Proactive coping and quality of life management", in Frydenberg, E. (Ed.), Beyond Coping: Meeting Goals, Visions, and Challenges, Oxford University Press, New York, NY, pp 37-62.

Jin, L., Madison, K., Kraiczy, N. D., Kellermanns, F. W., Crook, T. R., Xi, J. (2017) "Entrepreneurial Team Composition Characteristics and New Venture Performance: A Meta–Analysis", *Entrepreneurship Theory and Practice*, Vol 41, No. 5, pp 743-771.

Kaur, L. and Walia, I. (2008) "Effect of laughter therapy on level of stress: A study among nursing students", *Nursing and Midwifery Research Journal*, Vol 4, No. 1, pp 34–38.

Klotz, A. C., Hmieleski, K. M., Bradley, B. H. and Busenitz, L. W. (2014) "New Venture Teams: A Review of the Literature and Roadmap for Future Research", *Journal of Management*, Vol 40, No. 1, pp 226-255.

Lazarus, R.S. and Folkman, S. (1984) *Stress, Appraisal, and Coping*, Springer, New York, NY.

Lechat, T. and Torrès, O. (2016) "Exploring negative affect in entrepreneurial activity: effects on stress and contribution to burnout", in Ashkanasy, N.M., Härtel, C.E.J. and Zerbe, W.J. (Eds), Emotions and Organizational Governance, Emerald Group Publishing Limited, pp 69-99.

Leprince, C., D'Arripe-Longueville, F., and Doron, J. (2018) "Coping in Teams: Exploring Athletes' Communal Coping Strategies to Deal With Shared Stressors", *Frontiers in Psychology*, Vol 9, p 1908.

Lerman, M. P., Munyon, T. P. and Williams, D. W. (2021) "The (not so) dark side of entrepreneurship: A meta-analysis of the well-being and performance consequences of entrepreneurial stress", *Strategic Entrepreneurship Journal*, Vol 15, pp 377– 402.

Lyons, R. F., Mickelson, K. D., Sullivan, M. J. L., and Coyne, J. C. (1998) "Coping as a communal process", *Journal of Social and Personal Relationships*, Vol 15, No. 5, pp 579–605.

Mol, E. de, Khapova, S. N., and Elfring, T. (2015) "Entrepreneurial Team Cognition: A Review", *International Journal of Management Reviews*, Vol 17, No. 2, pp 232–255.

Owens, O. L., Beer, J. M., Revels, A. and Levkoff, S. (2017) "Feasibility of using a video diary methodology with older African Americans living alone", *Qualitative Social Work*, Vol. 18, pp 397 – 416.

Ozturk, F. O. and Tezel, A. (2021) "Effect of laughter yoga on mental symptoms and salivary cortisol levels in first-year nursing students: A randomized controlled trial", *International Journal of Nursing Practice*, Vol 27, No. 2, p e12924.

Perry, S. J., Penney, L. M. and Witt, L. A. (2008) "Coping with the constraints of self-employment: A person-situation model of entrepreneurial burnout". In George T. Solomon (Ed.), Proceedings of the Sixty-Sixth Annual Meeting of the Academy of Management (CD), ISSN 1543-8643.

Raelin, J.A. (2001) "Public reflection as the basis of learning", *Management Learning*, Vol 32, No. 1, pp 11-30.

Ries, E. (2011) *The lean start-up*, New York: Crown Publishing Group.

Salas, E., Driskell, J. E. and Hughes, S. (1996) "Introduction: The study of stress and human performance". In J. E. Driskell & E. Salas (Eds.), Stress and human performance (pp. 1–45). Mahwah, NJ: Lawrence Erlbaum Associates.

Schwarz, N., Kahneman, D. and Xu, J. (2009) „Global and episodic reports of hedonic experiences". In R. F. Belli, F. P. Stafford, & D. F. Alwin (Eds.), Calendar and time diary methods in life course research (pp. 157–174). Thousand Oaks, CA: Sage.

Schwarzer, R. and Taubert, S. (2002) "Tenacious goal pursuits and striving toward personal growth: proactive coping". In Frydenberg, E. (Ed.), Beyond Coping: Meeting Goals, Visions and Challenges, Oxford University Press, London, pp. 19-35.

Shapiro, S.L., Carlson, L.E., Astin, J.A. and Freedman, B. (2006) "Mechanisms of mindfulness", *Journal of Clinical Psychology*, Vol 62, No. 3, pp 373–386.

Shepherd, C.D., Marchisio, G., Morrish, S.C., Deacon, J.H. and Miles, M.P. (2010) "Entrepreneurial burnout: exploring antecedents, dimensions and outcomes", *Journal of Research in Marketing and Entrepreneurship*, Vol. 12, No. 1, pp 71-79.

Stephan, U. and Roesler, U. (2010) "Health of entrepreneurs versus employees in a national representative sample", *Journal of Occupational and Organizational Psychology*, Vol 83 No. 3, pp 717-738.

Tamminen, K. A., and Gaudreau, P. (2014) "Coping, social support, and emotion regulation in teams". In Group Dynamics in Exercise and Sport Psychology: Contemporary Themes, 2nd Edn, eds M. Beauchamp and M. Eys (New York, NY: Routledge), pp 222–239.

Terjesen, S., Hessels, J. and Li, D. (2016) „Comparative International Entrepreneurship", *Journal of Management,* Vol 42, No. 1, pp 299–344.

Thompson, N. A., van Gelderen, M. and Keppler, L. (2020) „No Need to Worry? Anxiety and Coping in the Entrepreneurship Process", *Frontiers in Psychology*, Vol 11, p 398.

Tikkamäki, K., Heikkilä, P. and Ainasoja, M. (2016) "Positive Stress and Reflective Practice Enhancing Innovativeness Among Entrepreneurs", *Journal of Entrepreneurship, Management and Innovation*, Vol 12, No. 1, pp 35–56.

Uy, M. A., Foo, M. D. and Aguinis, H. (2010) "Using experience sampling methodology to advance entrepreneurship theory and research", *Organizational Research Methods*, Vol 13, No. 1, pp 31-54.

Wach, D., Stephan, U., Weinberger, E., and Wegge, J. (2021) „Entrepreneurs' stressors and well-being: A recovery perspective and diary study", *Journal of Business Venturing*, Vol 36, No. 5, 106016.

Williamson, A. J., Gish, J. J., and Stephan, U. (2021). "Let's focus on solutions to entrepreneurial ill-being! Recovery interventions to enhance entrepreneurial well-being", *Entrepreneurship Theory and Practice*, Vol 45, No. 6, 1307-1338.

Wlodarczyk, A., Basabe, N., Páez, D., Amutio, A., García, F.E., Reyes, C. and Villagrán, L. (2016) "Positive effects of communal coping in the aftermath of a collective trauma: The case of the 2010 Chilean earthquake", European Journal of Education and Psychology, Vol 9, No. 1, pp 9-19.

Enabling Undergraduate Student Entrepreneurs to Structure Their own Experiential Learning Course

Kenneth Grant
Department of Entrepreneurship & Strategy, Ted Rogers School of Management, Toronto Metropolitan University, Toronto, Canada
kagrant@ryerson.ca

Abstract: The one-semester undergraduate course "Applied Entrepreneurship" allows student entrepreneurs to investigate their own business idea while following a course structure that they design for themselves under the mentorship of an entrepreneurship professor. The course is available to all students across campus, regardless of degree program or year of study. No prior courses in entrepreneurship are required (indeed the only students excluded are those already enrolled in the Management School Entrepreneurship Major). The course is based on a widely held teaching principle for entrepreneurship education -- getting the students out of the classroom and into the real world. Students bring their own business idea to the course, which can be at any stage of development from ideation, through launch, operation and even sale of their business. Each student develops a personal course workplan of eight modules including a mix of structured learning and primary and secondary research appropriate for their own personal development as entrepreneurs and about their business idea. A short write-up is prepared by the student for each module, including evidence of the work they have done. They conclude the course by presenting a summary of the work they have done and a personal reflection. As the course progresses, the instructor provides individual feedback and counselling to each student as they submit their modules. Student feedback on the course is highly positive, on the education experience, improvement of their business idea and on their personal development.

Keywords: instructional design, engagement, flipped classroom, personal learning, experiential learning

1. Introduction

Just as entrepreneurship education has moved from being a peripheral activity to an important discipline in many universities, there has been significant and increasing dialogue on whether and how entrepreneurship should be taught as an academic subject. Indeed, the role of the University in the wider entrepreneurial ecosystem has also been a subject of significant debate with questions raised as to whether that role should address the delivery of entrepreneurship classes, the development of Faculty and Student entrepreneurs, the establishment of incubators and accelerators and the support of industry. For some universities, playing a role in the local entrepreneurial community is seen as a key element of the university strategy. In practice, however, the level and commitment to entrepreneurship education varies widely from institution to institution.

Thus, it is hardly surprising that there has been significant debate on both the content and the delivery of entrepreneurship education. A significant part of this debate comes from the contribution of "practitioner-scholars" who combine interests in pedagogy and actual entrepreneurial activities. Nowhere is this more evident than in the examination of Lean Launchpad approaches and the use of business models (Blank, 2013, Shepherd and Gruber, 2021).

2. Good practices in entrepreneurship education

University-level teaching, especially at the undergraduate level, is often subject to criticism, with the traditional lecture widely recognised as a flawed approach for many subjects, often producing inferior results (Grant and Gedeon, 2019). Courses are often built around standard textbooks, with lectures supported by publisher-provided slides.

Current "good practice" thinking tends to centre around several key concepts -- a focus on ""learning" rather than "teaching", building courses around curriculum-related learning outcomes, increasing student engagement with active learning techniques and at least some consideration of student learning styles and student-centred learning.

In what is still often considered good pedagogical practice in most business disciplines, curriculum and course development largely focuses on broadly accepted topics and content, with learning outcomes established to demonstrate the competence students gain through taking the relevant courses, frequently using a framework such as Bloom's Taxonomy (Armstrong, 2019). While the curriculum may build towards the beginning of a

professional accreditation (such as accounting) there is no particular expectation that the formal education goes beyond the imparting of discipline knowledge and the development of basic skills in the application of the knowledge. Sometimes, in an effort to make the work less structured and to require more active student commitment, problem-based learning is proposed, allowing students to bring a variety of approaches and background experiences to examine ill-structured problems (Bell, 2008). However, entrepreneurship education is frequently expected to go well beyond this expectation.

Many authors across several disciplines provide evidence of the contribution of active learning to improving student learning outcomes (Lambert, 2012, Freeman et al., 2014, Bonwell and Eison, 1991). In particular, active learning approaches are seen as having a significant effect in entrepreneurship education (Lassas-Clerc et al., 2008, Curtis et al., 2020). One form of active learning seen as particularly relevant for entrepreneurship education is experiential learning, where students learn in the field, applying knowledge in a real world context to develop new skills and new ways of thinking (Lewis and Williams, 1994), ideally, aligning the learning activities with the entrepreneurial process (Bell and Bell, 2020). As Bell and Bell suggest, this requires going beyond teaching *about* entrepreneurship to teaching *for* entrepreneurship and even teaching *through* entrepreneurship. This is often done through some form of "learning-by-doing", engaging students by having them deal with real world entrepreneurial challenges, whether from some form of secondary field study or even by developing their own business idea within a classroom environment.

Learning through action is not enough, it needs to be accompanied by appropriate reflection (Schön, 1983) which can even lead to transformative learning (Mezirow, 1997). It is also argued that students' learning styles can impact the effectiveness of different pedagogies and that experiential learning can help counter this challenge (McCarthy, 2010).

This paper describes an entrepreneurship course that builds on the preceding discussion to provide a transformative educational experience for its students. The course adopts a highly innovative and flexible approach to develop undergraduate student entrepreneurs. It combines flexible learning approaches, including flipped classroom sessions, with customised field experiences. It provides many of the elements of an incubator experience within a for-credit course that is designed by the student to meet their specific needs to develop their business idea and improve their capabilities to implement it. It should be of interest to all entrepreneurship educators and is implementable in many settings.

3. Institutional background and course conceptualisation

Toronto Metropolitan University[1] is recognised as Canada's leading innovation and entrepreneurship university (Grant and MacRitchie, 2021). Toronto Metropolitan is an urban university in a large cosmopolitan city with an overall strategy to be a key part of its community, adopting what is often described as the "third mission" of universities, going beyond the long-established twin missions of teaching and research (Shattock, 2009).

Much has been written on entrepreneurial ecosystems, with some discussion on what might constitute a university entrepreneurial ecosystem (Bedő et al., 2020). While most universities today have adopted some aspects of entrepreneurial education, this is often limited to a small number of entrepreneurship-related courses, perhaps some form of student incubator/innovation centre, and some approach to commercialisation of faculty research.

At Toronto Metropolitan University, the entrepreneurial ecosystem is much more developed and embedded across the university. Key elements include:

- Many active programs and courses in entrepreneurship
- *Two masters degrees (MBA and Engineering)*
- *Two undergraduate Majors*

[1]Toronto Metropolitan University, formerly called Ryerson University, was renamed in April 2022, as part of the University's response to Canada's Truth and Reconciliation process, addressing the tragic impact of the Canadian residential schools system on its Indigenous peoples. Egerton Ryerson while well recognised as a 19th Century leader in the development of education in Ontario, was also involved in the development of residential schools.

- *Two undergraduate Minors*
- *Four Certificates*
- *More than 50 entrepreneurship courses*
- A dedicated Department of Entrepreneurship & Strategy, with some 25 faculty, teaching students from across the whole university
- Ten on-campus incubators (called "Zones"), supporting more than 300 startups at any given time
- Several informal pre-incubator resources, available to support students and the wider Toronto community

The 10 Zones are part of a complete set of extracurricular activities, called Zone Learning, open to all Toronto Metropolitan University students, faculty and members of the wider community. To give an idea of scale, the Zones have hosted more than 6,000 members creating more than 3,500 startups, with more than 14,000 students being included in more general Zone Learning activities.

A key educational challenge faced by all universities developing entrepreneurial programs Is the disinclination of young entrepreneurs to take part in regular classroom activities to achieve course credit, they just want to "get going". However it was recognised early on that some form of structured learning was needed to support both the Zone Learning participants and, more generally, young entrepreneurs across campus who might not have the inclination or option to take regular entrepreneurship classes. To meet this need, a co-curricular activity called Start-up School was established several years ago. This provides access to just-in-time modular learning to meet young entrepreneurs' educational needs. Since its inception, every academic year, some 20 workshops are delivered. Start-up School was somewhat disrupted by the pandemic, first switching to online virtual presentations and, most recently, to providing students with access to a library of recorded presentations. The Content Library of Startup School is shown in Figure 1 and contains some 50 sessions.

Despite the wide range of options available to support student entrepreneurs, many students with business ideas or embryonic start-ups do not have access to any of the Zones and may find the entrepreneurship courses offered, although applied and experiential in nature, not a perfect match for them to help develop themselves and their business. It was decided to introduce a new course that would allow students to develop their own course structure, to work on their own business idea, drawing, in part, on such structured learning activities as Start-up School.

This new course was launched in 2018, with the title of "Applied Entrepreneurship".

4. The Course

4.1 Calendar description: ENT 100 applied entrepreneurship

Students work with their course instructor to identify, select and complete twelve entrepreneurship modules and assignments that support their specific entrepreneurial project. Potential modules include customer identification, stakeholder analysis, market segmentation, lean startup, design thinking, agile methods, business-model design, business planning, or financial analysis. This highly flexible course is designed to support independent student projects, startups and Zone Education. This is an experiential applied course, and students must engage with the entrepreneurial ecosystem both within and outside Toronto Metropolitan University

This course was developed drawing on foundational theories, such as Kolb's theory of experiential learning (Kolb, 1984) and Schön's reflection- in-action (Schön, 1983), in general following the constructivist approach to education, where learning is largely situation-specific and context-bound (McInerney, 2013), with the learner being guided by the educator in a personal voyage of discovery and learning. It adopts elements of the student self-regulated learning approach to problem-based learning as suggested by English and Kitsantis (2013). The reflection approach also draws on a scaffolding technique (Coulson and Harvey, 2013), where the students' reflective capacity is built through a series of class activities, starting with the development of their personal learning outcomes for their course workplan. It recognises the constraints identified by Huxtable-Thomas and Hannon (2018), who suggest that the learner "can only be influenced, not dictated, by what the teacher teaches" and emphasises the need to provide a diverse menu of learning opportunities that goes beyond standard methods of teaching and feedback and provides for potentially advantageous intangible and unintended learning outcomes.

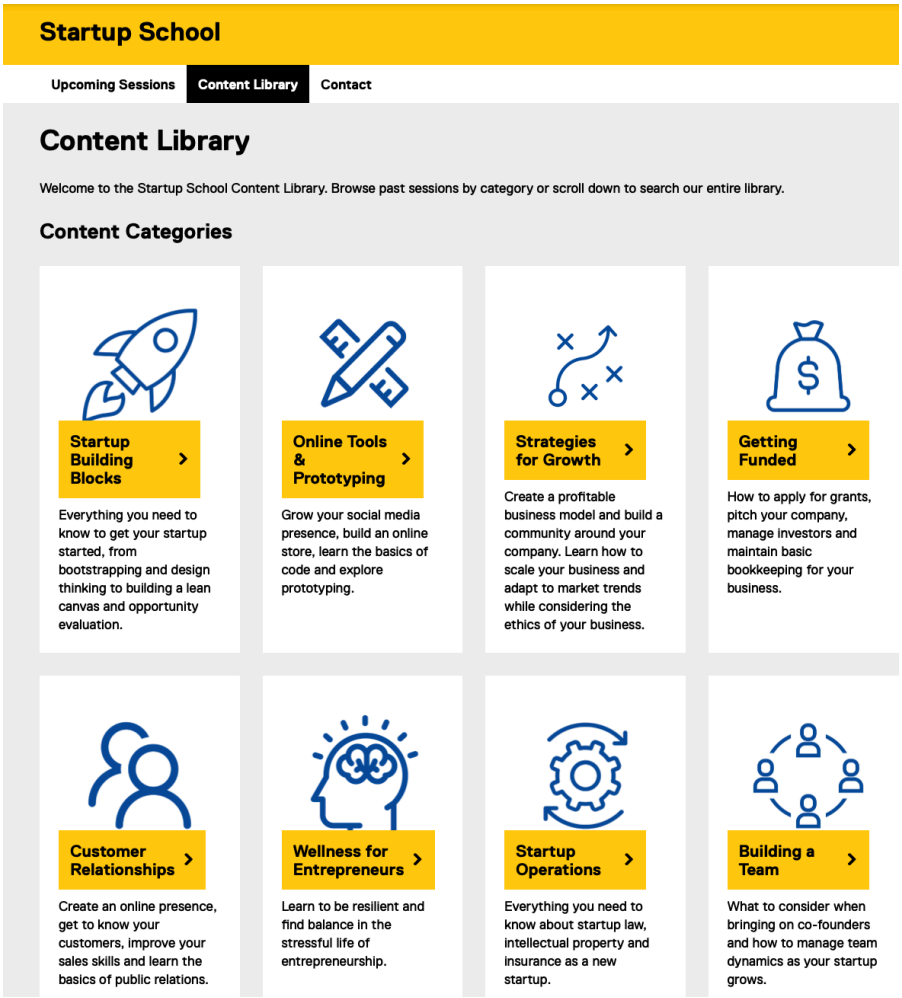


Figure 1: Startup school content library

4.2 The course structure

The overall course structure is shown in Figure 2, which also shows the grade allocation for each component.

In the first week, each student in the course starts by watching three short, pre-recorded video lectures and then develops a Workplan in conjunction with their professor for their individual course, that helps them investigate their business idea (which can be at any stage of development from ideation, through launch, operation and even sale of their business) as well as work on personal development. An initial Workplan is submitted and then a revised version is produced, following feedback from the instructor. They are then expected to complete eight approved modules that are a mix of structured learning (which involves attendance at or watching a workshop/lecture, following which they do specific tasks that apply the workshop/lecture content to their business idea), primary research (where they do field work that might include idea validation, customer discovery, online surveys, and competitor visits) and secondary research (such as market and customer research). They prepare a written report for each module, describing what they did, how they applied their time (the minimum time commitment expectation is about six hours per module) and provide evidence to demonstrate they did carry out the planned work. They conclude the course by preparing a final report and a personal reflection. In total 12 assignments are submitted (two Workplan Drafts, eight Modules, a Final Report and a Personal Reflection. Throughout the course the professor provides in-office and online coaching and support to each student.

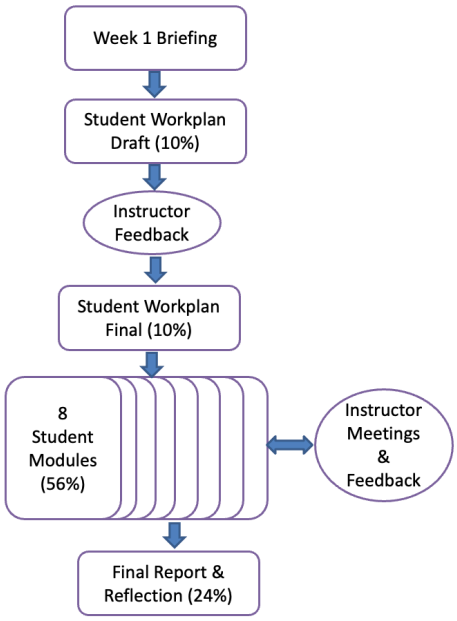


Figure 2: Course structure

The Workplan: students develop a Workplan that includes an introduction to themselves, their business idea and their motivation. They explain the stage of their idea/business, propose a set of personal learning objectives for the course and then describe eight study modules they will execute to complete the course. They are provided with detailed instructions and examples of Workplan content from previous students (anonymized and used with permission). They develop their first draft Workplan and submit it. The instructor then provides detailed feedback on the draft Workplan, possibly including individual discussions with the students. Each student then submits a revised work plan for final approval. Occasionally, a third cycle is required. Completed Workplans are typically about 1,500 -2,000 words in length.

The Student-designed Modules: Students design eight modules relevant to their project and experience. Figure 3 shows the three types of module they are expected to execute. Each module includes active learning, application of theoretical concepts and, often, interacting with the wider entrepreneurial ecosystem. Students have the freedom to select modules most relevant to their own situation, prior learning and business idea. To assist students in getting going, two outline modules are available for them to use if they lack experience. One presents the Lean Launchpad approach and the development of a Business Model Canvas, the other addresses competitor analysis. Students are free to choose their own source material, although guidance as to suitable material is provided for major topic areas. Specifically, students are encouraged to use Start-up School lectures and videos (which are available in a library) as the foundation for their Structured Learning activities, but they need not do so if they find better material relevant to their situation. In addition to Startup School, students frequently use material from LinkedIn Learning, the work of Steven Blank (2022) and other sources more specific to their business idea, including YouTube videos. Also, before the imposition of-COVID-19 restrictions, they would attend live sessions provided in the Toronto area, including those offered by MaRS, one of North America's largest urban innovation hubs, located close to Toronto Metropolitan University.

Students get credit for each module by submitting a report that describes what they did in the module and what they learned from it, linking this to their stated learning outcomes for their Workplan. This discussion is typically a 400-to-500-word piece. It is supported by an Appendix containing appropriate evidence that demonstrates that they did carry out the work. For example, they might provide notes taken while watching a lecture, work products produced after taking part in some structured learning (e.g. a Business Model Canvas for their business), a summary of results from a field survey or a competitor analysis. They receive feedback on both the assignment itself and on any aspect of the development of their business idea that merits comment or advice.

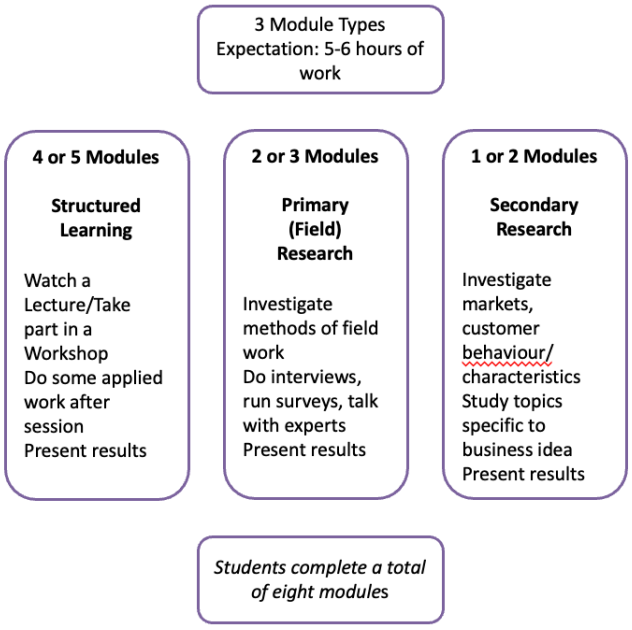


Figure 3: Study module design

The Final Report and Reflection: Completed at the conclusion of the course after all modules have been submitted, this is done in two parts. The first is a Course Review, where the student briefly summarises all work done during the course, discusses how well they met their personal learning objectives and considers the progress they made in developing their business idea. The second is a Personal Reflection, where the student describes their personal development and how they have grown as an entrepreneur and as an individual. They are asked to discuss what they might do differently in the future, based on their experience in the course. A simple reflection framework is provided to help them in doing this. Each of these reports is typically in the 1,000-1,500 word range.

5. The impact of the course on the participating students

The University has a standard measurement instrument where students in each course are asked to provide feedback on various aspects of the courses taken, including the instructor, course content and delivery, assessment, et cetera. The students who complete this assessment do provide high ratings, but the instrument is not really geared to the assessment of a self-developed and managed course.

However, in the course's first assignment, the Workplan, and the final Report and Reflection assignments -- do provide a rich dialogue on the student initial intentions and experience in the course.

The Course typically has between 20 and 30 participants in each offering and is offered twice per year.

An examination of the Workplans prepared over the last three years suggests that some 60% of the course participants were at the ideation stage, meeting the minimum course expectation that the students bring a fairly well fleshed-out business idea to build upon during the course. About 30% were in the early stages of setting up and running their business, possibly on a part-time basis. Finally, about 10% were running established businesses, looking to expand or grow. Interesting examples included:

- One undergraduate student entrepreneur who had launched a successful men's custom tailoring business, using pop-up stores on university campuses, ran this business for two years before using this course as a framework in which to plan their successful exit and sale to tie in with graduation with their business degree.
- Another student used the course as a framework to support their entry in the first Red Bull Basement University challenge, eventually winning both the Canadian and the Global competition! (Red Bull, 2019)

A few of the business ideas had significant growth potential, most would likely be personal or SME businesses. While the range of business ideas was very broad, several themes stood out:

- Fashion-related, including manufacturing, retail, recycling and environmentally friendly concepts
- Professional services, such as agencies, production and publication support
- Personal services, including grooming, business advice and investment management
- Food-related, including establishing restaurants, food curation and waste minimisation
- While most were planning physical businesses, a significant number were looking at technology enabled businesses, including app development
- Most intended to launch their businesses in Canada, however some had an international focus, planning businesses in Bangladesh, Peru, the Ukraine and Egypt

Students are given a framework to use for their personal reflection, asking for discussion in three areas:

- What did they do/experience?
- What did they learn from the experience?
- What will they do differently in the future because of the experience?

Examination of the students' comments in the course summary and personal reflection assignments prepared at the end of the course provided some good evidence as to the impact of the course on the students. The quality of reflection was, in general, quite high, showing good personal insights and learning.

Almost all the students expressed significant personal satisfaction in being able to complete their modules and achieve their personally set learning outcomes. Most mentioned that they found the entrepreneurial experience to be very satisfying and very beneficial in the development of both their own business idea and themselves as potential entrepreneurs. Other areas mentioned frequently included personal skills development, facing challenges and being able to overcome fears and setbacks. Challenges in meeting deadlines and managing their time were also frequently discussed.

In terms of impact on their business, some confirmed that while this was an interesting idea to investigate, they did not intend to take it further, with others stating that they definitely intend to launch or expand their businesses going forward.

6. Conclusions and the contribution of this paper

As Pittaway, Huxtable and Hannon (2018) have identified, approaches to the education of entrepreneurs has evolved significantly over the last 20 years or so. They suggest that practice lags the evolution of theory development in this area. While their work is more focused on experienced entrepreneurs, their arguments also hold true for young nascent entrepreneurs at universities. This paper describes a practical effort to advance knowledge and capacity of young entrepreneurs, building on a theoretical foundation.

Further, although it has been developed within a large university ecosystem that places considerable emphasis on entrepreneurship education, the course approach and structure could easily be implemented within a smaller university with limited resources. It provides a way of integrating structured education with real world experience that could complement basic entrepreneurship courses and a lack of incubators. It can also use teaching resources available from outside the University, allowing students to access the knowledge of experts from the wider entrepreneurial ecosystem.

7. Lessons learned and areas for improvement

As currently structured, ENT 100 provides a high-quality personal experience for those students who completed (who all provide high-quality feedback on what they have done). However, it has experienced a significant early dropout rate in the first two weeks, primarily due to the students' need to prepare and design their own educational journey for the course, which is developed in conjunction with their professor and forms the basis of the remainder of the work in the course.

Managing time and keeping up with their scheduled workplan is also an issue with a significant number of students. Given that modules are individual and may not neatly fit into one elapsed week, the weekly due dates for each module are more of a guideline than an absolute. As a result, some students fall significantly behind in the submission of their work, in most cases catching up with their submissions by the end of the course. As a

result, the instructor frequently has to chase up/encourage students to catch up with their submissions. In discussions with students who fall behind, they frequently cite the pressure of deadlines in other courses they are taking (which are usually firm in due dates). In their reflection discussions, students often identify this as a learning experience, pointing to a need to improve their time management skills and self-discipline.

Students use of the available meeting hours with the instructor is varied. These meetings are typically of two types. The first is with those students who are passionate about their idea and seek discussions about elements of the idea that have come up during the course, perhaps from their Module work, and they wish for further guidance or clarification. The second tends to be with students who have fallen behind and need coaching on how to complete specific modules and catch up with their Workplan. A significant number of students do not make use of this opportunity, either simply accepting the feedback provided in their assignments or asking further questions through email exchanges. Students do sometimes make changes in the work plan, asking for approval either through emails or through a visit in meeting hours.

The prior discussion, along with observation of the student participants over several years, as well as the feedback provided by students who do complete the course (through their personal reflection assignment) indicates that, while the concept of a flexible course designed by the student is achievable by the more committed of the students, more structure is needed to help those who are less certain about their idea and their abilities to encourage them to continue.

Thus, consideration is being given to the provision of some additional structure, and support tools, included pre-recorded material, that will ease student efforts in the design and execution of their personal course while still leaving them the freedom to pursue their individual needs. While scaffolding techniques can be used to ease the students into the course, care must be taken to ensure that they still have freedom to explore their own ideas rather than falling back into the safer suggestions made by the instructor. One possibility is to insist that each student must meet one or twice with the instructor during the scheduled meeting hours for the class, to assist in their course progress.

Finally, in the future, it is hoped to carry out a follow-on survey of all the participants in the course since its establishment to determine to what degree it had an impact on their subsequent entrepreneurial activities.

References

Armstrong, P. 2019. *Bloom's Taxonomy* [Online]. Center For Teaching, Vanderbilt University. Available: Https://Cft.Vanderbilt.Edu/Guides-Sub-Pages/Blooms-Taxonomy/ [Accessed September 30th, 2019 2019].

Bedő, Z., Erdős, K. & Pittaway, L. 2020. University-Centred Entrepreneurial Ecosystems In Resource-Constrained Contexts. *Journal Of Small Business And Enterprise Development,* 27.

Bell, J. R. 2008. Utilization Of Problem-Based Learning In An Entrepreneurship Business Planning Course. *New England Journal Of Entrepreneurship,* 11.

Bell, R. & Bell, H. 2020. Applying Educational Theory To Develop A Framework To Support The Delivery Of Experiential Entrepreneurship Education. *Journal Of Small Business And Enterprise Development,* 27.

Blank, S. 2013. Why The Lean Start-Up Changes Everything. *Harvard Business Review*.

Blank, S. 2022. *Steve Blank* [Online]. Available: Https://Steveblank.Com [Accessed May 10th, 2022 2022].

Bonwell, C. C. & Eison, J. A. 1991. Active Learning: Creating Excitement In The Classroom, 1991 Ashe-Eric Higher Education Report No. 1. Washington, D.C.: The George Washington University.

Coulson, D. & Harvey, M. 2013. Scaffolding Student Reflection For Experience- Based Learning: A Framework. *Teaching In Higher Education,* 18**,** 401-413.

Curtis, V., Moon, R. & Penaluna, A. 2020. Active Entrepreneurship Education And The Impact On Approaches To Learning: Mixed Methods Evidence From A Six-Year Study Into One Entrepreneurship Educator's Classroom. *Industry And Higher Education,* 35**,** 443-453.

English, M. & Kitsantis, A. 2013. Supporting Student Self-Regulated Learning In Problem- And Project-Based Learning. *Interdisciplinary Journal Of Problem-Based Learning,* 7**,** 128-150.

Freeman, S., Eddy, S., Mcdonough, M., Smith, M., Okoroafor, N., Jordt, H. & Wenderoth, M. 2014. Active Learning Increases Student Performance In Science, Engineering, And Mathematics. . *Proceedings Of The National Academy Of Sciences,* 111**,** 3410-3415.

Grant, K. A. & Gedeon, S. A. 2019. Chapter 7: Teaching And Learning In The 21st Century University. *In:* Remenyi, D., Grant, K. A. & Singh, S. (Eds.) *The University Of The Future.* Academic Conferences And Publishing International Ltd.

Grant, K. A. & Macritchie, J. 2021. Ryerson: Canada's Innovation University. *In:* Remenyi, D. (Ed.) *Excellence With University Leadership And Management.* Uk: Academic Publishing International, Uk.

Huxtable-Thomas, L. & Hannon, P. D. 2018. Chapter 4: Beyond Content And Pedagogy: The Role Of Self And Place In Entrepreneurial Leadership Development. *In:* Fayolle, A., Kariv, D. & Matlay, H. (Eds.) *The Role And Impact Of Entrepreneurship Education.* Elgar.

Kolb, D. A. 1984. *Experiential Learning: Experience As The Source Of Learning And Development,* Englewood Cliffs, Nj, Prentice-Hall, Inc.

Lambert, C. 2012. Twilight Of The Lecture. *Harvard Magazine.* Boston: Harvard University.

Lassas-Clerc, N., Delmar, F. & Fayolle, A. 2008. Entrepreneurship Education Initiatives: Does Active Learning Really Make Difference? (Summary). *Frontiers Of Entrepreneurship Research,* 28.

Lewis, L. H. & Williams, C. J. 1994. Experiential Learning: A New Approach. *In:* Jackson, L. & Caffarella, R. S. (Eds.). San Francisco: Jossey-Bass.

Mccarthy, M. 2010. Experiential Learning Theory: From Theory To Practice. *Journal Of Business & Economics Research,* 8**,** 131-140.

Mcinerney, D. M. 2013. *Educational Psychology: Constructing Learning*, Pearson Higher Education.

Mezirow, J. 1997. *Transformative Learning: Theory To Practice*.

Pittaway, L., Huxtable, L. & Hannon, P. 2018. Learning And Educational Programs For Entrepreneurs. *Sage Handbook For Entrepreneurship And Small Business.*

Red Bull. 2019. *Winners Of Red Bull Basement University Global Final Revealed* [Online]. [Accessed May 1st, 2022 2022].

Schön, D. A. 1983. *The Reflective Practioner: How Professionals Think In Action,* London, Temple Smith.

Shattock, M. (Ed.) 2009. *Entrepreneurialism In Universities And The Knowledge Economy: Diversification And Organizational Change In European Higher Education,* Maidenhead, Uk: Open University Press.

Shepherd, D. A. & Gruber, M. 2021. The Lean Startup Framework: Closing The Academic–Practitioner Divide. *Entrepreneurship Theory And Practice,* 45**,** 967-998.

Capturing Competitive Advantage Through Product Innovation: Study of a Small Culinary Business

Jurry Hatammimi and Amelia Thahara
Department of Management, School of Economics and Business, Telkom University, Bandung, Indonesia
jurryhatammimi@telkomuniversity.ac.id
amelia.thahara99@gmail.com

Abstract: In the early phase of the Covid-19 outbreak, all aspects of life, including the culinary sector, were impacted very hard by this outbreak in addition to the existing tight competition. Many businesses were in danger of going bankrupt. However, there was a culinary brand that continued to make an expansion in Bandung, Indonesia. There are seven branches opened by this brand until 2021. Hence, it is interesting to study the phenomena. This study aims to determine the effect of product innovation on the competitive advantage of this culinary brand. Besides this, the customers' evaluation regarding product innovation and competitive advantage is revealed by this study as well. This research uses a quantitative method by surveying with the purposive sampling technique. The questionnaires were distributed to 100 customers who had made transactions more than once within the last six months before the survey began. The descriptive data analysis was carried out to investigate the customers' evaluation. It is examined that product innovation has a positive impact on the competitive advantage after a simple linear regression analysis was conducted. This result is strengthened by the t-test that shows the acceptance of the hypothesis. Moreover, the coefficient of determination test presents that the impact of product innovation on competitive advantage is 51 percent. It means that the product innovation has provided 51 percent of the information needed to predict the competitive advantage in this small culinary business. From the overall results of the descriptive analysis, the consumer assessment scores obtained fall into the medium to high category range. This result proves that the response given to the company's competitive advantage and product innovation is still quite good and positive. The result of this study is expected can inspire other culinary companies to survive their businesses during a difficult situation like the Covid-19 outbreak and to sustain for the future. Further study can compare the condition during and after the Covid-19 outbreak.

Keywords: product innovation, competitive advantage, culinary, small business

1. Introduction

Company X is a small business that runs a restaurant that carries the concept of a franchise with a menu made from fish as the main ingredient. Even though Company X is a company that was just established in October 2019, it already has 122 branches spread throughout Indonesia. In a wider scope, culinary industry is one of the fastest-growing sectors in Indonesia. Based on data from the Creative Economy Agency of the Republic of Indonesia at the launch of Bango Culinary Heritage in 2018, it is mentioned that the culinary sector contributed 41.4 percent to the country's total contribution. The Year 2016 was the culinary highest contribution compared to the 16 other sub-sectors, according to the Creative Economy Agency. The food and beverage industry can still grow 0.22 percent in 2019 (Sindo News, 2020).

Meanwhile, Statistics Indonesia (2018) shows that the number of food and beverage providers in Indonesia has a total of 11,001 units. There are 1,794 businesses in the culinary field recorded in West Java Province. West Java Province has the second largest population of culinary businesses after Jakarta Province. This makes the West Java Province the second favourite place for visitors to do culinary tourism. In addition, nowadays it is also common for the culinary business to become one of the tourism icons in an area. Each region has its unique cuisine and this can be a draw for its taste and history. Culinary often becomes a brand that elevates an area (Media Indonesia, 2021).

A business is required to have strong competitiveness so that the business can survive and thrive. Innovation can be a source of success for a business. It takes the ability to generate new and different product ideas through innovation, as well as the courage to take risks and be optimistic about the success of the ideas initiated. Involvement in a business, especially in the culinary world, requires an innovation that can differentiate it from its competitors.

In this regard, as a newcomer to the culinary industry, especially processed fish products, Company X must also create innovations to compete in the market. At the beginning of the establishment of Company X, many people

were curious about the menu offered and were willing to wait in long queues. Many customers are willing to queue up to 2.5 hours for the fish and rice menu offered by Company X. Days after the grand opening, long lines always occur at Company X outlets from visitors who are curious about the menu offered (Detik Food, 2019).

Coupled with the Covid-19 outbreak, Company X increasingly requires creating something unique to at least maintain the position it has achieved. It was recorded that around 30 million micro, small, and medium enterprises (MSMEs) went out of business due to the implementation of the Covid-19 outbreak's area restrictions. Based on the data of the Association of Indonesian Micro, Small and Medium Enterprises, there are approximately 34 million micro-enterprises in 2020, a decrease of more than 50 percent from around 64.7 million businesses in 2019. This has also caused more than 7 million MSME workers to lose their jobs (CNN Indonesia, 2021). However, this contrasts with Company X. In 2020-2021 when many restaurants are threatened with bankruptcy and have even gone bankrupt, Company X continues to open seven branches, including relocation, in Bandung City. Of course, this needs to be investigated further to find out if there is an influence of Company X's innovation on competitive advantage.

2. Literature study

According to Pradeep, Appel, & Sthanunathan (2018:123), the process of product innovation requires a research team to continuously do the update things and then visit trending places to determine the consumers' needs. Later, the innovator examines the data that has been collected and then exchanges ideas to determine the product innovations that might be interesting. The concept that has been formed is then presented to the consumer group. Then potential consumers will be asked to choose the most interesting idea, then it will be used in the future.

Product innovation based on Kotler & Keller (2016: 454-458) is defined as the result of different processes that match and influence each other. By innovating products, it is hoped that buyers can make better purchasing decisions. There are four dimensions of product innovation, namely:

- 1. New products for the world. It is done by focusing on incremental innovation, entering new markets through product customization for new consumers, and utilizing a variety of core products to always be one step ahead of the market.
- 2. Improvement of the existing product. It means the products that offer greater or better value performance and can replace existing products, including new products whose performance is improved.
- 3. New product lines i.e., new products that may make the company enter an established market for the first time, by using a new product line so that consumers can make product choices.
- 5. Addition to an existing product line. It is a new product that adds to or complements a product line from an established company so that the product is more diverse and can provide many choices.

As described by Bharadwaj, Varadarajan, & Fahy (1993: 83-84), unique skills and strengths are seen as a source of competitive advantage. If there is no uniqueness, the company's ability to develop skills as well as to apply strategies based on its human resources will be difficult to catch up with its competitors. While unique resources or assets are resources or assets that are needed by the company to carry out a competitive strategy. These two resources are needed to support the creation of a low-cost business and differentiate it from the rest of the field. Competitive advantage in this study is measured using five indicators from Bharadwaj, Varadarajan, & Fahy (1993) namely: product uniqueness, difficulty to be imitated, rare to find, competitive price, and difficulty to be replaced.

In addition, according to Diderich (2020: 184), competitive advantage in a company can be demonstrated through differentiation such as having uniqueness in one or more aspects. It can be seen where the same product is not offered by another company and results from special abilities, unique technologies, and access to resources or patents. The customer perspective is very important in defining competitive advantage based on differentiation because the differentiation that is seen explicitly or implicitly can have an impact on customer decisions. Innovative firms usually compete by demonstrating a distinct competitive advantage. Some previous studies focus on innovation and competitive aspects. From a study by Lestari, Budianto, & Setiawan (2020) on decorative umbrella craft products, the results show that product innovation partially has a significant effect of 18.49 percent on competitive advantage. Furthermore, product quality partially has a significant effect of 20.25

percent on competitive advantage. Meanwhile, simultaneously, product innovation and product quality have an effect of 33.64 percent on competitive advantage.

A study by Taan (2017), which examines handicraft products, shows product and price innovation, partially, have a significant influence on competitive advantage. Furthermore, both simultaneously have a significant influence on competitive advantage. A study by Ferreira, Coelho, & Moutinho (2020) shows that dynamic ability, creativity, and innovation ability significantly and positively affect company performance and competitive advantage with entrepreneurial orientation as a moderating variable. Another study by Ferreira, Cardim, & Branco (2018) shows the positive influence of dynamic capabilities on competitive advantage and company performance, through moderating marketing capabilities and innovation capabilities. Hussain et al.'s (2020) research in the hospitality industry shows that sustainable brand equity and marketing innovation have a positive influence on market performance by intermediary competitive advantage. The results of another study by Srivastava, Sultan, & Chashti (2017), which takes the object of the study of the agribusiness industry, show that there is a significant influence of innovation competence on the enterprise's competitive level. Udriyah, Tham, & Azam (2019), which examines SMEs in the textile sector, shows that market orientation and innovation simultaneously have a positive and significant impact on competitive advantage and business performance by 46.3 percent.

3. Methodology

This study is causal descriptive research. It uses quantitative research analysis through the descriptive analysis method and simple linear regression. The research strategy used is a survey by distributing questionnaires as the data collection technique. The independent variable in this study is Product Innovation (X), while the dependent variable in this study is Competitive Advantage (Y). Following Table 1 contains the operational variables.

Table 1: Operational variables

No.	Variable	Sub Variable	Indicator	Code
1	Product Innovation (Kotler & Keller, 2016:454-458)	New Products	Company X always focuses on innovating its new menu.	PI1
			Company X's new product innovation is getting better and better.	PI2
		Existing Product Improvements	Want to insert other innovations when improving their products	PI3
			I feel that product innovations that still need improvement are always evaluated by Company X	PI4
		New Product Line	Company X continues to innovate on its newest product line. (Such as a new product line, namely in the form of a pop fish snack)	PI5
		Additions to existing product lines	Company X continues to innovate by adding new product variants to a product line. (Such as the addition of the spice variant menu on the pop fish snack)	PI6
2	Competitive Advantage (Bharadwaj, Varadarajan, & Fahy, 1993)	Product uniqueness	Company X has a menu with its characteristics that make its products unique to enable them to excel in the competition.	CA1
			I feel that the characteristics of the food they have can be one of the reasons why consumers choose Company X over its competitors.	CA2
		Difficulty to be imitated	The menu offered by Company X may be difficult for competitors to imitate.	CA3
			I feel like I haven't found a competitor that can imitate the food from Company X.	CA4
		Rare to find	I find it rare to get food with the taste that Company X has in its competitors.	CA5
		Competitive price	The prices that Company X charge to consumers are affordable so they can compete in the market.	CA6
		Difficulty to be replaced	It is difficult to find a meal replacement product offered by Company X elsewhere or its competitors.	CA7

The scale used in the distributed questionnaire is a five levels Likert scale. Because Company X cannot provide the number of customers' data, this study uses Bernoulli's formula to determine the number of samples. With an accuracy rate of 5 percent, confidence level of 95 percent, Z value equals 1.960, and an error rate of 10 percent, the formula results in the number of 96.04 which is rounded to 100. Therefore, the number of respondents for this study is 100 respondents. The sampling technique used in this research is non-probability sampling with purposive sampling. The sample criteria taken are Company X consumers in Bandung City who have made transactions at least once in the last 6 months with an age range of 15-54 years old.

The questionnaires distributed have gone through validity and reliability tests first with the number of respondents as many as 30 people. The validity test was carried out by using the Pearson Product Moment formula. As for the reliability test, the researcher used the Cronbach's Alpha method. Furthermore, for data analysis, this study used descriptive analysis. Based on the evaluation criteria for each questionnaire's statement, the rating categories are obtained as shown in Table 2 below.

Table 2: Rating categories

Proportion	Category
20% - 36%	Very low
37% - 52%	Low
53% - 68%	Medium
69% - 84%	High
85% - 100%	Very High

Source: own elaboration

Furthermore, to determine the direction of the relationship between the independent and the dependent variable and predict the value of the dependent variable if the value of the independent variable changes, this study uses simple linear regression analysis. To test the research hypothesis, the researchers used a t-test with criteria for accepting or rejecting H0 at a 95 percent confidence level or a five percent error rate. The hypotheses of this research are:

H0: There is no effect of product innovation on the competitive advantage.

H1: There is an effect of product innovation on the competitive advantage.

Finally, to find out the influence percentage of the independent variable on the dependent variable simultaneously, the study uses the coefficient of determination. Furthermore, the results of the data analysis are presented in the next section.

4. Result and discussion

From the observations on the Company X, it is known that some of its innovations are:

- Company X has two concepts to be offered to the partner who wishes to participate. The first concept is a regular franchise, which means all operational funds are directly managed by partners. This concept is very appropriate for potential partners who want to be serious when running their business. The second concept is autopilot where all operational processes are directly managed by the Company X team, while partners only need to receive monthly results reports. The following concept is appropriate for partners who want to do business but do not want to do it themselves due to limited time.
- Company X is inspired by a fish and chips dish, but then it was modified to replace chips with rice according to the staple food of Indonesians. The main menu is fish fillet wrapped in flour and equipped with a dish of coconut rice and a variety of chili sauces to choose from. As an accompaniment to the fried fish, rice is also provided with the stuffing of fine anchovies and sliced lime leaves.
- Before the grand opening, a branch of Company X created an Instagram account that provides the latest information for its followers such as information on the menus offered, guessing games with prizes, and so on. Four days before the grand opening, buyers can pre-order the food from Company X with a minimum purchase requirement of three portions through a marketplace.
- Company X has more than 3 food packages with a menu that is constantly being developed.

4.1 Validity and reliability test

Before discussing the results of the descriptive analysis, it is needed to know the results of the validity and reliability tests carried out. The results of the validity test are used to see the degree of accuracy between the data that occurs in the research object and the data that can be reported by the researcher. Based on the results of the validity test using SPSS, the values obtained for all Product Innovation (PI1 – PI6) and Competitive Advantage (CA1 – CA7) statements have a t-count result that is greater than the standard value. It is also found that the 2-tailed significance value is smaller than the significance level. This result indicates that all statement items are valid. While the results of the reliability test show that six statement items for the Product Innovation variable and seven statement items for the Competitive Advantage variable have Cronbach's Alpha values that are greater than the good limit indicator value. These results indicate that both variables are indicated as reliable.

4.2 Characteristics of respondents

Based on data from 100 respondents in this study, the characteristics of respondents based on age were dominated by respondents aged 15-24 years old with a proportion of 95 percent. Meanwhile, the proportion of respondents aged 25-54 years old is 5 percent. If classified by gender, most of the respondents in this study were women with a proportion of 57 percent. Meanwhile, the proportion of male respondents is 43 percent. Furthermore, if classified by occupation, students dominate the total respondents with a proportion of 70 percent. It then followed by the private employees around 18 percent, entrepreneurs around 8 percent, and housewives around 4 percent.

If classified based on monthly income, it is recorded that respondents with monthly income below IDR 1,800,000 dominate with a proportion of 50 percent. The next rank is respondents with a monthly income between IDR 1,800,000 to IDR 3,000,000 with a proportion of 25 percent. Furthermore, respondents with monthly income between IDR 4,800,001 to 7,000,000 with a proportion of 10 percent, monthly income of IDR 3,000,001 to 4,800,000 with a proportion of 8 percent, and monthly income above IDR 7,000,000 with a proportion of 7 percent.

4.3 Descriptive analysis

4.3.1 Assessment of product innovation

Table 3: Assessment of product innovation

Statement	Score	Category
PI1	72.2%	High
PI2	74.4%	High
PI3	76.6%	High
PI4	76.2%	High
PI5	77.8%	High
PI6	78.0%	High
Total	75.8%	High

Based on Table 3 above, PI6 is the statement with the highest rating with a score of 78 percent. The PI6 statement is in the high category. This shows that respondents agree and respond positively to Company X because it has made innovations in adding new product variants to its product line.

While the lowest score of respondents' assessment for the product innovation variable is in the PI1 statement with a score of 72.2 percent. This PI1 item states that Company X always focuses on innovating its new menu. Even though this statement received the lowest assessment score, the rating category was still included in the high category. This proves that the response given to all indicators of product X innovation is positive. Overall, the consumer's assessment of the Product Innovation variable belongs to the category of high percentage grouping with a score of 75.8 percent.

4.3.2 Assessment of competitive advantage

Table 4: Assessment of competitive advantage

Statement	Score	Category
CA1	80.4%	High
CA2	82.2%	High
CA3	64.0%	Medium
CA4	68.6%	Medium
CA5	72.6%	High
CA6	79.0%	High
CA7	72.2%	High
Total	74.1%	High

Based on Table 4 above, CA2 is the statement with the highest score of 82.2 percent. The CA2 statement is in the high category. This result shows that respondents agree and respond positively to Company X because it has a characteristic in its food to be one of the causes of consumers choosing Company X over its competitors. Meanwhile, a statement that received the lowest score was CA3 at 64 percent. With this score, CA3 is still in the medium category. This shows that respondents feel that the menu offered by X is not too difficult for competitors to imitate. Overall, the consumer's assessment of the Competitive Advantage variable is included in the high category with a score of 74.1 percent.

4.4 Simple linear regression analysis

From the results of the analysis of variance (ANOVA), it is found that the F count equals 101.896 with a significance level of 0.000. This value is smaller than 0.05, so it can be identified as the influence of the Product Innovation variable (X) on the Competitive Advantage variable (Y). Furthermore, the regression equation is seen as follows:

$Y = 5.149 + 0.869X$

From this regression equation, it can be interpreted that the consistent value of the Competitive Advantage variable is 5.149. With a regression coefficient of Product Innovation (X) of 0.869, it shows that for every additional value of Product Innovation, the value of Competitive Advantage increases by 0.869. The regression coefficient is positive, so it can be said that the direction of the influence of the variable X on Y is positive.

4.5 Hypothesis test

The results of the t-test indicate that the significance value of the effect of Product Innovation on Competitive Advantage is 0.000, where this value is less than 0.05. Meanwhile, the t-count value is 10.094, where this value is greater than the t-table value of 1.984. Because of these results, it can be indicated that H0 is rejected and H1 is accepted. The hypothesis test proves that there is an effect of Product Innovation (X) on Competitive Advantage (Y).

4.6 Coefficient of determination

The result of the coefficient of determination test shows that the value of r^2 or the coefficient of determination is 0.510. This indicates that the Product Innovation variable provides more than half of the information needed to predict the Competitive Advantage variable. The magnitude of the influence of Product Innovation on Competitive Advantage is 51 percent.

By comparing to the previous studies, this study strengthens studies by Lestari, Budianto, & Setiawan (2020) and Taan (2017) which show the effect of product innovation on competitive advantage. There is a difference in the value of the influence of product innovation on competitive advantage between this study and Lestari, Budianto, & Setiawan (2020). It is reasonable considering that both are researching different sub-sectors of the creative economy. This study examines the culinary sub-sector, while the two studies examine the craft sub-sector.

Furthermore, this study also strengthens the research of Ferreira, Coelho, & Moutinho (2020), Ferreira, Cardim, & Branco (2018), Hussain et al. (2020), Srivastava, Sultan, & Chashti (2017), and Udriyah, Tham, & Azam (2019) which shows that innovation, as a variable with various dimensions, influences competitive advantage.

Innovation together with other variables and as an intermediary variable influence competitive advantage in various economic sectors.

5. Conclusion

From the data processing and analysis that has been done, it can be concluded several things as follows:

- Product Innovation and all its indicators are in the high category based on the respondents' assessment.
- Competitive advantage is in the high category based on the respondent's assessment, although the difficulty to be imitated indicator is still rated medium.
- Product innovation has a positive effect on competitive advantage by 51 percent. Furthermore, the value of Competitive Advantage is 5.149 if product innovation is worth 0. For every addition of one value to Product Innovation, the value of Competitive Advantage increases by 0.869.

It is suggested for the X company to improve the 'difficult to be imitated' aspect, so later the customers will perceive it as a high category indicator. For further research, it is encouraged to conduct the study to measure the impact of product innovation on the competitive advantage as a periodic study. Hence, there will be seen the company's innovation performance periodically. It is also suggested to explore the other aspects that influence the company's competitive advantage and compare the condition of innovation and competitive advantage during and after the Covid-19 outbreak.

References

Bharadwaj, S. G., Varadarajan, P. R., & Fahy, J. (1993). "Sustainable competitive advantage in service industries: a conceptual model and research propositions". *Journal of Marketing*, Vol. 57, No.4, pp 83-99. https://doi.org/10.2307/1252221

CNN Indonesia. (2021). "30 Juta UMKM Bangkrut, 7 Juta Orang Kehilangan Kerja (30 Million MSMEs Bankrupt, 7 Million People Lost Their Jobs)" [online]. https://www.cnnindonesia.com/ekonomi/20210326124010-92-622407/30-juta-umkm-bangkrut-7-juta-orang-kehilangan-kerja

Detik Food. (2019). "Ngikan: Rela Antre 2,5 Jam Demi 'Fish & Chips' ala Indonesia Racikan Rachel Vennya (Ngikan: Willing to Queue for 2.5 Hours for Indonesian 'Fish & Chips' Concocted by Rachel Vennya)" [online]. https://food.detik.com/resto-dan-kafe/d-4782701/ngikan-rela-antre-25-jam-demi-fish--chips-ala-indonesia-racikan-rachel-vennya

Diderich, C. (2020). *Design Thinking for Strategy: Innovating Towards Competitive Advantage*. Springer, Switzerland.

Ferreira, J., Cardim, S., & Branco, F. (2018). "Dynamic capabilities, marketing and innovation capabilities and their impact on competitive advantage and firm performance". In *2018 13th Iberian Conference on Information Systems and Technologies (CISTI),* pp. 1-7. IEEE. https://doi.org/10.23919/CISTI.2018.8399271

Ferreira, J., Coelho, A., & Moutinho, L. (2020). "Dynamic capabilities, creativity and innovation capability and their impact on competitive advantage and firm performance: The moderating role of entrepreneurial orientation", *Technovation*, 92, 102061. https://doi.org/10.1016/j.technovation.2018.11.004

Hussain, I., Mu, S., Mohiuddin, M., Danish, R. Q., & Sair, S. A. (2020). "Effects of sustainable brand equity and marketing innovation on market performance in hospitality industry: mediating effects of sustainable competitive advantage" (Effects of sustainable brand equity and marketing innovation on market performance in the hospitality industry: mediating effects of sustainable competitive advantage). *Sustainability*, Vol.12, No.7, p. 2939. https://doi.org/10.3390/su12072939

Kotler, P., & Keller, K.L. (2016). *Marketing Management* (15th Global Edition*)*. Pearson, England

Lestari, W.A., Budianto, A., & Setiawan, I. (2020). "Pengaruh Inovasi Dan Kualitas Produk Terhadap Keunggulan Bersaing: Suatu Studi pada Payung Geulis Mandiri Tasikmalaya" (The Effect of Innovation and Product Quality on Competitive Advantage (A Study on Payung Geulis Mandiri Tasikmalaya)). *Business Management and Entrepreneurship Journal*, Vol.2, No.1, pp. 56-65. https://jurnal.unigal.ac.id/index.php/bmej/article/view/2451

Media Indonesia. (2021). "Jawa Barat Genjot Angka Kunjungan Wisatawan (West Java Boosts Tourist Visits)" [online]. https://mediaindonesia.com/nusantara/400253/jawa-barat-genjot-angka-kunjungan-wisatawan

Pradeep, A. K., Appel, A., & Sthanunathan, S. (2018). "*AI for marketing and product innovation: powerful new tools for predicting trends, connecting with customers, and closing sales"*. John Wiley & Sons.

Sindo News. (2020). "Industri Kuliner Berkembang Pesat di Indonesia (Culinary Industry is Growing Rapidly in Indonesia)". [online]. https://daerah.sindonews.com/read/266736/701/industri-kuliner-berkembang-pesat-di-indonesia-1607861534#:~:text=Di%20Indonesia%20sendiri%2C%20dari%20data,Rp922%20triliun%20pada%20tahun%202016

Srivastava, S., Sultan, A., & Chashti, N. (2017), "Influence of innovation competence on firm level competitiveness: an exploratory study", *Asia Pacific Journal of Innovation and Entrepreneurship*, Vol. 11, No. 1, pp. 63-75. https://doi.org/10.1108/APJIE-04-2017-021

Statistics Indonesia. (2018). *Statistik Indonesia: Statistical Yearbook of Indonesia 2018*. BPS, Jakarta

Taan, H. (2017). "Pengaruh Inovasi Produk dan Harga Terhadap Keunggulan Bersaing Usaha Karawo di Kota Gorontalo. (The Effect of Product and Price Innovation on the Competitive Advantage of Karawo Business in Gorontalo City)", *Jurnal Bisnis & Kewirausahaan*, Vol.6, No.2, https://e-jurnal.nobel.ac.id/index.php/jbk/article/view/92

Udriyah, U., Tham, J., & Azam, S. (2019). "The effects of market orientation and innovation on competitive advantage and business performance of textile SMEs", *Management Science Letters*, Vol. 9, No. 9, pp. 1419-1428. https://doi.org/10.5267/j.msl.2019.5.009

Assessment Dimensions and Items for the Evaluation of the Technological Maturity of Applied R&D Organizations

Fabian Hecklau[1], Florian Kidschun[1] and Holger Kohl[2]
[1]Fraunhofer IPK, Division Corporate Management, Berlin, Germany
[2]Technical University of Berlin, Department Sustainable Corporate Development, Berlin, Germany
fabian.hecklau@ipk.fraunhofer.de
florian.kidschun@ipk.fraunhofer.de
holger.kohl@tu-berlin.de

Abstract: Applied research and development (R&D) organizations strive to develop technological solutions that translate results from research and science into state-of-the-art products and services. This can only be achieved when technological resources and competences are effectively and efficiently used to build up competitive advantages. Therefore, the assessment of the technological capability can provide applied R&D organizations with information on strengths and weaknesses in their specific technology areas, on the basis of which technology strategies can be derived to contribute to the development and training of substantial (core) competences, which in turn improve the quality of unique and differentiating products and services. In this context, the main aim of this paper is to describe crucial assessment dimensions and the respective items within those dimensions. Therefore, it must be focused on the technology basis of the applied R&D organization to identify important evaluation items. The technological base serves as input, as both technologies and competencies that are used for the execution of R&D activities need to be analyzed and evaluated. Additionally, the results of the R&D activities need to be focused as outputs. In this regard, technologies that result in products or technological services need to be considered. Lastly, assessment items in the field of cooperation must be taken into account as technological synergies through partnerships are important success factors for R&D organizations. In this context, partners who support the execution of R&D activities must be focused.

Keywords: assessment dimensions & items, technological capability, technological resources, technological competences, technology evaluation, strategic technology management, research and technology organizations

1. Introduction

The *technology audit* presents a suitable methodology and approach for the assessment of the technological maturity of an applied R&D organizations and in a broader sense also of RTOs within a workshop procedure (Rubenstein and Geisler 1991; Porter 1978). In the following, it will only be referred to the term *RTO* which will here denote RTOs in a broader sense as well as applied R&D organizations. The technology audit mainly focusses on the analysis of research work within the R&D service areas of the RTO in order to get a comprehensive understanding of the used technologies, research competences, developed technologies as well as the established technological partnerships of the RTO.

The methodology of the technology audit has been developed over a long period of time and has been updated constantly. It has been developed through a series of papers over time. This paper provides a detailed analysis of crucial assessment dimensions and assessment elements. Additionally, a brief overview of the methodology itself and is the condensed outcome of previous research work is given. The derivation of the methodology as well as the previous academic work that lead to this paper can be found in the following publications: (Hecklau et al. 2019a; Hecklau et al. 2019b; Hecklau et al. 2019c; Hecklau et al. 2020a, 2020b, 2020c; Hecklau et al. 2022). These papers take into consideration a large number of literature and expert discussions, which are highlighted in the respective papers in detail.

2. Method of technology audit

The technological performance of RTOs and thus its technological maturity is analyzed and subsequently assessed with the help of the technology audit assessment procedure. For this purpose, a standardized procedure is available in addition to various models, such as the maturity model or the assessment dimensions model, as well as the tools and templates. This procedure enables a structured assessment of the RTO to be audited. The three main steps and a fourth optional step are described in Figure 1 below. (Hecklau et al. 2022)

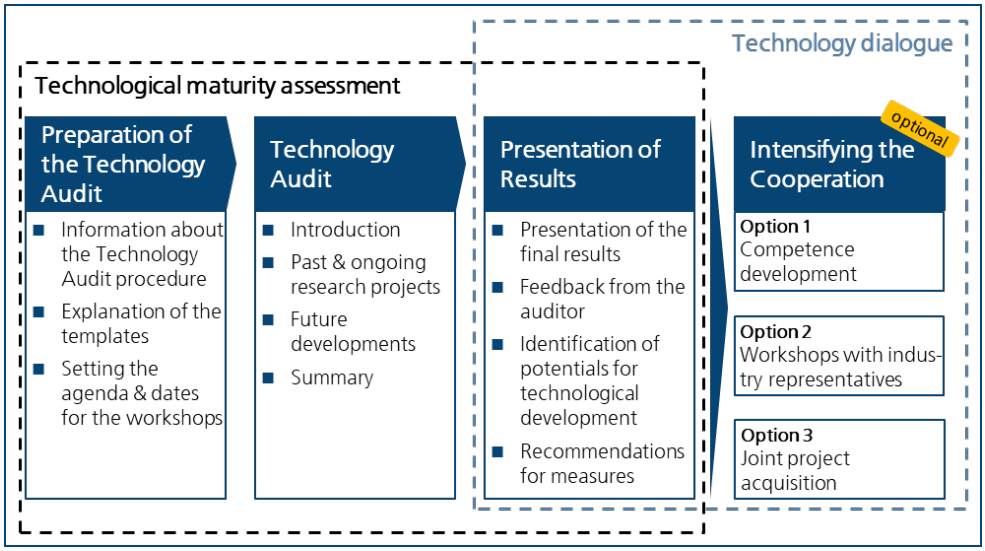


Figure 1: Technology audit procedure

The procedure consists of two main parts: the *technological maturity assessment* as well as the *technology dialogue*. The *technology audit* workshop as the main session takes place in the technological maturity assessment process step. In this step, the technological maturity of the RTO will be assessed using the assessment dimensions and assessment elements, that are focused and described in detail in this paper. Further steps are the *preparatory session* and the *final presentation and discussion of the auditor's assessment results*. In the second and optional part of the *technology dialog* the aim is a further cooperation between the technology auditor and the organization to be audited. For this purpose, for example mutual competence development is aimed based on the results of the assessment of technological maturity. Activities to initiate joint research activities, such as workshops with industry representatives or joint project acquisitions, are also possible. It is important that the neutrality of the auditor is ensured despite of any intended further cooperation. (Hecklau et al. 2022)

3. Assessment dimensions and assessment elements

Within the procedure as briefly described above, three main technological assessment dimensions and the respective assessment items form the basis within the technology audit workshop. These dimensions target the RTO's *technology base*, *products and services*, and *collaboration*. Within the assessment dimensions, further assessment items are defined and will be described in detail in this chapter. These concretize the dimension and enable a targeted assessment within the technology audit.

On the one hand, the *technological base* of the RTO will be analyzed and assessed. This dimension serves as the "input-dimension" as technologies as well as competences, that are available and actually used for the execution of R&D projects, are evaluated. The output-dimension, which is called *products & services*, focusses on the results of the executed R&D projects. In this dimension, technologies that are developed as products or technological services are analyzed and assessed. In the third dimension, the *cooperation*, technological synergies through partnerships are evaluated. In this context, partners that support the execution of R&D projects are put into focus. (Hecklau et al. 2022) The three main dimensions are shown in the figure below.

In the following chapter, the three dimensions will be further explained and operationalized. The selected assessment items as well as the aspects and descriptions are based on an extensive literature review that include the following sources: (Garcia-Arreola 1996; Kaiser 2001; Hecklau et al. 2018; Phaal et al. 2004; Prahalad and Hamel 1990; Herstatt and Lettl 2001; Martinez-Vela 2016; Oberhagemann 2015; Sun and Fan 2016; Geisler 1999; Phaal et al. 2001; Kohl 2003; Coombs and Bierly 2006; Labuschagne and Brent 2006; Rush et al. 2007; Lau et al. 2010; Chen and Zhao 2012; Macchi and Fumagalli 2013; Liu and Jiang 2016; Chakravarty et al. 2013; Zhou et al. 2016; Gökalp et al. 2007; Ravichandran 2017; Lee et al. 2018; Salisu and Abu Bakar 2020; Wu et al. 2020; Hassan et al. 2021)

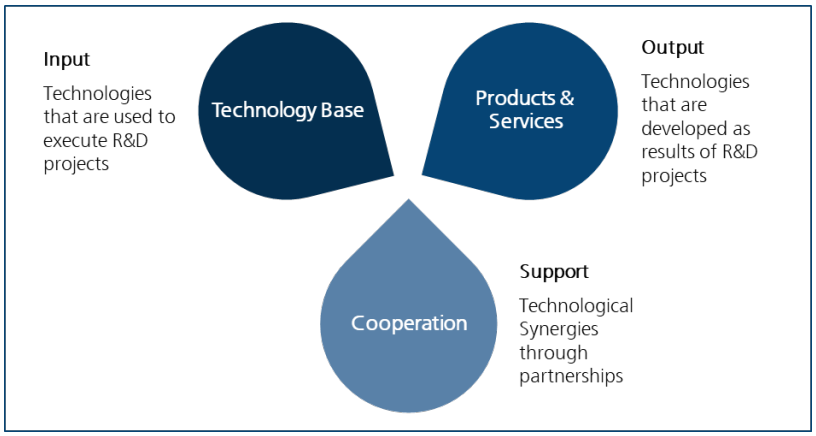


Figure 2: Dimensions of the technology audit

The essence of the literature review is described in the following chapters 3.1, 3.2. and 3.3.

3.1 Technology base

As the dimension *technology base* focusses on the technologies and competences of the RTO that are available and used to execute R&D projects, it can be described as the input dimension. The leading question for assessing this dimension can be formulated as follows: *Is the technology base of the RTO sufficient to be able to execute R&D projects in the defined technology & service areas on a state-of-the-art level?* To answer this leading question, three main items can be identified and operationalized with other key questions.:

- Core competences: Does the RTO possess the necessary core competences to cover its defined research areas and to deliver its defined products & services?
- Technologies, equipment and infrastructure: Does the RTO possess the necessary technologies, core equipment and infrastructure to cover its defined research areas and to deliver its defined products & services?
- Future technology developments: Is the RTO aware of future technology developments and does it have a strategy to evolve competences and infrastructure accordingly?

To detail and operationalize the raised leading key questions a set of assessment items with various aspects have been identified and will be described in the following table.

Table 1: Assessment items of the assessment dimension "technology base"

Assessment Item	Aspect	Description
Technology Base		
Technology Strategy	Technical Resource Planning	Effective and efficient planning of technology resources are essential to the RTO's performance and the ability to execute high-quality R&D work.
	Human Resource Planning	Human resource planning includes effective recruitment, human resource development and retention management within the RTO.
	Technology Benchmarking	Suitable technology benchmarking enables the comparison to state-of-the-art technology and thus the derivation of the technological maturity. Additionally, it allows the optimization of the own technology base.
	Technology Foresight	The look into the future and the identification of potential new relevant technologies form the basis for innovation research and builds the basis for a long-term technology strategy.
	Technology Roadmapping (external)	External technology roadmapping enables the RTO to plan strategically the integration of needed technologies into the own infrastructure in a long-term perspective by anticipating possible developments in markets, products and technologies.
	Awareness of new usable Technologies	The constant awareness of new usable technologies besides the very structure approaches of technology foresight and technology roadmapping is an important part of the mindset and thus a crucial factor for an RTO's competitiveness.
Technical Infrastructure	Building(s)	Building in which the RTO operates. It contains all rooms, such as laboratories and offices and the technical networking of the rooms.

Assessment Item	Aspect	Description
	Laboratories	All premises in which technical equipment is provided and operated. Laboratories are used for technical work such as tests, experiments or measurements.
	Maintenance of Infrastructure	The technical infrastructure, such as buildings and laboratories located therein, must be maintained and serviced in order to be functional in the long term.
	Accreditation	For certain activities, it is necessary to have laboratories or entire buildings certified and / or accredited according to certain standards in order to obtain an operating license. These include certified clean rooms, for example.
Technical Equipment / Software	General Equipment / Software	All basic equipment as well as technologies and software that are available and required to fulfill the services offered are considered here. These are standard equipment and standard software that are mandatory.
	Specific Main Equipment / Software	All specific equipment as well as highly specialized technologies and special software that are available and required to fulfill the services offered are considered here. This involves special equipment and special software that goes well beyond standard existing equipment.
	Maintenance of Equipment / Software	The existing general and specific main equipment must be maintained and serviced in order to be available in the long term as a resource for performing research services and developing products. Software must also be updated regularly and replaced by the latest versions to be functional in the long run.
Competences	General Technical Competences	A competence describes the ability to apply knowledge and skills in a targeted manner. General technical competences that are necessary to carry out research services and to develop products are taken into account here.
	Specific Technical Competences	A competence describes the ability to apply knowledge and skills in a targeted manner. A competence describes the ability to apply knowledge and skills in a targeted manner. This aspect takes into account the specific technical competences required to perform research services and develop products.
	Core Competences	The technological core competences represent bundles of technologies and capabilities with a concrete application reference (technological competences) which, detached from concrete product and market constellations, lead to a decisive competitive advantage through superior customer benefits. Core competences should be valuable, rare, difficult for competitors to imitate and not substitutable by other competences.
	Formal Qualification of Staff	The various competence areas of employees can partly be described based on formal qualifications, such as professional degrees, certifications etc., which are considered here.
	Competence Development / Training	The RTO can proactively contribute to the employee competence development by providing internal or external trainings and education. This builds the basis for the necessary qualification level of the human resources for today and the future.

3.2 Products and services

As the dimension *products & services* is mainly focusing on the results of research, development and innovation projects and on the creation of innovative solutions, it can be described as the output dimension. The leading question is the following: *Is the RTO actually transforming technologies into innovative applications / products with a clear benefit for the industry by executing R&D projects in the defined R&D / service areas?* The following items and operational key questions help to guide the technological maturity assessment:

- Execution of R&D projects: Is the RTO executing and delivering R&D projects with an ambitious degree of complexity in all of its defined research / service areas?
- Transformation of state-of-the-art technologies into products and services: Is the RTO transforming state-of-the-art technologies into innovative applications, products and services with a benefit for the industry?

- Potential new technological solutions, products and services: Is the RTO aware of potential new technological solutions, products and services to increase its competitiveness and pursue a unique selling proposition on the market?

The following table describes the main assessment items and the respective aspects of the assessment dimension of *products & services*.

Table 2: Assessment items of the assessment dimension "products & services"

Assessment Item	Aspect	Description
Products & Services		
Complexity of R&D&I Results	Market-Pull / Technology Push	Market-Pull refers to a customer-driven product innovation. Conversely, Technology Push refers to a new technology or a new application of a technology that provides an innovation or problem solution on the market.
	Diversification according to TRL	Technology readiness levels (TRL) are used to classify the range of conducted research activities between basic research, applied research and commercialization. Within an RTO various TRL level should be addressed to diversify the research activities.
	Multidisciplinarity	Multidisciplinarity describes the number and diversity of scientific disciplines engaged in research activities of the RTO.
	Project Volume	Complex research projects need an adequate financial volume in order to have the chance to create complex and innovative research results.
	Run Time of the Project	Longer projects allow more complex research activities and thus can lead to more complex research results in the defined duration of the project.
	Follow-Up Projects	All projects that follow on from the completed project and possibly build on it in terms of content allow the creation of more complex research results.
Innovative Technological Results	High Quality Products / Processes	A high technological maturity lead to a high quality of the products and processes offered by the RTO, in particular in regards to the clear benefit for the industry.
	High Quality Technical Services	A high technological maturity lead to a high quality of the technical services provided by the RTO, in particular in regards to the clear benefit for the industry.
	Customized Technical Solutions	Innovative technological results can also be described by the extent to which the RTO is able to offer customer-specific technical solutions. This aspect takes into account how complex and individual requirements can be addressed.
	High-Quality Research Work	A high-quality research work of the RTO builds the basis for successful creation of innovative technological solutions.
	Technology Protection / IP	Protecting its own technologies through effective IP management is a crucial factor for the RTO to ensure long-term competitiveness. As intangible technological resources, patents and licenses are a central dimension of this.
New Technological Solutions as Products	Technology Trends	The innovativeness of technologies can only be considered in the context of global technology trends, that indicate which technologies are currently formative and will be in the future as potential new products of the RTO.
	Technology Scouting	Effective technology scouting is essential to identify technology trends and innovative technologies at an early stage. The RTO can thus position itself accordingly to be able to develop state-of-the-art technologies as products itself.
	Technology Roadmapping (internal)	Roadmapping internal technology developments enables the RTO to plan strategically and for the long term by working out the expected future developments of the own technological solutions as products.
	Potential Technology Spillovers	Technology spillover refers to the unintentional technological benefits of and to the RTO that result from the research and development efforts of the RTO and other companies without sharing the costs. The RTO can thus benefit from transmission effects to create new technological solutions as a product.

3.3 Cooperation

In the *cooperation* dimension, the level of integration of the RTO within the regional, national, or even international innovation ecosystem is analyzed and assessed. Synergetic technological cooperation helps the RTO to get access to complementary research competences or even technologies, equipment and infrastructure from partners, which are needed for the research work. In this sense, this dimension can be described as the support dimension and focusses on the following leading question: *Does the RTO actively insert itself into an attractive innovation ecosystem and create strategic technological synergies with high-level R&D partners to expand its own field of actuation?* The following further items and operational key questions support finding an answer to it:

- Cooperation with external R&D partners: Does the RTO cooperate with external R&D partners to create interdisciplinary technological synergies and develop new technologies & applications on a higher complexity level?
- Integration & usage of technologies from externals: Does the RTO integrate and use technologies or solutions from partners or technological service providers in its own R&D projects?
- National / international players as new partners: Is the RTO aware of national and international players in relevant technology fields and strategically pursuing new attractive partnerships?

In the following table the raised leading key questions will be described in detail and operationalized with a set of assessment items with various aspects.

Table 3: Assessment items of the assessment dimension "cooperation"

Assessment Item	Aspect	Description
Cooperation		
Cooperation with External research organizations	Universities	Collaborations with universities and other educational institutions with the aim of jointly providing research results and developing innovative solutions are taken into account in this aspect.
	Research Academies	Research academies as well as scientific working groups can support the activities of the RTO as external cooperation partners. Cooperation with research academies is considered in this aspect.
	RTOs	To provide joint research performances and develop innovative solutions, synergistic collaboration with other RTOs is considered in this aspect.
Cooperation to Subcontractors / Third Parties	Integration & Usage of Technologies from Service Providers	If the technological basis for carrying out research services is not fully available in the RTO, recourse can be made to service providers who make technologies or technological services available. This collaboration for the use and integration of third-party technologies and services are considered in this aspect.
	Integration & Usage of Technologies from Customers	In collaborative applied research projects, it may be possible to leverage end-user technologies and technology services that are needed to deliver or accelerate the targeted research performance. This aspect also focuses on an incomplete technology base of the RTO that necessitates the involvement of partners for service provision.
Cooperation with Innovation Ecosystem	Start-Ups	Cooperation with smaller and young companies / start-ups can be advantageous for the RTO for its own service provision. Innovative and agile start-ups can, for example, close competence gaps of the RTO or support the rapid creation of prototypes.
	Incubators	Incubators can be helpful as cooperation partners for the RTO for further networking with start-ups and young companies. For example, new and innovative ideas from start-ups can be pursued together with the RTO and initiated and supported by incubators.
	Accelerators	Cooperation with accelerators can be advantageous for the RTO's service provision. Accelerators support start-ups, particularly in the early phase, for example by providing coaching or financial resources and by establishing the necessary contacts. RTOs can benefit from start-ups supported by accelerators or can profit from the accelerator's extensive network of experts.

Assessment Item	Aspect	Description
	Science and Technology Parks	RTOs can be a part of a science and technology park, which often results in close collaborations simply because of the physical proximity to other organizations in the park (e.g., industrial companies, other research organizations). However, cooperation can also be beneficial for RTOs that are not part of a science and technology park to work with spatially clustered partners.
Future Cooperation with National / International Partners	Partner Scouting	For future activities of the RTO it is necessary to be able to identify important and potential new partners. Partner scouting aims at the structured observation of current partners as well as the early identification of potential partners that may be important for the service provision of the RTO.
	Competitor Analysis	Competitors can also be interesting as partners for the RTO. There is also a risk that partners may become competitors. Therefore, the focus must be on current and potential competitors that may be relevant for future collaborations.

The above described assessment dimensions and the respective assessment items build the basis for the assessment of the technological maturity of RTOs.

4. Technological maturity model

For the evaluation of the assessment dimensions and the assessment items, a technological maturity model is developed, which consists of different levels. It forms the basis for the assessment of an RTO within the scope of the technology audit, where each of the assessment dimensions and items will be evaluated according to this model. The spectrum comprises various gradations between minimal technological maturity and very high technological maturity. Each level is described individually and specifically for each of the assessment dimensions in order to ensure the highest possible degree of standardization and thus a high degree of comparability between different RTOs. (Hecklau et al. 2022)
After the technology auditor analyzed the different service areas of the RTO by deeply analyzing several R&D projects, technological equipment and research competences, the expert needs to assess the technological maturity of the RTO for each dimension and, if necessary, for each service area. For the evaluation of the dimensions, a Likert-scale is used. The purpose of its application is to give the auditor's subjective discretionary judgments greater accuracy. This is done with the help of a uniform and systematic procedure. (Likert 1932; Neukirch, Semmler 2011; Hecklau et al. 2022)

Therefore, a generic technological maturity model has been created, which consists of 5 different levels, starting with maturity level 1 – minimal technological maturity – and ending with the highest maturity level 5 – very high technological maturity.

The generic technological maturity model is visualized in the following figure.

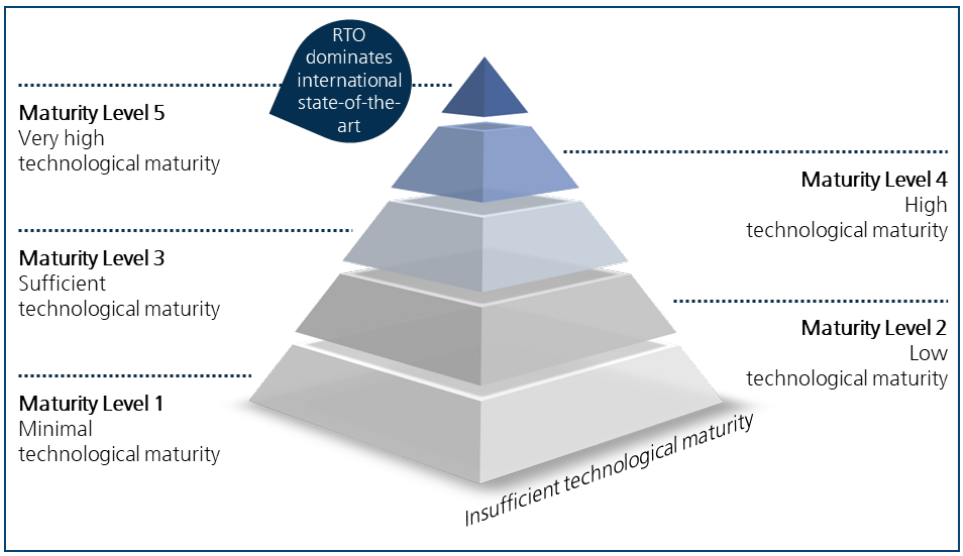


Figure 3: Technology maturity model

If an RTO reaches the technological maturity level 3, which means, that the technological maturity is sufficient, the organization is considered operational with all the necessary technologies, equipment, research competences and strategic technological partnerships to execute R&D projects in its defined service areas. If an RTO reaches a technological maturity level of 4 or higher, it means it is already very mature and is able to execute complex R&D projects and develop very innovative technological solutions. If the different service areas of the RTO are too distinct, it is also possible to define maturity levels not only for each assessment dimension and item, but also for every single service area. As this leads to a big number of maturity levels, it is advised to cluster the assessment of service areas with a similar technical maturity level.

5. Summary and outlook

The technology audit methodology as a procedure to analyze and assess the technological maturity forms the essence of a long-term research work of the authors. In addition to a maturity model, various checklists, templates, etc., the assessment items form the basis for the evaluation of technological maturity. Therefore, the described assessment dimensions and the respective assessment items have been identified and analyzed in detail.

As the technology audit is practically oriented, the high number of assessment items is not practical. That is why, in a next step a questionnaire will be created and distributed to several experts (e.g. methodology expert, technology experts) to assess the relevance of the assessment items. The main goal is to reduce the number of assessment items to an essential minimum. All remaining assessment items will be considered as additional elements.

References

Chakravarty, Anindita; Grewal, Rajdeep; Sambamurthy V. (2013): Information Technology Competencies, Organizational Agility, and Firm Performance: Enabling and Facilitating Roles. In Information Systems Research (24), pp. 976–997.

Chen, Xi; Zhao, Shuming (2012): Research on the evaluation model of Chinese enterprises' technological innovation system. From a perspective of complex system. In Chinese Management Studies 6 (1), pp. 65–77. DOI: 10.1108/17506141211213735.

Coombs, J. E.; Bierly, P. E. (2006): Measuring technological capability and performance. In R & D Management (36), pp. 421–438.

Garcia-Arreola, Javier (1996): Technology Effectiveness Audit Model (TEAM): A Framework for Technology Auditing. Dissertation. University of Miami, Miami, Florida.

Geisler, Eliezer (1999): The metrics of technology evaluation: where we stand and where we should go from here. Illinois Institute of Technology, Chicago, Illinois.

Gökalp, Ebru; Sener, Umut; Eren, P. Erhan (2007): Development of an Assessment Model for Industry 4.0: Industry 4.0-MM. In SPICE, pp. 128–142.

Hassan, Noor Aishah; Zailani, Suhaiza; Rahman, Muhammad Khalilur (2021): Impact of integrated audit management effectiveness on business sustainability in manufacturing firms. In MRR 44 (12), pp. 1599–1622. DOI: 10.1108/MRR-10-2020-0658.

Hecklau, Fabian; Kidschun, Florian; Kohl, Holger (2022): Technology Audit: Procedure for the Assessment of the Technological Maturity of Applied R&D Organizations. In Manuel Au-Yong-Oliveira, Carlos Costa (Eds.): Proceedings of the 21st European Conference on Research Methodology for Business and Management Studies. A Conference hosted by University of Aveiro Portugal, 2-3 June 2022. Reading, U.K.: Academic Conferences International Limited.

Hecklau, Fabian; Kidschun, Florian; Kohl, Holger; Tominaj, Sokol (2019a): Requirements for a Methodology for the Analysis and Assessment of Technological Capability in Research and Technology Organizations. In Anabela Mesquita, Paulino Silva (Eds.): Proceedings of the 15th European Conference on Management, Leadership and Governance ECMLG 2019. [S.l.]: ACPIL, pp. 159–168.

Hecklau, Fabian; Kidschun, Florian; Kohl, Holger; Tominaj, Sokol (2020a): Analyzing the Role of Research and Technology Organizations (RTOs) in National Innovation Systems (NIS). In: Proceedings of 16th European Conference on Management Leadership and Governance (ECMLG).

Hecklau, Fabian; Kidschun, Florian; Kohl, Holger; Tominaj, Sokol (2020b): Generic Process Model for the Structured Analysis of Methods. A Method Engineering Approach for the Analysis of RTO Capability Methodologies. In Manuel Au-Yong Oliveira, Carlos Costa (Eds.): Proceedings of the 19th European Conference on Research Methodology for Business and Management Studies (ECRM). A virtual conference hosted by University of Aveiro, Portugal: Academic Conferences and Publishing International (ACPI).

Hecklau, Fabian; Kidschun, Florian; Kohl, Holger; Tominaj, Sokol (2020c): Structured Analysis of Methodologies for the Assessment of the Technological Capability of RTOs – Using a Method Engineering Approach. In: Proceedings of 15th European Conference on Innovation and Entrepreneurship (ECIE).

Hecklau, Fabian; Kidschun, Florian; Tominaj, Sokol; Kohl, Holger (2019b): Review of Methodologies for the Assessment of the Technological Capability of RTOs. In Zsolt János Viharos, Lorenzo Ciani (Eds.): Proceedings of 16th IMEKO TC10 Conference"Testing, Diagnostics & Inspection as a comprehensive value chain for Quality & Safety", pp. 66–70.

Hecklau, Fabian; Kidschun, Florian; Will, Markus; Kohl, Holger; Prim, Marcelo Fabricio; Pavim, Alberto Xavier; Oliveira, José Eduardo (2019c): Application Example: Assessment of the Technological Maturity of Brazilian Innovation Institutes. In Pabafiotis Liargovas (Ed.): Proceedings of the 14th European Conference on Innovation and Entrepreneurship ECIE 2019, Kalamata, Greece, 19th -20th September 2019. [S. l.]: Academic Conferences and Publishing International (ACPI) (Proceedings of the … European conference on entrepreneurship and innovation (Print)), pp. 363–371.

Hecklau, Fabian; Orth, Ronald; Kidschun, Florian; Nick, Gábor (2018): The Four-Step Approach for the Creation of the HR Concept for the EPIC Centre of Excellence in Production Informatics and Control (EPIC CoE). In Benny M. E. de Waal, Pascal Ravesteijn (Eds.): Proceedings of the 14th European Conference on Management, Leadership and Governance, ECMLG 2018. Hosted by HU University of Applied Sciences, Utrecht, Netherlands, 18-19 October 2018. Reading, U.K.: Academic Conferences and Publishing International Limited, pp. 381–389.

Herstatt, Cornelius; Lettl, Christopher (2001): Management von technologiegetriebenen Entwicklungsprojekten. In Oliver Gassmann, Carmen Kobe, Eugen Voit (Eds.): High-Risk-Projekte. Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 109–131.

Kaiser, Stephan (2001): Entwicklung von Humanressourcen. Eine ressourcen- und lernorientierte Perspektive. Zugl.: Eichstätt, Univ., Diss., 2001. 1. Aufl. Wiesbaden: Springer Fachmedien; Gabler (Gabler-Edition Wissenschaft Schriften zur Unternehmensentwicklung).

Kohl, Holger (2003): Performance of Institutes for Applied Research. In Kai Mertins (Ed.): Innovation in Indonesia. Assessment of the national innovation system and approaches for improvement. Stuttgart: Fraunhofer-Informationszentrum Raum und Bau, pp. 91–112.

Labuschagne, Carin; Brent, Alan C. (2006): An industry perspective of the completeness and relevance of a social assessment framework for project and technology management in the manufacturing sector. In Journal of Cleaner Production.

Lau, Antonio K.W.; Yam, Richard C.M.; Tang, Esther P.Y. (2010): The impact of technological innovation capabilities on innovation performance. An empirical study in Hong Kong. In Journal of Science and Technology Policy in China 1 (2), pp. 163–186. DOI: 10.1108/17585521011059893.

Lee, Seung Hyun; Leem, Choon Seong; Bae, Dae Jung (2018): The impact of technology capability, human resources, internationalization, market resources, and customer satisfaction on annual sales growth rates of Korean software firms. In Inf Technol Manag 19 (3), pp. 171–184. DOI: 10.1007/s10799-018-0287-2.

Likert, R. (1932): A Technique for the Measurement of Attitudes. In Archives of psychology 140 (22), pp. 5–55.

Liu, L.; Jiang, Z. (2016): Influence of technological innovation capabilities on product competitiveness. In Industrial Management & Data Systems (5), pp. 883–902.

Macchi, Marco; Fumagalli, Luca (2013): A maintenance maturity assessment method for the manufacturing industry. In Journal of Quality in Maintenance Engineering 19 (3), pp. 295–315. DOI: 10.1108/JQME-05-2013-0027.

Martinez-Vela, C. (2016): Benchmarking Research and Technology Organizations (RTOs): A Comparative Analysis. Massachusetts Institute of Technology (MIT). Cambridge.

Neukirch, S.; Semmler, M. (2011): Die Lehre von der Frage und dem Fragebogen. Uni Oldenburg, 2011.

Oberhagemann, Petra (2015): KMU-Instrument und Fast Track to Innovation im EU-Förderprogramm Horizont 2020. go-Inno Fachkongress für Beraterinnen und Berater. Edited by Bundesministerium für Wirtschaft und Energie (BMWi). Nationale Kontaktstelle KMU. Berlin. Available online at https://www.innovation-beratung-foerderung.de/INNO/Redaktion/DE/Downloads/Unterlagen_go-inno/ws_kmu_po_fin.pdf?__blob=publicationFile&v=10, checked on 2/5/2019.

Phaal, R.; Farrukh, C.J.P.; Probert, D. R. (2001): Technology management process assessment. A case study. In Int Jrnl of Op & Prod Mnagemnt 21 (8), pp. 1116–1132. DOI: 10.1108/EUM0000000005588.

Phaal, Robert; Farrukh, Clare J.P.; Probert, David R. (2004): Technology roadmapping—A planning framework for evolution and revolution. In Technological Forecasting and Social Change 71 (1-2), pp. 5–26. DOI: 10.1016/S0040-1625(03)00072-6.

Porter, J. G. (1978): Post-Audits-An Aid to Research Planning. In Research Management 20 (1), pp. 35–38.

Prahalad, C. K.; Hamel, G. (1990): The Core Competence of the Corporation. In Harvard Business Review (3), pp. 79–91.

Ravichandran, T. (2017): Exploring the relationships between IT competence, innovation capacity and organizational agility. In Journal of Strategic Information Systems, pp. 23–39.

Rubenstein, A. H.; Geisler, E. (1991): Evaluating the Outputs and Impacts of R&D/Innovation. In International Journal of Technology Management, pp. 182–204.

Rush, Howard; Bessant, John; Hobday, Mike (2007): Assessing the technological capabilities of firms: developing a policy tool. In R & D Management (37), pp. 221–236.

Social Entrepreneurship and Sustainable Development Goals: A Conceptual Framework

Anton Herutomo, Wawan Dhewanto and Eko Agus Prasetio
School of Business and Management, Institut Teknologi Bandung, Indonesia
anton_herutomo@sbm-itb.ac.id
w_dhewanto@sbm-itb.ac.id
eko.prasetio@sbm-itb.ac.id

Abstract: Studies linking social entrepreneurship and sustainable development goals (SDGs) are gaining interest due to the possible impact acceleration to achieve both social and economic goals. Social entrepreneurship supports technology upgrading and innovation with the digital approach. This study proposes an updated conceptual framework that connects social entrepreneurship with SDGs, mainly targeting 8.2 in SDG 8 (achieving higher economic productivity levels through diversification, technological upgrading, and innovation, focusing on high value-added and labour-intensive sectors). However, less research addresses the focus on digital technology and SDGs. With this study, the authors contribute to filling this research gap by answering this research question: how can social innovation within social entrepreneurship using digital technology improve Sustainable Development Goals achievement? A systematic literature review of 3,214 social entrepreneurship-related journals based on the Scopus database with no publication date restriction resulted in 111 included studies. The results were then mapped into two bibliographic visualizations using VOSViewer, i.e., "social entrepreneurship" and "technology innovation in social entrepreneurship." In social entrepreneurship visualization, the technology-related keyword filter only resulted in 1 keyword, i.e., "technology transfer," which shows fewer research activities. In technology-related visualization, there are four keywords ("technology transfer," "social technology," "technology and innovation," and "technology"). Five organizational level constructs in digital social entrepreneurship were identified: sustainable entrepreneurship development, social business model design, government regulation, marketing strategy, and creative solution generation capacity. These organization behaviour dimensions have been categorized to illustrate their influence on digital social entrepreneurship and SDG. Hence, this study is envisioned to provide original work in the theoretical development of bridging digital social entrepreneurship and SDGs that benefit both academicians and practitioners.

Keywords: social entrepreneurship, digital social innovation, service-dominant logic, sustainable development goals, conceptual framework

1. Introduction

Technology, science, and capacity building have become significant pillars in the implementation of the recent Sustainable Development Goals (SDGs) by the United Nations Development Programme (UNDP) (UN-DESA, 2021). Technology represented mainly by digital technology usually aims to advance society. Technology is also addressed in early research, which showed in the context of innovation - an intertwined phenomenon between technology, social, and economic context (Austin et al., 2006; Ganne et al., 1989).

Social and technology context in innovation can also be seen in the entrepreneurship process, which is shown in the works of Dacin et al. (2010), Zahra et al. (2009), Peredo & McLean (2006), Mair & Martí (2006). Perceived change is one notable factor that shapes the social innovation process to benefit the social system (Bărbulescu et al., 2021; Cadenas et al., 2020; Goyal & Sergi, 2020; Popkova & Sergi, 2020).

In response to change, research also highlighted that technology-based innovation for social purposes needs to employ a social business model and its impact on social gain for the society and the firm (Amry et al., 2021; Chilukuri, 2021; Gerli et al., 2021; Gouvea et al., 2021). In recent years, one of the social business models includes innovation using Information and Communication Technology (ICT) means or digital platforms (Bărbulescu et al., 2021; Gerli et al., 2021; Ghatak et al., 2020). In this context, exogenous events like Covid-19 accelerate the new digital approach for the social business model.

Further, the social business model innovation can be geared toward the Sustainable Development Goals (SDGs/SDG). Various researchers stated the importance of the social business model to achieve the Sustainable Development Goals agenda (Bretos et al., 2020; Conway et al., 2019; Eichler & Schwarz, 2019; Lavišius et al., 2020; Ramani, 2020; Tiba et al., 2020). Others stated that networking skills are essential for a social enterprise to situate around the agenda of the SDGs (Craveiro et al., 2020; García-Jurado et al., 2021).

However, few research efforts convey the focus on digital technology and SDGs. Some research efforts in social innovation discuss cultural motive (Lyne, 2020), economic motive, self-efficacy (Quiroz-Niño & Murga-Menoyo, 2017), proactiveness (Mintrom & Thomas, 2018; Portuguez Castro & Gómez Zermeño, 2021), agreeableness (Lehoux et al., 2018), and marketing (Shu et al., 2020; Tiba et al., 2020). With this study, the authors contribute to filling this research gap by conducting a systematic literature review and answering this research question: *how can social innovation within social entrepreneurship using digital technology improve Sustainable Development Goals achievement?* Answering related research questions is imperative to developing social innovation and social business models using digital means to support sustainable development. It will also benefit academic knowledge in social entrepreneurship to support social innovation advancement using digital-based platforms.

2. Literature review

2.1 Social entrepreneurship and social innovation

The common elements of social entrepreneurship include social value creation, engagement in a process, and social entrepreneurship creation process (Dhewanto et al., 2020; Mair & Martí, 2006; Morris et al., 2021; Peredo & McLean, 2006). Nowadays, the business model must be followed by market values and principles, business strategies, operation methods, and collaboration capabilities with public institutions while focusing on their main visions (Kabir, 2019, p. 16). Entrepreneurs use the "creative destruction" process to fuel new economic growth to create an up-to-date fit in the ever-growing environment. Schumpeter called this "gambling," the individual vision and investors' money on new products (Ettlie, 2006, p. 8). The so-called gambling or creative destruction behaviour relates to giving resources with a new capacity to create wealth; Drucker (1986, p. 30) called this "to innovate." Innovation is one of the challenges in entrepreneurship to become sustainable (Dhewanto et al., 2020). Geoff Mulgan (former Chief Executive Officer of Nesta, an innovation foundation based in the UK) defined innovation in the social context as innovative activities and services created by organizations with a social or environmental related mission (Campopiano & Bassani, 2021).

2.2 Digital social innovation and value creation

Service-Dominant (SD) logic is the new way of introducing and clarifying alternative views of exchange and value creation in the market. Some important principles of SD logic are viewed as follows: service is the foundation of exchange, and the customer actor is the value co-creator (Lusch & Vargo, 2014, pp. 15, 68).

Social entrepreneurship activities provide value creation (Lan et al., 2017). In the value creation process, information and communication technology act as the value shifter leading to new market opportunities (Bărbulescu et al., 2021; Bonomi et al., 2017; Henry et al., 2017; Scillitoe et al., 2018). Digital technology plays an essential facilitator of new value creation in forming products or services in the organization. There is a need to have appropriate strategies in place, particularly previous digital experience (in individual) or perceived feasibility (in the organization), to diffuse innovation using digital technology (Bărbulescu et al., 2021; Ghatak et al., 2020; Scillitoe et al., 2018). Researchers (Carroll & Casselman, 2019; Faludi, 2020) linked digital social innovation with innovation activities and process measurement such as member interaction to unlock social value creation potential.

2.3 Digital social innovation and SDGs

Recent research reports suggest that social innovation influences social performance (do Adro et al., 2021; Salim Saji & Ellingstad, 2016; Sarkki et al., 2019). In this context, The United Nations' SDGs provide orientation reference for social performance for social enterprises (Günzel-Jensen et al., 2020; Marave-Vivas et al., 2021). Shu et al. (2020) studied the perspective framework toward SDGs awareness, which includes creativity as an essential factor. Gidron et al. (2021) analysed the impact of technology start-ups on solving social and environmental issues and used SDGs as a tool for characterizing the concept, which combines technology start-up (as innovation) and social enterprise (as social innovation).

3. Methodology

3.1 Literature resources

The literature review started with the keyword selection and followed protocol guidelines in PRISMA 2020 to provide a systematic way to the intellectual structure in social entrepreneurship and social innovation research (Page et al., 2021). The term systematic in this study refers to the steps in research protocol; it fosters evidence-based practices and is fundamental to scientific activities, including social science (Pahlevan-sharif et al., 2019). The selected database is Scopus ProQuest, considering its broad coverage of 76.8 million core records covering 26.8% titles in social science (12,464 titles in social sciences covering psychology, economics, arts, and humanities as of January 2020) (Elsevier, 2020). The Scopus results are then compared to another scientific database i.e., ProQuest Central (9,096 titles in social sciences, sociology, psychology, humanities, business, and economics as of May 2022) (ProQuest LLC, 2022).

3.2 Search string and study selection

The identification stage began with identifying keywords with the criteria based on organizational behaviour and technological factors which influence the social innovation process within social entrepreneurship. Authors also exercised keywords related to social innovation and SDGs.

Table 1: Keyword query string

Keyword	Scopus Advanced Search query string	ProQuest Basic Search command
Main topic: Social entrepreneurship, social innovation	TITLE-ABS-KEY ("social entrepreneurship" AND "social innovation")	(ab("social entrepreneurship" AND "social innovation") OR ti("social entrepreneurship" AND "social innovation") OR if("social entrepreneurship" AND "social innovation"))
Digital constructs	TITLE-ABS-KEY ("social entrepreneurship" AND digital)	(ab("social entrepreneurship" AND digital) OR ti("social entrepreneurship" AND digital) OR if("social entrepreneurship" AND digital)) AND at.exact("Article")
	TITLE-ABS-KEY ("social entrepreneurship" AND technolog* AND innovation)	(ab("social entrepreneurship" AND technolog* AND innovation) OR ti("social entrepreneurship" AND technolog* AND innovation) OR if("social entrepreneurship" AND technolog* AND innovation))
Social innovation and Sustainable Development Goals (SDGs) constructs	TITLE-ABS-KEY("social innovation" "SDG*")	(ab("social innovation" AND SDG*) OR ti("social innovation" AND SDG*) OR if("social innovation" AND SDG*))

The initial search of the "social entrepreneurship" exact keyword with no restrictions on language, published date, or type of article resulted in 3,214 results. It is identified that 1,201 results need to be filtered out due to non-English, non-journal, and non-article exclusion criteria. This activity reflected the identification phase (the first one) in the PRISMA 2020 flow diagram.

Several assessment processes are used for eligibility in the screening phase (the second one). The process of "reports sought for retrieval" and "reports assessed for eligibility" employ a comparison between Scopus and ProQuest search results. In general, ProQuest Search Results yielded fewer data compared to Scopus. For example, Scopus search results for "social innovation" and SDG* generated 40 articles, whereas ProQuest yielded 11 articles. Since the particular attention of this study is to get the latest progression of social innovation, the query strings in Table 1 assisted the focus. They resulted in 111 included studies (the inclusion phase, third process).

3.3 Data collection

Search results from the "social entrepreneurship" exact keyword (3,214 articles) were filtered to include only journal articles written in English and four subject areas (Business, Management, and Accounting; Economics,

Econometrics, and Finance; Social Sciences; Decision Sciences), yielded in 1,900 articles. It is then downloaded as comma-delimited (.csv) file and fetched to VoSViewer (Visualization of Similarities Viewer) software for keyword occurrence mapping.

Other search results from "social entrepreneurship" and "technology-based innovation" keywords were treated similarly and yielded 77 articles. After downloading the .csv bibliographic file, VoSViewer is also used for keyword occurrence mapping.

Figure 1 contains two graphic illustrations for treatment on 111 included studies. The articles were tabularized to get important constructs on current social innovation frameworks.

4. Findings and discussion

Findings from VOSViewer give initial objective data on the intellectual structure in the relative timeframe. The analysis of interest is co-occurrence analysis (focusing on author keywords), which means the relatedness of items based on the number of documents they exist together (van Eck & Waltman, 2021, p. 37).

Research articles related to "social entrepreneurship" are visualized in Figure 1 (on the left side). It was extracted using keyword co-occurrence analysis with a minimum of 5 author keywords in abstract, title, and keywords, resulting in 4,146 keywords, 4,590 total link strength, and 228 articles.

Research articles related to "social entrepreneurship" and "technology-based innovation" are visualized in Figure 1 (on the right side). It was extracted using keyword co-occurrence analysis with a minimum of 2 author keywords in abstract, title, and keywords, resulting in 320 keywords, 134 total link strength, and 28 resulting articles.

Recent research (around the year 2018 to 2020) in social entrepreneurship focuses on social entrepreneurial intention, passion, sustainable development, self-efficacy, design thinking, entrepreneurial ecosystem, and hybrid organizing. Likewise, research keywords in technology innovation and social entrepreneurship surround technology transfer, innovation ecosystem, technological innovation, and entrepreneurial ecosystem.

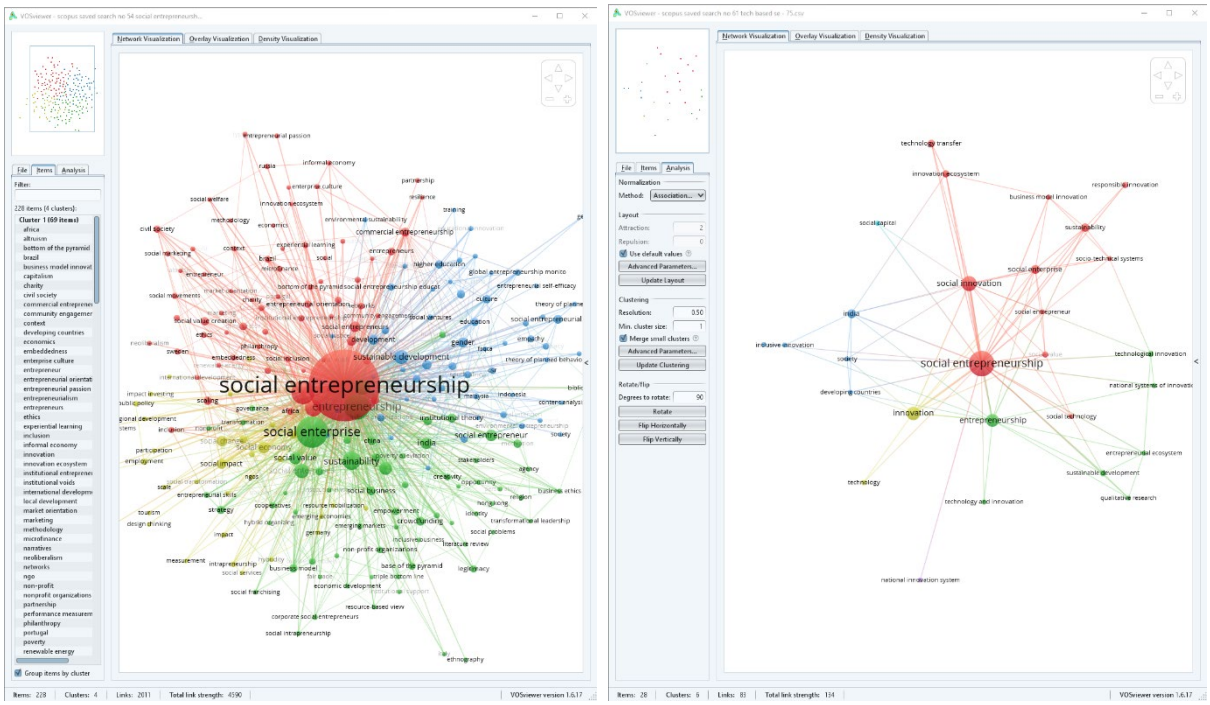


Figure 1: Co-occurrence keywords from 2 bibliographic data

4.1 Research focus: digital social innovation to address SDGs

The study intended to identify existing digital social innovation frameworks in social entrepreneurship to support the achievement of SDGs. This study's specific SDG focus is target 8.2 in SDG 8 (achieving higher economic productivity levels through diversification, technological upgrading, and innovation, focusing on high value-added and labour-intensive sectors). The findings from the tabularization process resulted in 17 factors influencing technology-based social innovation within social entrepreneurship:

- Individual behaviour = 9 factors: social mission, networking ability, deliberate action to use knowledge, economic motives, perceived change, customer opportunity recognition, creativity, prior entrepreneurship experience, and empathy.
- Group behaviour = 3 factors: social network development, group entrepreneurship development, spontaneous order.
- Organization behaviour = 5 factors: sustainable entrepreneurship development, impact, social business model design, government regulation, marketing strategy.

4.2 Theoretical lens for framework development

The digital social innovation process has the potential for improvement in social value and social structure (Faludi, 2020). From the Diffusion of Innovation theory and actor side, innovation begins with a linking process initiated by actors. There are several types of mediating actors in the diffusion of innovation described by (Caiazza & Volpe, 2017): opinion leader, facilitator, champion, linking agent, and change agent. This study focuses on the change agent role, an actor who fosters self-reliance in adopters.

A more recent finding (Downes & Nunes, 2014) suggested a more radical change in the diffusion process. Looking from the actor side, they argued that the bell-shaped curved in diffusion innovation theory has shifted to the shark-fin-shaped curve. The Big Bang Disruption Theory is particularly applicable to the actors who have the below characteristics: undisciplined strategy (not tied to one market discipline); unconstrained growth: (achieve nearly vertical market adoption with customers' help e.g., through social networks); unencumbered development (engineer products or services by testing in the real market).

From the Service-Dominant logic lens, all four axioms beautifully fit with social innovation with the digital approach: "service is the foundation of exchange," "the customer is always the value co-creator," and "all economic and social actors act as integrators for resources," and "beneficiaries determine value" (Lusch & Vargo, 2014, p. 15).

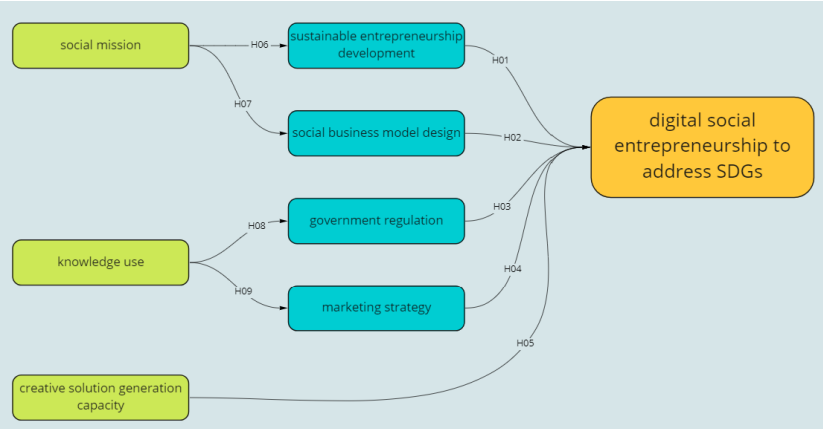


Figure 2: A proposed conceptual framework

Considering the focus of this study on the organization analysis and actors of innovation, factors included in the conceptual model development come from organizational behaviour synthesis.

Impact is defined as the transformation which leverages partnership and collaboration (Goyal & Sergi, 2020). Impact of social entrepreneurship generates social and economic values which support sustainability (Cardella et al., 2020; Gerli et al., 2021; Turker, 2021). Sustainable entrepreneurship development relies on a relationship with suppliers, employees, and customers based on mutual benefit and sustainability outcomes

(Cardella et al., 2020; Gerli et al., 2021; Scillitoe et al., 2018). Costs are within consideration after social and environmental outcomes are achieved (Alberti & Garrido, 2017). Therefore, we have the following hypothesis:

> ***H01:*** *sustainable entrepreneurship development capability is positively related to digital social entrepreneurship to address SDGs.*

Digital social entrepreneurship, which uses digital technology for social impact, is the future of social entrepreneurship (Faludi, 2020; Ghatak et al., 2020; Goyal & Sergi, 2020). The business model addresses explicit social or environmental issues; organizational slack and business case are relatively minor priorities(Alberti & Garrido, 2017). Thus, we have the following hypothesis:

> ***H02:*** *social business model design is positively related to digital social entrepreneurship to address SDGs.*

Nowadays, new roles of government include ways to address failure in the innovation system and bottlenecks in the flow of knowledge and technology (Gouvea et al., 2021). In a broad sense, government regulations positively affect sustainable enterprise development in a country (Apostolopoulos et al., 2020; Bajwa et al., 2021; Díaz-Perdomo et al., 2021; Jiatong et al., 2021; Tabares, 2021; Thiam et al., 2021). Therefore, we have proposed the following hypothesis:

> ***H03:*** *government regulation is positively related to digital social entrepreneurship to address SDGs.*

Social entrepreneurship uses marketing strategy for relationship development rather than competitive advantage (Ko et al., 2019; Mirvis & Googins, 2018; Powell & Osborne, 2015). Although several studies found that most social enterprises had no explicit marketing capacity, it is currently executable with the free approach in the era of digital. Social enterprises can use relatively accessible digital tools for marketing strategies like blogs and video-based platforms (like Youtube, Instagram, Tiktok). Therefore, the following hypothesis applies:

> ***H04:*** *marketing strategy is positively related to digital social entrepreneurship to address SDGs.*

Creativity at the individual level can produce new communities (Gouvea et al., 2021). Scholars also argued that creativity is the factor that drives social innovation performance (Ko et al., 2019). Creativity also relates to digital social entrepreneurship since value creation can use digital platforms (Chandna, 2021). Thus, we have the following hypothesis:

> ***H05:*** *creative solution generation capacity is positively related to digital social entrepreneurship to address SDGs.*

Challenges in social entrepreneurship include creating impact with a sustainable approach and a proper social business model (Chandna, 2022). Having a social mission is imperative in social entrepreneurship. A feasible business model and sustainable entrepreneurship could be generated through the social experience and perceived feasibility of digital solutions(Gerli et al., 2021; Ghatak et al., 2020; Ibáñez et al., 2021).

> ***H06:*** *the relationship between social mission and digital social entrepreneurship to address SDGs is mediated by sustainable entrepreneurship development.*

> ***H07:*** *the relationship between social mission and digital social entrepreneurship to address SDGs is mediated by social business model design.*

Social entrepreneurship operates in a specific institutional context at a minimum within country boundaries. Knowledge of the regulation and the market shaped by the regulation is essential to ensure sustainable entrepreneurship. Government regulation and marketing influence knowledge use in digital social entrepreneurship (Gerli et al., 2021; Ghatak et al., 2020). Thus, we have the following hypothesis:

> ***H08:*** *the relationship between knowledge use and digital social entrepreneurship to address SDGs is mediated by government regulation.*

> ***H09:*** *the relationship between knowledge use and digital social entrepreneurship to address SDGs is mediated by marketing strategy.*

This study tries to improve the understanding of social entrepreneurship as a field of study and practice. It examined the social entrepreneurship context and the process of social innovation to create value. It might have several limitations, such as focusing on the processual view of social innovation actors. Future research can also consider viewing the social innovation from the adoption process on the consumer or user side.

Another limitation entails the unit analysis of social enterprise as an organization. Future research can combine the unit of analysis by integrating individual and organizational factors to improve perceptions of technology use in social innovation.

5. Conclusion

The global development network has highlighted the importance of having technology-based solutions to improve unsustainable development tracks. Related digital technology enables improvement in almost every economic sector, including social innovation. However, we still see many blockers in technology adoption for social good. Social entrepreneurship embodies the potential to become a catalyst in technology transformation and social improvement. The value creation process can be enhanced using technology in social innovation.

This study explores the research questions concerning digital social innovation and its influence on achieving sustainable development goals. Using bibliometric data from Scopus and 111 literature reviews, this research mapped social entrepreneurship's intellectual structure and technology-based social innovation within social entrepreneurship. Six variables were extracted from state-of-the-art research tabularization. Subsequently, a conceptual framework model and its hypotheses from an organization-level view are proposed. Having this conceptual framework enables the researchers in social entrepreneurship to pave a more focused relationship with sustainable development goals.

References

Alberti, F. G., & Garrido, M. A. V. (2017). Can profit and sustainability goals co-exist ? New business models for hybrid firms. Journal of Business Strategy, 38(1), 3–13. https://doi.org/10.1108/JBS-12-2015-0124

Amry, D. K., Ahmad, A. J., & Lu, D. (2021). The new inclusive role of university technology transfer : Setting an agenda for further research. International Journal of Innovation Studies, 5(1), 9–22. https://doi.org/10.1016/j.ijis.2021.02.001

Apostolopoulos, N., Liargovas, P., Stavroyiannis, S., Makris, I., Apostolopoulos, S., Petropoulos, D., & Anastasopoulou, E. (2020). Sustaining rural areas, rural tourism enterprises and EU development policies: A multi-layer conceptualisation of the obstacles in Greece. Sustainability (Switzerland), 12(18). https://doi.org/10.3390/su12187687

Austin, J., Stevenson, H., & Wei-Skillern, J. (2006). Social and Commercial Entrepreneurship: Same, Different, or Both? Entreprneurship Theory and Practice, 30(1), 1–22. https://doi.org/https://doi.org/j.1540-6520.2006.00107.x

Bajwa, S., Dabral, A., Chatterjee, R., & Shaw, R. (2021). Co-producing knowledge innovation through thematic incubators for disaster risk reduction and sustainable development in India. Sustainability (Switzerland), 13(4), 1–22. https://doi.org/10.3390/su13042044

Bărbulescu, O., Tecău, A. S., Munteanu, D., & Constantin, C. P. (2021). Innovation of Startups , the Key to Unlocking Post-Crisis Sustainable Growth in Romanian Entrepreneurial Ecosystem. Sustainability (Switzerland), 13(2), 1–16.

Bonomi, S., Ricciardi, F., & Rossignoli, C. (2017). Network organisations for externality challenges: How social entrepreneurship co-evolves with ICT-enabled solutions. International Journal of Knowledge-Based Development, 8(4), 346–366. https://doi.org/10.1504/IJKBD.2017.088183

Bretos, I., Díaz-Foncea, M., & Marcuello, C. (2020). International expansion of social enterprises as a catalyst for scaling up social impact across borders. Sustainability (Switzerland), 12(8). https://doi.org/10.3390/SU12083262

Cadenas, G. A., Angélica, E., Lynn, N., Spence, T., & Ruth, A. (2020). A programmatic intervention to promote entrepreneurial self- e ffi cacy , critical behavior , and technology readiness among underrepresented college students. Journal of Vocational Behavior, 116(October 2019), 103350. https://doi.org/10.1016/j.jvb.2019.103350

Caiazza, R., & Volpe, T. (2017). Innovation and its diffusion: process, actors and actions. Technology Analysis and Strategic Management, 29(2), 181–189. https://doi.org/10.1080/09537325.2016.1211262

Campopiano, G., & Bassani, G. (2021). Social innovation: Learning from social cooperatives in the Italian context. Journal of Cleaner Production, 291, 125253. https://doi.org/10.1016/j.jclepro.2020.125253

Cardella, G. M., Hernández-Sánchez, B. R., & Sánchez García, J. C. (2020). Entrepreneurship and Family Role: A Systematic Review of a Growing Research. Frontiers in Psychology, 10(January), 1–17. https://doi.org/10.3389/fpsyg.2019.02939

Chandna, V. (2021). Social entrepreneurship and digital platforms: Crowdfunding in the sharing-economy era. Business Horizons, xxxx. https://doi.org/10.1016/j.bushor.2021.09.005

Chilukuri, K. C. (2021). Planning and Teaching design thinking online. Journal of Engineering Education Transformations, 34(Special Issue), 703–706.

Conway, D., Robinson, B., Mudimu, P., Chitekwe, T., Koranteng, K., & Swilling, M. (2019). Exploring hybrid models for universal access to basic solar energy services in informal settlements: Case studies from South Africa and Zimbabwe. Energy Research and Social Science, 56(May), 101202. https://doi.org/10.1016/j.erss.2019.05.012

Craveiro, I., Carvalho, A., & Ferrinho, P. (2020). “get us partnerships!”- A qualitative study of Angolan and Mozambican health academics’ experiences with North/South partnerships. Globalization and Health, 16(1), 1–10. https://doi.org/10.1186/s12992-020-00562-7

Dacin, P., Dacin, M., & Matear, M. (2010). Social entrepreneurship: Why we don't need a new theory and how we move forward from here. Academy of Management Perspectives, 24(3), 37–57. https://doi.org/10.5465/AMP.2010.52842950

Dhewanto, W., Ratnaningtyas, S., Permatasari, A., Anggadwita, G., & Prasetio, E. A. (2020). Rural entrepreneurship: Towards collaborative participative models for economic sustainability. Entrepreneurship and Sustainability Issues, 8(1), 705–724. https://doi.org/10.9770/jesi.2020.8.1(48)

Díaz-Perdomo, Y., Álvarez-González, L. I., & Sanzo-Pérez, M. J. (2021). A Way to Boost the Impact of Business on 2030 United Nations Sustainable Development Goals: Co-creation With Non-profits for Social Innovation. Frontiers in Psychology, 12(August), 1–17. https://doi.org/10.3389/fpsyg.2021.719907

do Adro, F., Fernandes, C. I., Veiga, P. M., & Kraus, S. (2021). Social entrepreneurship orientation and performance in non-profit organizations. International Entrepreneurship and Management Journal, 0123456789. https://doi.org/10.1007/s11365-021-00748-4

Downes, L., & Nunes, P. (2014). Big Bang Disruption: Strategy in the Age of Devastating Innovation. the Penguin Group Penguin Group (USA) LLC.

Drucker, P. F. (1986). Innovation and Entrepreneurship (1st editio). First Perennial Library.

Eichler, G. M., & Schwarz, E. J. (2019). What sustainable development goals do social innovations address? A systematic review and content analysis of social innovation literature. Sustainability (Switzerland), 11(2). https://doi.org/10.3390/su11020522

Elsevier. (2020). Content Coverage Guide. 1–24. https://www.elsevier.com/__data/assets/pdf_file/0007/69451/Scopus_ContentCoverage_Guide_WEB.pdf (Accessed on 22 July 2021)

Ettlie, J. E. (2006). Managing Innovation: New Technology, New Products, and New Services in a Global Economy (2nd ed.). Elsevier Butterworth-Heinemann.

Faludi, J. (2020). How to Create Social Value Through Digital Social Innovation ? Unlocking the Potential of the Social Value Creation of Digital Start-Ups How to Create Social Value Through Digital Social Creation of Digital Start-Ups. Journal of Social Entrepreneurship, 0(0), 1–18. https://doi.org/10.1080/19420676.2020.1823871

Ganne, B., Homme, S. D. I., & Berthelot, A. (1989). Regional dynamics of innovation : A look at the Rhône Alpes Region. Entrepreneurship and Regional Development, 1(2), 147–154. https://doi.org/10.1080/08985628900000013

García-Jurado, A., Pérez-Barea, J. J., & Nova, R. (2021). A new approach to social entrepreneurship: A systematic review and meta-analysis. Sustainability (Switzerland), 13(5), 1–16. https://doi.org/10.3390/su13052754

Gerli, F., Chiodo, V., & Bengo, I. (2021). Technology Transfer for Social Entrepreneurship : Designing Problem-Oriented Innovation Ecosystems. Sustainability (Switzerland), 13(1), 1–19.

Ghatak, A., Chatterjee, S., & Bhowmick, B. (2020). Intention Towards Digital Social Entrepreneurship : An Integrated Model. Journal of Social Entrepreneurship, 0(0), 1–21. https://doi.org/10.1080/19420676.2020.1826563

Gouvea, R., Kapelianis, D., Montoya, M. R., Vora, G., Gouvea, R., Kapelianis, D., Montoya, M. R., & Vora, G. (2021). The creative economy , innovation and entrepreneurship : an empirical examination. Creative Industries Journal, 14(1), 23–62. https://doi.org/10.1080/17510694.2020.1744215

Goyal, S., & Sergi, B. S. (2020). Social entrepreneurship for scalable solutions addressing sustainable development goals (SDGs) at BoP in India. Qualitative Research in Organizations and Management: An International Journal. https://doi.org/10.1108/QROM-07-2020-1992

Günzel-Jensen, F., Siebold, N., Kroeger, A., & Korsgaard, S. (2020). Do the United Nations' Sustainable Development Goals matter for social entrepreneurial ventures? A bottom-up perspective. Journal of Business Venturing Insights, 13(January), e00162. https://doi.org/10.1016/j.jbvi.2020.e00162

Henry, E., Newth, J., & Spiller, C. (2017). Emancipatory Indigenous social innovation: Shifting power through culture and technology. Journal of Management and Organization, 23(6), 786–802. https://doi.org/10.1017/jmo.2017.64

Ibáñez, M. J., Guerrero, M., & Valdés, C. Y. (2021). Digital social entrepreneurship : the N Helix response. The Journal of Technology Transfer, 0123456789. https://doi.org/10.1007/s10961-021-09855-4

Jiatong, W., Li, C., Murad, M., Shahzad, F., & Ashraf, S. F. (2021). Impact of Social Entrepreneurial Factors on Sustainable Enterprise Development: Mediating Role of Social Network and Moderating Effect of Government Regulations. SAGE Open, 11(3). https://doi.org/10.1177/21582440211030636

Kabir, M. N. (2019). Knowledge-Based Social Entrepreneurship: Understanding Knowledge Economy, Innovation, and the Future of Social Entrepreneurship. Palgrave Macmillan.

Ko, W. W., Liu, G., Wan Yusoff, W. T., & Che Mat, C. R. (2019). Social Entrepreneurial Passion and Social Innovation Performance. Nonprofit and Voluntary Sector Quarterly, 48(4), 759–783. https://doi.org/10.1177/0899764019830243

Lan, J., Ma, Y., Zhu, D., Mangalagiu, D., & Thornton, T. F. (2017). Enabling Value Co-Creation in the Sharing Economy : The Case of Mobike. https://doi.org/10.3390/su9091504

Lavišius, T., Bitė, V., & Andenas, M. (2020). Social entrepreneurship in the baltic and nordic countries. Would the variety of existing legal forms do more for the impact on sustainable development? Entrepreneurship and Sustainability Issues, 8(1), 276–290. https://doi.org/10.9770/jesi.2020.8.1(19)

Lehoux, P., Silva, H. P., Sabio, R. P., & Roncarolo, F. (2018). The unexplored contribution of Responsible Innovation in Health to Sustainable Development Goals. Sustainability (Switzerland), 10(11). https://doi.org/10.3390/su10114015

Lusch, R. F., & Vargo, S. L. (2014). Service-Dominant Logic: Premises, Perspectives, Possibilities. Cambridge University Press.

Lyne, I. (2020). Bottling water differently, and sustaining the water commons? Social innovation through water service franchising in Cambodia. Water Alternatives, 13(3), 731–751.

Mair, J., & Martí, I. (2006). Social entrepreneurship research: A source of explanation, prediction, and delight. Journal of World Business, 41(1), 36–44. https://doi.org/10.1016/j.jwb.2005.09.002

Marave-Vivas, M., Salvador-garcia, C., Capella-peris, C., & Gll-Gomez, J. (2021). Influence of Socio-Demographic Factors in the Promotion of Social Entrepreneurship : A Service-Learning Programme. International Journal of Environmental Research and Public Health, 18.

Mintrom, M., & Thomas, M. (2018). Policy entrepreneurs and collaborative action: Pursuit of the sustainable development goals. International Journal of Entrepreneurial Venturing, 10(2), 153–171. https://doi.org/10.1504/IJEV.2018.092710

Mirvis, P., & Googins, B. (2018). Catalyzing Social Entrepreneurship in Africa: Roles for Western Universities, NGOs and Corporations. Africa Journal of Management, 4(1), 57–83. https://doi.org/10.1080/23322373.2018.1428020

Morris, M. H., Santos, S. C., & Kuratko, D. F. (2021). The great divides in social entrepreneurship and where they lead us. Small Business Economics, 57(3), 1089–1106. https://doi.org/10.1007/s11187-020-00318-y

Page, M. J., Moher, D., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., Mcdonald, S., … Mckenzie, J. E. (2021). PRISMA 2020 explanation and elaboration: Updated guidance and exemplars for reporting systematic reviews. The BMJ, 372. https://doi.org/10.1136/bmj.n160

Pahlevan-sharif, S., Mura, P., & Wijesinghe, S. N. R. (2019). A systematic review of systematic reviews in tourism. Journal of Hospitality and Tourism Management, 39(November 2018), 158–165. https://doi.org/10.1016/j.jhtm.2019.04.001

Peredo, A. M., & McLean, M. (2006). Social entrepreneurship: A critical review of the concept. Journal of World Business, 41(1), 56–65. https://doi.org/10.1016/j.jwb.2005.10.007

Popkova, E. G., & Sergi, B. S. (2020). Human capital and AI in industry 4 . 0 . Convergence and divergence in social entrepreneurship in Russia. Journal of Intellectual Capital, 21(4), 565–581. https://doi.org/10.1108/JIC-09-2019-0224

Portuguez Castro, M., & Gómez Zermeño, M. G. (2021). Identifying entrepreneurial interest and skills among university students. Sustainability (Switzerland), 13(13), 1–19. https://doi.org/10.3390/su13136995

Powell, M., & Osborne, S. P. (2015). Can marketing contribute to sustainable social enterprise? Social Enterprise Journal, 11(1), 24–46. https://doi.org/10.1108/sej-01-2014-0009

ProQuest LLC. (2022). ProQuest - Title Lists. http://tls.search.proquest.com/titlelist/jsp/list/tlsSingle.jsp?productId=10000255&_ga=2.205447184.1686838085.1654176600-263655394.1652154133

Ramani, S. v. (2020). On consortium driven sanitation interventions to end open defecation: insights from an Indian village study. Innovation and Development, 10(2), 245–261. https://doi.org/10.1080/2157930X.2019.1580934

Salim Saji, B., & Ellingstad, P. (2016). Social innovation model for business performance and innovation. International Journal of Productivity and Performance Management, 65(2), 256–274. https://doi.org/10.1108/IJPPM-10-2015-0147

Sarkki, S., Ficko, A., Miller, D., Barlagne, C., Melnykovych, M., Jokinen, M., Soloviy, I., & Nijnik, M. (2019). Human values as catalysts and consequences of social innovations. Forest Policy and Economics, 104(May 2018), 33–44. https://doi.org/10.1016/j.forpol.2019.03.006

Scillitoe, J. L., Poonamallee, L., & Joy, S. (2018). Balancing Market Versus Social Strategic Orientations in Socio-tech Ventures as Part of the Technology Innovation Adoption Process–Examples from the Global Healthcare Sector. Journal of Social Entrepreneurship, 9(3), 257–287. https://doi.org/10.1080/19420676.2018.1498378

Shu, Y., Ho, S. J., & Huang, T. C. (2020). The Development of a Sustainability-Oriented Creativity, Innovation, and Entrepreneurship Education Framework: A Perspective Study. Frontiers in Psychology, 11(August), 1–7. https://doi.org/10.3389/fpsyg.2020.01878

Tabares, S. (2021). Do hybrid organizations contribute to Sustainable Development Goals? Evidence from B Corps in Colombia. Journal of Cleaner Production, 280, 124615. https://doi.org/10.1016/j.jclepro.2020.124615

Thiam, S., Aziz, F., Kushitor, S. B., Amaka-Otchere, A. B. K., Onyima, B. N., & Odume, O. N. (2021). Analyzing the contributions of transdisciplinary research to the global sustainability agenda in African cities. Sustainability Science, 16(6), 1923–1944. https://doi.org/10.1007/s11625-021-01042-6

Tiba, S., van Rijnsoever, F. J., & Hekkert, M. P. (2020). The lighthouse effect: How successful entrepreneurs influence the sustainability-orientation of entrepreneurial ecosystems. Journal of Cleaner Production, 264, 121616. https://doi.org/10.1016/j.jclepro.2020.121616

Turker, D. (2021). How do social entrepreneurs develop technological innovation ? Social Enterprise Journal, 17(1), 63–93. https://doi.org/10.1108/SEJ-05-2020-0034

UN-DESA. (2021). Technology | Department of Economic and Social Affairs. https://sdgs.un.org/topics/technology

van Eck, N. J., & Waltman, L. (2021). VOSviewer Manual. In Leiden: Univeristeit Leiden (Issue July). Universiteit Leiden, CWTS. http://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.1.pdf

Zahra, S. A., Gedajlovic, E., Neubaum, D. O., & Shulman, J. M. (2009). A typology of social entrepreneurs: Motives, search processes and ethical challenges. *Journal of Business Venturing*, *24*(5), 519–532. https://doi.org/10.1016/j.jbusvent.2008.04.007

The All-Wales Academy for Innovation in Health and Social Care

Tom James[1], Roderick Thomas[2], Daniel Rees[2] and Gareth Davies[2]
[1]Welsh Government, Wales, UK
[2]School of Management, Swansea University, Wales, UK
Thomas.james@gov.wales
Roderick.thomas@swansea.ac.uk
D.J.Rees@swansea.ac.uk
G.H.Davies@swansea.ac.uk

Abstract: This paper presents the case of the All-Wales Intensive Learning Academy (ILA) for Innovation in Health and Social Care (IHSC), established in the context of the broader Regional Innovation System (RIS) (Braczyk et al., 1998, Pino and Ortega, 2018). Developing capacity and capability for innovation in the Health and Social Care sectors in south west Wales has been a longstanding endeavour alongside efforts to revitalise the region's economy. Welsh Government's recent initiative to establish Intensive Learning Academies to support development of senior leaders and managers within the Health and Social Care is a further endeavour within the RIS. The IHSC ILA in particular has relevant to this agenda, operating across Health & Social Care, with further engagement of private and third sectors. Delivered by a partnership of Swansea University, Cardiff & Vale University Health Board and the Bevan Commission, the initial phase of the IHSC has involved three of its core offerings being launched, engaging just over 200 learners. While the initiative is still in its early stages, this case study provides an initial examination of its activity exploring its potential to support the RIS through consideration of *Region*, *Innovation, Network, Learning*, and *Interaction*. As this work continues, it offers potential learning for future phases of IHSC, and to other post-industrial regions grappling concurrent challenges relating to population health and economic development.

Keywords: health, social care, innovation, Wales

1. Introduction

The south west Wales region is home to just under 700,000 people, mainly in the urban conurbations of Swansea and Neath Port Talbot, though with notable communities spreading westwards into the more rural counties of Carmarthenshire and Pembrokeshire. Combined, this region also accommodates 302,000 jobs and 22,000 businesses (SU, 2018) across the Swansea Bay City Region (SBCR). This geography broadly reflects the combined 'Swansea Bay and Western Valleys' and 'Pembrokeshire' regions originally defined within the 'fuzzy boundaries' of the Wales Spatial Plan (WAG, 2004), aligning with the areas of the University Health Boards covered by Swansea Bay and Hywel Dda within the ARCH (A Regional Collaboration for Health) initiative (ARCH, 2017).

The region has over recent decades been undergoing the transition to a post-industrial knowledge economy. Efforts have been made by Welsh Government to mobilise academia and industry to support this transition with emphasis on innovation (WAG, 2003) (WG, 2014), particularly in targeted sectors (WG, 2013). This ambition links with the concept of Territorial Innovation Systems, described initially at a national level by Lundvall (1992) and Nelson (1993), with subsequent consideration at regional level (RIS) (Cooke, 2001b), including specifically the case of south west Wales (Cooke, 2001b; Davies et al. (2018)). In parallel, it has worked to overcome population health challenges exacerbated recently by the Covid-19 pandemic, including existing engrained health inequalities (Brunt et al., 2017).

This paper examines one of the efforts to support this transition, the Intensive Learning Academy for Innovation in Health and Social Care. The following sections introduce the Academy concept and its activities, through the five key, linked concepts within RIS identified by Cooke (2001b) of *Region*, *Innovation, Network, Learning*, and *Interaction*.

2. Southwest Wales Health and Social Care innovation ecosystem

The Health and Social Care sectors are significant within the Swansea Bay City Region, and are aligned to the Life Sciences sector which have been the focus of prior work (Davies et al., 2018). They represent a notable part of regional employment with the University Health Boards alone (i.e. the major parts of the public health systems) of Swansea Bay and Hywel Dda employing over 17,000 people. This is in addition to the General Practitioners and pharmacies of the primary care system or the employment of Social Care providers (ARCH, 2017).

The longstanding regional focus on Life Sciences and Health sectors stretches back to the turn of the century when Cooke (2001a) noted a mini-agglomeration that UK government had also identified as an early-stage cluster (DTI, 2001). More recently, the cluster was recognised in the 'South Wales Crucible' audit of regional knowledge economy strengths (SU, 2018), though not featuring as strongly in other studies during the intervening period (McKinsey, 2014) (SQW, 2014).

This regional cluster exists withing the Welsh Regional Innovation System, with Cooke (2001a) highlighting the opportunity of the National Health Service (NHS) in Wales being a major potential resource. NHS Wales is an integrated health system which differs to the fragmented nature of the US system described by Herzlinger (2006), or even by comparison NHS England. It does however present barriers of substantial regulation, a rigid business model (dominated by NHS) (Hwang and Christensen, 2008), public procurement constraints and stringent regulation of patient information (Uyarra et al., 2014).

The importance of skills within health systems to support innovation has been well-established (Länsisalmi et al., 2006) (Bevan, 2010) (Parmar et al., 2021), including the role of managers (Bevan, 2010), with focus on senior managers (Birken et al., 2012). Within this context, the role of business and management schools to deliver leadership and enterprise training has been an emerging theme (Bell 2017). However, while significant efforts have been made to develop R&D activity and associated infrastructure across SBCR, there has been limited regional focus upon innovation skills. This is explored in the following section examining notable initiatives undertaken within the ecosystem.

3. Capability and capacity building initiatives

South west Wales has benefitted from both pan-Wales and regional initiatives to support innovation, both generally and in targeted sectors including Life Sciences and Health. An historic summary of a range of initiatives is included in (Davies et al., 2018). Notable recent major initiatives within the region operate around the focus of the Institute of Life Sciences (ILS) attached to Swansea University's Medical School. ILS has provided a hub for technical and service innovation, including spin-out and technology transfer into the regional ecosystem. It is being joined by ambitions for further major infrastructure in the form of the Campuses and Villages City Deal projects supported through the joint UK/Welsh Governments' City Deal portfolio (SU, 2017).

Recently, efforts have extended to expanding the scale of innovation activity, notably through identifying and supporting project opportunities. Within SBCR, an '*Innovation Forum*' has been created by ARCH to connect challenges and ideas across the clinical and wider innovation community. Integration of pan-Wales initiatives such as Accelerate (through the local Healthcare Technology Centre) provide connection with the national ecosystem. However, there has been limited activity to address the translational skills deficit noted withing the region by the RLSP (2013), and more widely in a Healthier Wales (WG, 2018). This presents the question as to how these initiatives within the ecosystem may relate to Policy goals presented in the next section along with an introduction to the ILA. Notably, this relates to the challenges of interdependency described by Marjanovic (2020) as to how "*effective leadership and skills and capability-building go hand in hand*".

4. Intensive learning academy for innovation in health and social care

An important gap in skills hindering the needed economic and health system transformation was noted by Welsh Government in the *Healthier Wales* (WG, 2018). The policy, which aims to integrate and transform Health and Social Care called for establishment of Intensive Learning Academies to support development of existing and aspiring senior leaders in the sectors. Central to this ambition is the intent to ensure the sectors become better-equipped to provide leadership of innovation activity. Despite the immediate challenges presented as the world emerges from the worst of the Covid-19 pandemic, this upskilling agenda is also positioned as a long-term endeavour. As such, it is notable that the Academies themselves are framed in the context of the *Well-being for Future Generations Act* (NAW, 2015) goals. These expressly target long-term support for improved health, economic development and inclusivity across Wales, resonating with the more localised SBCR ambitions. Following a process of Expressions of Interest and Business Case development, Academies were established in *Innovation & Transformation* (IHSC), *Value-based Health & Care*, *Digital*, and *Prevention & Behaviour Change*. Each ILA offers academic award-bearing programmes and Executive Education/Continuing Professional Development short courses.

The focus of this paper, the IHSC ILA, launched in Spring 2021 involving a partnership between Swansea University, Cardiff & Vale University Health Board, the Bevan Commission and Cardiff University. The research aim of this study is to examine how the ILA relates to the broader RIS, with particular regard to the learning connections established through the IHSC activities delivered in south west Wales. The region is of particular interest as its requirements for innovation skills in related sectors was identified in the 'Skills for Life' Regional Learning and Skills Partnership report (RLP, 2013). While the Report focused on industry needs, the capabilities and capacity of the health system workforce to engage in innovation emerged as an important theme.

The IHSC currently offers a Virtual Learning Environment/Knowledge Hub, accredited and non-accredited courses, and a growing cohort of doctoral-level research students (Fig.1 below). The ILA delivery phase commenced with recruitment of the first cohorts against core offerings. Initial programmes include the *Advanced Management in Health and Social Care Innovation MSc*. from Swansea University, the *Spread & Scale* innovation diffusion initiative led by partners in Cardiff & Vale University Health Board, and the *Intensive Learning Week* delivered by the Bevan Commission. The following section outlines initial progress in their delivery to date.

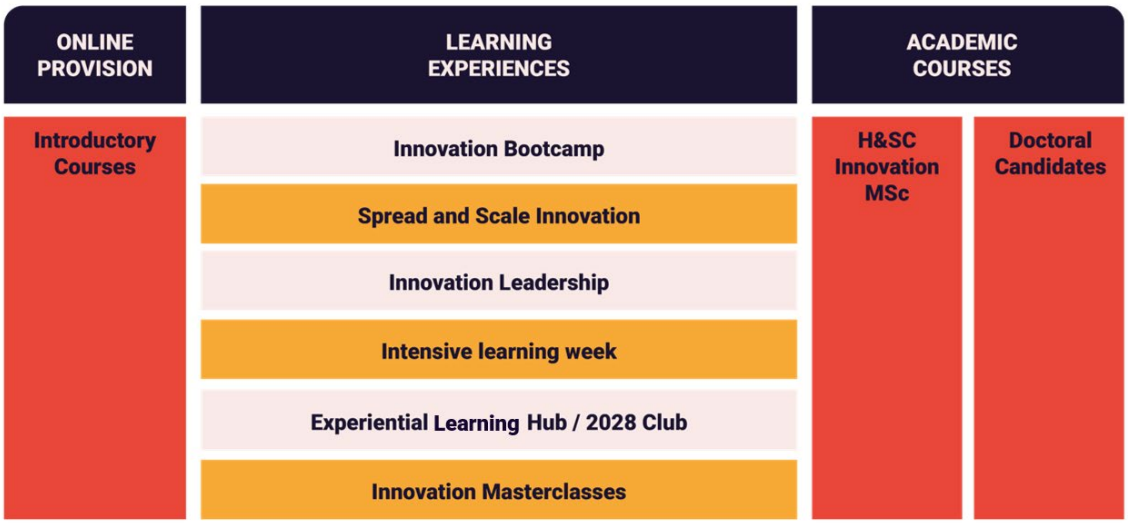


Figure 1: IHSC offerings

Spread & Scale Programme: 120 participants from across Wales joined the first of these immersive training events intended to support teams in expanding innovations across their organisations, Wales and further afield. Delivered over three days with support from the Billions Institute, the programme builds upon longstanding international engagements (Cooper et al., 2015)

Advanced Management in Health and Social Care Innovation MSc.: Delivered through blended online sessions and weekend workshops, the programme offers funded and fee-paying places for professional learners. Just over 70% of MSc scholarships were awarded to learners working within the Health sector, while 22% went to Social Care participants, and the remainder to individuals from the third sector (charity/independent non-profit). Through case-study learning the MSc. along with aligned postgraduate research opportunities aims to deliver against the management and entrepreneurship training that Bell (2017) called for in his review undertaken for UK Government.

Intensive Learning Week: Delivered online by the Bevan Commission due to Covid-19 restrictions the first instance of this week-long interactive attracted 85 participants over the full five days. The week builds upon the Commission's successful 'Exemplars' Programme (Rich, 2019) including the international perspective of the Commissioners themselves. It is intended that future delivery will be in-person to allow greater interaction between participants.

5. Analysis

This paper examines this role of the ILA through the five key, linked concepts within RIS identified by Cooke (2001b) of *Region, Innovation, Network, Learning, and Interaction*.

Earlier (Autio et al., 2014) and more recent (Tödtling and Trippl, 2011) RIS models present 'Educational Institutions' as part of 'knowledge generation and diffusion systems' connected across the wider system. Somewhat differently, the ILA aims to operate in both the Generation/Diffusion and Application/Exploitation componentry of RIS. Therefore, this study takes a step back from these models to reflect upon the ILA context within RIS, and whether/how the initiative relates to the concept. Noting the difference between conceptual and real systems, the study starts at a higher level with Cooke's (2001b) key concepts, aiming to explore the initial ILA context. As the work of the Academy progresses, this would allow subsequent consideration of the Academy's position and engagement within the RIS structure using models such as that of Tödtling and Trippl, (2011).

The analysis is based upon the sources of the IHSC Business Case, monitoring information collated by the ILA, and bibliographic review of associated academic and sector literature. This allows exploration of both the nature of the activities, the participants involved, and the level of IHSC integration with local and national ecosystems. This includes drawing insight that is intended to inform development and delivery of further phases of the IHSC. The paper also provides initial insight for the monitoring and evaluation work for both the IHSC itself and further academies, in support of both policy and practice by Welsh Government, and for potential interest of other regions/practitioners engaged in similar endeavours.

Region: The IHSC ILA operates pan-Wales as part of its broader consortium, as part of a network of four ILAs with Welsh Government oversight, thus providing one geographical context. In parallel, the IHSC ILA also has focus upon the geographies of NHS University Health Boards, including Swansea Bay and Hywel Dda in the south west as part of the 'ARCH' region, as well as Cardiff & Vale in East Wales. As such the ILA itself is only indirectly and loosely linked to the City Regions (SU, 2017). However, this does present a strengthening of connection between regional governance and the Health sector at a regional level, for it was omitted as a sector in the previous Wales Spatial Plan agenda (WAG, 2004). The recognition of combined potential for economic development and population health benefit appears to have been part of this change, with innovation skills for both now appearing as a common thread.

Innovation: The practice-based and applied nature of the IHSC ILA offerings present well to support innovation, while connection with practitioner initiatives (e.g. Accelerate) offers direct involvement with application of innovation management knowledge and skills. In parallel, working with teams such as AgorIP taps into a network of technology transfer and Intellectual Property management expertise, representing a further specialist skillset (Mom et al., 2012). In terms of practice within the ILA partners, it is also noteworthy that both the Spread & Scale and Bevan Commission elements are themselves well-established, having demonstrated positive evaluation of the return delivered by their approaches (Cooper et al., 2015) (Rich, 2019). Crossover with other themes has been demonstrated through the ILA's initial activity, which includes AgorIP developing tailored training materials for University Health Boards. Such behaviour shows a step towards the potential and ambition shown in the NESTA (2013) report examining potential for deeper collaboration to support public sector innovation in Wales.

Network: Each of the IHSC ILA partners is a node within the local and wider ecosystem, providing connection across the Smart Specialisations noted by the EU (2017) and the Science and Innovation Audit (SU, 2018). Partners such as the Health Technology Centre and AgorIP provide connection through to private sector, while the Bevan Commission offers a depth of engagement across the Health and Social Care sectors, creating a network of networks. In a further operational context, aligning with the *Innovation* element noted above, the NHS Innovations Leads Group, bringing together key practitioners from across NHS Wales bodies offers further connection for the ILA. As such, the ILA integrates by virtue of its partnership into deep, if somewhat complex, networks. As the work develops, there is potential to map the ILA alumni and how they provide deeper engagement across the sectors. The continued dominance of public sector actors for R&D in Wales will mean effective and open networks remain important to attract and develop opportunities, whether it is for spillovers (Jaffe, 1986) or targeted brokering (Youtie and Shapira, 2008).

Learning: The fundamental purpose of the ILA is to promote institutional learning through the participants in each of the programmes. For example, within the initial MSc. cohort, there are fifteen organisations represented which offers potential for shared learning. As further cohorts join, there is scope for an alumni network which carries further into the ecosystem, though this will depend upon the medium to longer-term ILA performance. Learners on the MSc. programme for example have already reported application of analytical tools and core

concepts into their practice. For example, one senior civil servant noted how they had shifted their consideration of Business Cases to focus far more on validating the challenge involved rather than the proposed solution. This they found was already helping them think more broadly in identifying and appraising options, approaching the business case as more of a 'process' than a 'pitch'.

The case-based approach adopted by the ILA, uses existing local and international cases and new insight drawn from original research undertaken by the Academy with its *Network* partners. An example of this is the Covid-19 Innovation Study undertaken in collaboration with the ILA which provides learning cases ranging from telehealth technology through to workforce wellbeing (Doneddu et al., 2021).

Interaction: The ILA is in its early days of delivery, though activities such as Intensive Learning Weeks are starting to create interactions of the nature described by Cooke (2001b). Industry participation is also linking in through connection with regional activities such as the Health Hack. Notably, within the MSc. Programme, many of the guest speakers are from industry backgrounds providing private sector perspective to predominantly public sector learners. In terms of ongoing interactions to support innovation, the ILA base within a university does provide potential for the forms of knowledge spillover to support the joint ambitions of improved health outcomes and economic development (Leyden and Link, 2013), as targeted by a Healthier Wales. There are already though examples of this interaction producing tangible outcomes. For example, one University Health Board has commissioned change management support from the University to help deliver a major digital transformation initiative.

6. Conclusion

In a sector where innovation can take some time it is early days for the ILA in its operation and potential impact. The south west Wales ecosystem presents an ecosystem offering much relevant infrastructure and a sizable workforce, along with the wider potential across Wales and beyond. The IHSC ILA responds in part to the RLSP call for non-STEM skills, though scope remains to expand industry engagement and scale its activity to support the RIS. How the ecosystem can be orchestrated to maximise its Innovation and deliver effectively will be a major challenge for WG and the IHSC partners. The longer-term, and meaningful targeted impact of the ILA will come from delivery of learner's current projects, and their ability to apply and add to their learning over the years to come. This can include more detailed consideration of how the ILA activities impact upon the Knowledge Exploitation components of RIS presented in models such as that of Tödtling and Trippl (2011), though this will need to build upon real-world context-specific structural mappings such as that developed in Davies et al. (2018). However, with over 200 participants in the first year of operation this provides a foundation for the IHSC ILA to start filling the gap within the RIS for the Health and Social Care sector, as identified in a Healthier Wales (WG, 2018).

References

Arch. 2017. *A Regional Collaboration For Health* [Online]. Online. Http://Arch.Wales/En/ [Accessed 10th April 2017].

Autio, E., Kenney, M., Mustar, P., Siegel, D. & Wright, M. 2014. Entrepreneurial Innovation: The Importance Of Context. *Research Policy,* 43**,** 1097-1108.

Bell, J. 2017. Life Sciences Industrial Strategy - A Report To The Government From The Life Sciences Sector. Life Science Industrial Strategy Board. Online. Https://Www.Gov.Uk/Government/Publications/Life-Sciences-Industrial-Strategy [Accessed 8th May 2022]

Bevan, H. 2010. How Can We Build Skills To Transform The Healthcare System? *Journal Of Research In Nursing,* 15**,** 139-148.

Birken, S. A., Lee, S.-Y. D. & Weiner, B. J. 2012. Uncovering Middle Managers' Role In Healthcare Innovation Implementation. *Implementation Science,* 7**,** 1-12.

Braczyk, H.-J., Cooke, P. N. & Heidenreich, M. 1998. *Regional Innovation Systems: The Role Of Governances In A Globalized World*, Psychology Press.

Brunt, H., Barnes, J., Jones, S., Longhurst, J., Scally, G. & Hayes, E. 2017. Air Pollution, Deprivation And Health: Understanding Relationships To Add Value To Local Air Quality Management Policy And Practice In Wales, Uk. *Journal Of Public Health,* 39**,** 485-497.

Cooke, P. 2001a. Biotechnology Clusters In The U.K.: Lessons From Localisation In The Commercialisation Of Science. *Small Business Economics,* 17**,** 43-59.

Cooke, P. 2001b. Regional Innovation Systems, Clusters, And The Knowledge Economy. *Industrial And Corporate Change,* 10**,** 945-974.

Cooper, A., Gray, J., Willson, A., Lines, C., Mccannon, J. & Mchardy, K. 2015. Exploring The Role Of Communications In Quality Improvement: A Case Study Of The 1000 Lives Campaign In Nhs Wales. *Journal Of Communication In Healthcare,* 8**,** 76-84.

Davies, G. H., Roderick, S. & Williams, M. 2018. A Sub-Regional Innovation Ecosystem? Life Sciences And Health In The Swansea Bay City Region. *International Journal Of Innovation And Regional Development,* 8**,** 15.

Doneddu, D., Bourne, J., Davies, G., Howson, T., Joyce, N., Rees, D., Hughes, S., Charles, S. & Beharrel, W. 2021. The Nhs Wales Covid-19 Innovation And Transformation Study Report. Online: Nhs Confederation Wales. Https://Www.Nhsconfed.Org/Publications/Nhs-Wales-Covid-19-Innovation-And-Transformation-Study-Report [Accessed 8th May 2022]

Dti 2001. Business Clusters In The Uk - A First Assessment. *In:* Department For Trade And Industry, (Ed.). Crown Copyright

Eu. 2017. *Wales Smart Specialisations* [Online]. Available: Http://S3platform.Jrc.Ec.Europa.Eu/Regions/Ukl/Tags/Ukl [Accessed 10th April 2017].

Herzlinger, R. E. 2006. Why Innovation In Health Care Is So Hard. *Harvard Business Review,* 84**,** 58.

Hwang, J. & Christensen, C. M. 2008. Disruptive Innovation In Health Care Delivery: A Framework For Business-Model Innovation. *Health Affairs,* 27**,** 1329-1335.

Jaffe, A. B. 1986. Technological Opportunity And Spillovers Of R&D: Evidence From Firms' Patents, Profits And Market Value. National Bureau Of Economic Research.

Länsisalmi, H., Kivimäki, M., Aalto, P. & Ruoranen, R. 2006. Innovation In Healthcare: A Systematic Review Of Recent Research. *Nursing Science Quarterly,* 19**,** 66-72.

Leyden, D. P. & Link, A. N. 2013. Knowledge Spillovers, Collective Entrepreneurship, And Economic Growth: The Role Of Universities. *Small Business Economics,* 41**,** 797-817.

Lundvall, B.-Å. 1992. *National Systems Of Innovation: Towards A Theory Of Innovation And Interactive Learning*, Pinter, London.

Marjanovic, S., Altenhofer, M., Hocking, L., Chataway, J. & Ling, T. 2020. Innovating For Improved Healthcare: Sociotechnical And Innovation Systems Perspectives And Lessons From The Nhs. *Science And Public Policy,* 47**,** 283-297.

Mckinsey 2014. Industrial Revolutions: Captruing The Growth Potential. Centre For Cities.

Mom, T. J. M., Oshri, I. & Volberda, H. W. 2012. The Skills Base Of Technology Transfer Professionals. *Technology Analysis & Strategic Management,* 24**,** 871-891.

Naw 2015. Well-Being Of Future Generations (Wales) Act 2015. *Online* Https://Gweddill.Gov.Wales/Docs/Dsjlg/Publications/150623-Guide-To-The-Fg-Act-En.Pdf [Accessed 8th May 2022]

Nelson, R. R. 1993. *National Innovation Systems: A Comparative Analysis*, Oxford University Press.

Nesta 2013. State Of Innovation: Welsh Public Services And The Challenge Of Change. *In:* Matthew Gatehouse, A. P. (Ed.). Nesta.

Parmar, J., Sacrey, L. A., Anderson, S., Charles, L., Dobbs, B., Mcghan, G., Shapkin, K., Tian, P. & Triscott, J. 2021. Facilitators, Barriers And Considerations For The Implementation Of Healthcare Innovation: A Qualitative Rapid Systematic Review. *Health & Social Care In The Community*.

Pino, R. M. & Ortega, A. M. 2018. Regional Innovation Systems: Systematic Literature Review And Recommendations For Future Research. *Cogent Business & Management,* 5**,** 1463606.

Rich, N. 2019. The Big Picture Exemplar Cohort 3 Evaluation.

Rlp 2013. Life Science Skills For Life. *In:* Wales, R. L. P. S. W. A. C. (Ed.).

Sbcr 2013. Swansea Bay City Region Economic Regneration Strategy. Online. Https://Www.Swanseabaycitydeal.Wales/ [Accessed 8th May 2022]

Sqw 2014. Accelerating Local Economic Growth - Clusters And Deals. *Viewpoint.* Https://Www.Sqw.Co.Uk/Insights-And-Publications/Viewpoint-Archive [Accessed 10th April 2017].

Su 2017. Internet Coast: Phase 1: City Deal Proposal Impact Appraisal. *V1.26.* School Of Management: Swansea University.

Su 2018. South Wales Crucible: Final Report. *In:* Swansea University.Online Https://Www.Southwalescrucible.Co.Uk/ [Accessed 8th May 2022]

Tödtling, F. & Trippl, M. 2011. Regional Innovation Systems. *Handbook Of Regional Innovation And Growth.* Edward Elgar Publishing.

Uyarra, E., Edler, J., Garcia-Estevez, J., Georghiou, L. & Yeow, J. 2014. Barriers To Innovation Through Public Procurement: A Supplier Perspective. *Technovation,* 34**,** 631-645.

Wag 2003. Wales For Innovation. Welsh Assembly Government. Cathays Park, Welsh Government, Cardiff, Crown Copyright

Wag 2004. People, Places, Futures: The Wales Spatial Plan. Cathays Park, Welsh Government, Cardiff, Crown Copyright

Wg 2013. Sectors Delivery Plan. Department For Business, Enterprise And Transport (Ed.). Cathays Park, Welsh Government, Cardiff, Crown Copyright

Wg 2014. Innovation Wales. Department For Business, Enterprise And Transport (Ed.). Cathays Park, Welsh Government, Cardiff, Crown Copyright

Wg 2018. Healthier Wales. *In:* Department For. Health And Social Care S. (Ed.). Online: Https://Gov.Wales/Sites/Default/Files/Publications/2019-04/In-Brief-A-Healthier-Wales-Our-Plan-For-Health-And-Social-Care.Pdf [Accessed 8th May 2022] Welsh Government, Crown Copyright.

Youtie, J. & Shapira, P. 2008. Building An Innovation Hub: A Case Study Of The Transformation Of University Roles In Regional Technological And Economic Development. *Research Policy,* 37**,** 1188-1204.

The Role of Motivation and Entrepreneurial Role Models in Shaping Entrepreneurship Competence of Higher Education Students

Sanna Joensuu-Salo
Seinäjoki University of Applied Sciences, Seinäjoki, Finland
sanna.joensuu-salo@seamk.fi

Abstract: Entrepreneurship competence (EC) has received considerable attention in Europe, particularly after the European Commission published the EntreComp framework in 2016. EC can be defined as a competence for life, relevant to personal development and fulfilment, finding and progressing in employment, as well as initiating new ventures ranging from community campaigns, social enterprises to new start-up businesses. There is a need to develop EC of European citizens, and especially in higher education context, but little is known about the factors shaping EC. The objective of this research is twofold: (1) to examine the relationship between entrepreneurial role models and entrepreneurship competence of higher education students, and (2) to examine the relationship between motivation and entrepreneurship competence of higher education students. The data (n=1373) was gathered from two Finnish universities, and respondents represent first year students in versatile study fields. In this research, entrepreneurial role model is defined as someone in the close family (parents or siblings) working as an entrepreneur, and motivation is examined through multidimensional achievement motivation. The results show that there is a positive relationship between entrepreneurial role models and EC. The most important factor explaining EC is the motivation subscale of work orientation followed by mastery needs and interpersonal competitiveness. The model explains 46 percent of the variance in EC. The study contributes to understanding the underlying factors shaping the EC of higher education students, and suggests practical solutions for entrepreneurship education.

Keywords: entrepreneurship competence, achievement motivation, entrepreneurial role models, higher education

1. Introduction

Entrepreneurship competence (EC) has received considerable attention in Europe, particularly after the European Commission published the EntreComp framework in 2016 (see Bacigalupo et al, 2016). EC can be defined as "a competence for life, relevant to personal development and fulfilment, finding and progressing in employment, as well as initiating new ventures ranging from community campaigns, social enterprises to new start-up businesses" (McCallum et al., 2018). There is a need to develop EC of European citizens, and especially in higher education context, but little is known about the factors shaping EC.

This research contributes to discussion on the antecedents of EC in two ways. First, the importance of entrepreneurial role models in shaping individual's EC is examined. Prior research has demonstrated a clear link between entrepreneurial role models and entrepreneurial intention (Chlosta et al, 2012; Laspita et al, 2012; Joensuu-Salo et al, 2015), but the relationship between entrepreneurial role models and entrepreneurship competence had not received much attention. In this research, role models are seen as someone in the close family working as an entrepreneur. Second, this research tests the impact of achievement motivation on entrepreneurship competence by using Atkinson's (1957, 1964) theory of Ach (achievement motivation), which suggests that individuals differ in strive for achievement and this disposition is fairly stable. Atkinsons´s Ach is a one-dimensional construct. However, Helmreich and Spence (1978) suggests, that Ach may not be one-dimensional but instead have several independent dimensions. They developed a multidimensional model of achievement motivation (multidimensional Ach), which have three distinct sub-dimensions. These are mastery needs (individual´s desire to perform challenging tasks instead of easy ones), work orientation (individual´s desire to work hard and enjoy it), and interpersonal competition (individual´s desire to compete with others and succeed better than others). In this research, the perspective of multidimensional Ach is adopted. The study of motivation in entrepreneurship research has been scarce in recent years, and Carsrud and Brännback (2011) call for new studies on motivation and entrepreneurship. As they argue, the subscales of multidimensional Ach tap into some underlying motivational characteristics of the entrepreneur. Thus, in this research the relationship between mastery needs, work orientation, interpersonal competitiveness and entrepreneurship competence is examined.

This research has two main objectives: first, to examine the relationship between entrepreneurial role models and entrepreneurship competence, and second, to examine the relationship between multidimensional achievement motivation and entrepreneurship competence.

2. Theoretical framework

2.1 Entrepreneurship competence

Ismail et al (2015) define competence as a set of knowledge, capabilities, characteristics, and attitudes that are required for a good performance in some task. Further, Mitchelmore and Rowley (2010) argue that competence should be viewed as the essential personal traits, skills, knowledge, and motives that enable people to do the task. Based on the definition of competence, entrepreneurship competence is linked with the capacity of entrepreneurs to succeed (Man et al, 2002). Mitchelmore and Rowley (2010) define entrepreneurial competencies as "a specific group of competencies relevant to the exercise of successful entrepreneurship."

There has been several attempts to identify different sub-competences of entrepreneurship competence. Schelfhout et al (2016) include the competences of initiative-taking, creativity, performance orientation, problem-solving, and risk-taking ability for a generic entrepreneurial competence, while Oosterbeek et al. (2010) used 10 competencies in measuring entrepreneurship competence. Despite earlier work on entrepreneurship competence, Ferreras-Garcia et al (2019) point out that it is still difficult to find a precise definition of entrepreneurship competence. This problem was also recognized by the European Commission, which promoted an initiative to develop a framework for entrepreneurship competencies. This led to the development of EntreComp framework (Bagicalupo et al, 2016), in which entrepreneurship is defined as the capacity to turn value-generating ideas into action, and a transversal key competence needed by every citizen to secure personal fulfilment and development, active citizenship, social inclusion, and employment in the knowledge society. The EntreComp framework sees entrepreneurship competence through three inter-related and interconnected areas of 1) ideas and opportunities, 2) resources, and 3) into action (Bagicalupo et al, 2016). Each area consists of five competences, which together form the concept of entrepreneurship competence. The ideas and opportunities competence encompasses spotting opportunities, creativity, vision, valuing ideas, and ethical & sustainable thinking. The resources competence encompasses self-awareness and self-efficacy, motivation and perseverance, mobilizing resources, financial and economic literacy, and mobilizing others. The into action competence encompasses taking the initiative, planning and management, coping with ambiguity, uncertainty and risk, working with others, and learning through experience.

Learning is strongly related to the development of entrepreneurship competence. As Kakouris and Liargovas (2021) highlight, learning can be formal (result of instruction) or informal (results of any experience). Thus, EC can be developed through entrepreneurship education (EE), and through life experience. However, learning is a holistic phenomenon, and the causal relation between EE and learning is under debate (Kakouris and Liargovas, 2021; Hytti and O'Gorman, 2004). In addition, the discussion about the three modes of EE (about, for, and through) is relevant in understanding the concept of entrepreneurship competence (see Lackeus, 2015; Kakouris and Liargovas, 2021). If EC is seen only as knowledge and skills needed in entrepreneurial career (corresponding to "for" mode in EE), the transformational nature of entrepreneurship as a value creative function is lost (corresponding to "through" mode in EE).

2.2 Entrepreneurial role models

Prior research has shown that entrepreneurial role models – especially parental role models – have positive effects on individual's entrepreneurial intentions (Chlosta et al 2012; Laspita et al 2012). Further, Joensuu-Salo et al (2015) showed, that especially having a father working as an entrepreneur has a stronger impact on entrepreneurial intentions compared to having a mother working as an entrepreneur. However, the impact of parental role models can depend on personality factors (Chlosta et al, 2012). It can be moderated e.g. by gender (Moreno-Gómez et al, 2020) or attitudes and self-efficacy (Nowiński and Haddoud, 2019). However, in addition to parents, also sisters and brothers can act as role models in entrepreneurship. Thus, in this research entrepreneurial role model is defined as someone in the close family (parents or siblings) working as an entrepreneur. As prior research has demonstrated a clear link between entrepreneurial role models and individual's interest towards entrepreneurial career, there may also exist a link between entrepreneurial role models and entrepreneurship competence. Joensuu-Salo et al (2021) suggest that growing up with entrepreneurial parents might stir an individual to develop entrepreneurship competence, a positive attitude towards entrepreneurship, and a strong belief in the ability to succeed as an entrepreneur to a greater degree than among individuals without a parental role model. Thus, the following hypothesis is proposed:

Hypothesis 1: Entrepreneurial role models have a positive relationship with entrepreneurship competence.

2.3 Motivation

Goals and motives are important for understanding human behaviour. The achievement motivation theory was developed by Atkinson (1957, 1964) and McClelland (1961). It suggests that individuals differ in the strength of achievement motive, which in turn has effects on the behaviour. Achievement motivation is considered to be individual and relatively stable, providing incentive value in particular when a difficult goal is pursued. It may be referred to as "striving for achieving the best possible outcome which has an established standard of perfection and hence may result in success or failure" (Staniewski and Awruk, 2019). Prior research has demonstrated a clear link between entrepreneurial career, entrepreneurial performance, and achievement motivation (Collins, Hange and Locke, 2004). Thus, it would be reasonable to assume that achievement motivation has some relationship with entrepreneurship competence.

Based on the theory of achievement motivation (Ach), Helmreich and Spence (1978) developed a multidimensional model to be used in measuring Ach. It includes three elements of interpersonal competition, work orientation, and mastery needs. Interpersonal competition is seen as a social dimension, and work and mastery as nonsocial dimensions. Interpersonal competition refers to the level of how much individual enjoys competition with others and has the desire to be better than others. Mastery refers to individuals' desire to perform difficult tasks instead of non-challenging ones. The sub-dimension of work can be defined as individual's desire to work hard and enjoy it. Multidimensional Ach has been used in prior entrepreneurship research. Carsrud, Olm and Thomas (1989) showed interactions of these sub-dimensions in predicting entrepreneurial success, and DeMartino, Barbato and Jacques (2006) explored career/achievement and personal life orientations of entrepreneurs and the impact of sex. Overall, recent research has demonstrated that there is a positive relationship between achievement motivation and entrepreneurial success (Staniewski and Awruk, 2019). However, Carsrud and Brännback (2011) call for more research on motivation and entrepreneurship, and suggest the benefits of using a multidimensional Ach for measuring motivation. By definition, entrepreneurship competence is needed for success in entrepreneurial ventures – hence, it can be assumed that achievement motivation and entrepreneurship competence are also linked. The following hypotheses are presented:

Hypothesis 2: Mastery needs have a positive relationship with entrepreneurship competence.

Hypothesis 3: Work orientation has a positive relationship with entrepreneurship competence.

Hypothesis 4: Interpersonal competition has a positive relationship with entrepreneurship competence.

3. Data and method

3.1 Data collection

The data were gathered from two Finnish universities of applied sciences (Seinäjoki and Tampere). The students answered a web-based survey during their first study year. The data therefore comprise answers from first year students collected in the fall of 2019 and of 2020. The data consists of 1373 answers from first year students. Among those surveyed, approximately 49 % were women and 51 % men. The respondents were aged between 18 and 58 (mean age 24.5). The survey revealed 66 % of the students had some entrepreneurial role model in their close family (father, mother or siblings). The students represented variety of different study fields.

3.2 Variables and reliability

The EC was measured with an instrument developed by Joensuu-Salo et al (2022), which is based on the EntreComp framework. The items for EC included:

Ideas and opportunities
EC1: I use my imagination and abilities to identify opportunities for creating value.
EC2: I develop creative and purposeful ideas.
EC3: I work toward a vision of my future.

EC4: I make the most of ideas and opportunities.
EC5: I assess the consequences and impact of ideas, opportunities, and actions.

Resources
EC6: I believe in myself and keep developing.
EC7: I know how to stay focused and don't give up.
EC8: I gather and manage the resources I need.
EC9: I have a good understanding of financial and economic issues.
EC10: I inspire, enthuse, and get others on board.

Into Action
EC11: I initiate processes that create value and can take up challenges.
EC12: I know how to prioritize, organize, and follow up.
EC13: I make decisions, thus dealing with uncertainty, ambiguity, and risk.
EC14: I know how to team up, collaborate, and network.
EC15: I reflect and learn from both success and failure, my own, and other people's.

Students were asked to evaluate their skills by answering these questions on a 7-point Likert scale anchored with completely disagree (1) and completely agree (7).

A multidimensional measurement of Ach developed by Helmreich and Spence (1978) was adapted for measuring the three subscales of "mastery needs", "work orientation", and "interpersonal competitiveness. All the variables were measured using 7-point Likert scale (1=Not at all agree --- 7=Totally agree).

Mastery needs was measured with the following five items:
MN1: I would rather do something at which I feel confident and relaxed than something, which is challenging and difficult. (reversed)
MN2: I would rather learn easy fun games than difficult thought games. (reversed)
MN3: If I am not good at something I would rather keep struggling to master it than to move on to something I may be good at.
MN4: I prefer to work in situations that require a high level of skill.
MN5: Once I undertake a task, I persist.

The work orientation was measured with the following four items:
WO1: I find satisfaction in working as well as I can.
WO2: I find satisfaction in exceeding my previous performance even if I don't outperform others.
WO3: I like to work hard.
WO4: Part of my enjoyment in doing things is improving my past performance.

Interpersonal competitiveness was measured with the following three items:
IC1: I enjoy working in situations involving competition with others.
IC2: It is important to me to perform better than others on a task.
IC3: I feel that winning is important in both work and games.

Entrepreneurial role model was operationalized as a dummy variable, where zero indicates that no father, mother or siblings worked as an entrepreneur, and one indicates that either father, mother or siblings worked an entrepreneur. All the items of EC loaded to one single factor, and factor loadings were higher than 0.50 as recommended by Hair et al (2010). Thus, EC was used as one-dimensional in this research. Cronbach's alpha for the scale was 0.93, which is well above the recommended level of 0.60-0.70 (Nunnally, 1978). Multidimensional Ach was examined through explorative factor analysis. As expected, the sub-scales or work orientation, mastery needs and interpersonal competition all loaded to their own independent factors. For work orientation, factor loadings varied between 0.54 and 0.74, for interpersonal competition from 0.62 to 0.87, and for mastery needs between 0.45 and 0.66. Even though one factor loading was below 0.50 in the sub-scale of mastery needs, the Cronbach's alphas were on acceptable level for all the sub-scales (Cronbach's alphas between 0.61 and 0.80). Table 1 presents the minimum and maximum values, means and standard deviations and correlations between the scales.

Table 1: Correlations, mean, minimum and maximum values of the study variables.

	Mean (sd)	Min/Max	1	2	3	4
1. EC	5.0 (0.9)	1.7/7.0	1			
2. MN	4.1 (1.0)	1.3/7.0	.461***	1		
3. WO	5.8 (0.8)	2.2/7.0	.590***	.312***	1	
4. IC	4.2 (1.3)	1.0/7.0	.351***	.283***	.203***	1
5. Role model	0.66 (0.5)	0/1	.118***	.100***	.081**	.074**
** p < .01. *** p <.001						

Podsakoff et al (2003) reminds that common method bias can be a potential problem when data for both the predictor and criterion variable are obtained from the same person in the same measurement context using the same item context and similar item characteristics. Common method bias can be examined using Harman's single factor test: all of the studied variables are loaded into an exploratory factor analysis and unrotated factor solution is examined. The basic assumption is that if a substantial amount of common method variance is present, either a single factor will emerge or one general factor will account for the majority of the covariance among the measures. Harman's single factor test was used to control for the method bias. Exploratory factor analysis using principal axis factoring where the unrotated factor solution was examined, as recommended by Podsakoff et al (2003). Kaiser's criterion for retention of factors was followed. The sample size seemed to be large enough for the factor analysis, at least based on the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO = .94). Factor analytic results indicated the existence of several factors with eigenvalues greater than 1.0. The first factor accounted for 34 percent of the variance. Since several factors, as opposed to one single factor, were identified and since the first factor did not account for the majority of the variance, a substantial amount of common method variance does not appear to be present.

4. Results

Linear regression analysis was used to examine the hypothesized relationships. We followed the recommendations of Hilbe (2009) and Menard (2010) in checking the suitability for using regression analysis (normal distribution of response and error terms, no autocorrelation, no homoscedasticity, and no multicollinearity). Table 2 presents the results of the linear regression analysis. In the first model A, only entrepreneurial role model was used as an independent variable. It has a significant and positive relationship with entrepreneurship competence (β .118, p<.001). However, the model explains only 1.3 % of the variance in entrepreneurship competence. In the second model B, the three elements of achievement motivation were added to the equation. Results show that the most powerful predictor of entrepreneurship competence is work orientation (β .469, p<.001) followed by mastery needs (β .260, p<.001). In addition, interpersonal competitiveness has a significant and positive relationship with entrepreneurship competence (β .179, p<.001). Entrepreneurial role model remains significant in the second model. Having an entrepreneurial role model is positively related to student's entrepreneurship competence (β .041, p<.05). The whole model explains 46 percent of the variance in entrepreneurship competence. All the hypotheses are confirmed.

Table 2: Results of the linear regression analysis.

	Model A B (sd.error) Beta	Model B B (sd.error) Beta
Constant	4.854 (.041)***	.599 (.131)***
Role model	.221.*** (.050) β .118	.077 (.037)* β .041
Mastery needs		.227(.019)*** β .260
Work orientation		.500 (.022)*** β .469
Interpersonal competitiveness		.120 (.014)*** β .179
Adjusted R^2	.013	.463
F statistics	19.449***	296.303***
F change		383.154***
*p < .05. ** p < .01 *** p <.001		

5. Discussion

The objective of this research was to examine how entrepreneurial role models and achievement motivation are related to entrepreneurship competence. The results show that having someone in the close family working an entrepreneur positively relates to entrepreneurship competence of a student. This supports the arguments of Joensuu-Salo et al (2021) – they suggested that growing in an entrepreneurial context can shape individual's entrepreneurship competence, positive attitudes towards entrepreneurial career, and belief in one's ability to succeed as an entrepreneur. As succeeding as an entrepreneur requires entrepreneurship competence, it can be hypothesized that the many entrepreneurs possess also high levels of entrepreneurship competence. If student's mother or father is a successful entrepreneur and has high level of entrepreneurship competence, can this somehow be inherited? Are the skills included in entrepreneurship competence strongly linked with personality traits and thus, embedded in genes? On the other hand, socialization (e.g., Falck et al. 2009) into the world of entrepreneurship may account for the effect. Prior research has demonstrated a clear link between entrepreneurial role models and entrepreneurial intentions (Chlosta et al, 2012; Laspita et al, 2012). This research adds new knowledge on the importance of role models in the development of entrepreneurship competence.

The second objective was to examine the relationship between multidimensional achievement motivation and entrepreneurship competence. Results show that all the elements of achievement motivation are positively related to entrepreneurship competence. The strongest relationship is between work orientation and entrepreneurship competence. Students who have high work morale have higher levels of entrepreneurship competence. In addition, mastery needs and interpersonal competition are positively related to entrepreneurship competence. This underlines the importance of achievement motivation in entrepreneurship research. It is not only related to entrepreneurial success like prior research has demonstrated (Staniewski and Awruk, 2019), but also to entrepreneurship competence, i.e. skills to gather resources, spot opportunities, and initiate processes to create value for others.

6. Conclusions

This research has several contributions and implications. First, it contributes to the discussion of the importance of role models when boosting entrepreneurship. Entrepreneurship competence is needed for successful entrepreneurship, hence, the use of role models in entrepreneurship education could be much stronger. In addition, students with entrepreneurial family background could be involved in designing entrepreneurship education. Second, this research contributes to entrepreneurship research by adding knowledge on the relationship between achievement motivation and entrepreneurship competence. The results of this research indicate that entrepreneurship education should be designed to support achievement motivation – the use of competitions, challenging tasks and assignments, and constant feedback on performance is needed. This in turn, makes entrepreneurship education more suitable to individuals with entrepreneurship competence and may lead to entrepreneurial ventures. Basic lectures or passive learning methods are not best pedagogical choices in entrepreneurship education. As Kakouris and Liargovas (2021) state, passive learning corresponds to "about" mode of teaching entrepreneurship, while "through" mode" is inherently transformational. The results of this research give emphasis on "through" mode of entrepreneurship education. There are some limitations in this study. The data was collected from one country only. The homogeneous cultural and temporal setting may limit the general applicability of the results, and future studies should check whether these results are similar in other settings. Furthermore, the analysis is here limited to examination of the three dimensions of Ach and role models on entrepreneurship competence. Future research could examine possible moderators like gender or attitudes, which prior research has identified to moderate the relationship between entrepreneurial role models and entrepreneurial intentions (Chlosta et al, 2012; Nowiński and Haddoud, 2019). Despite the limitations of the study, the research contributes to understanding different factors shaping entrepreneurship competence of individuals and has clear implications for entrepreneurship education.

References

Atkinson, J. W. (1957) "Motivational determinants of risk-taking behaviour", *Psychological Review*, Vol 64, No.6, pp 359-372.

Atkinson, J. W. (1964) *An Introduction to Motivation*, Van Nostrand, Princeton, NJ.

Bacigalupo, M., Kampylis, P., Punie, Y. and Van Den Brande, L. (2016) *EntreComp: The Entrepreneurship Competence Framework*, Publication Office of the European Union, Luxembourg.

Carsrud, A. and Brännback, M. (2011) "Entrepreneurial Motivations: What Do We Still Need to Know?" *Journal of Small Business Management*, Vol 49, No. 1, pp 9-26.

Carsrud, A., Olm, K. and Thomas, J. (1989) "Predicting entrepreneurial success: effects of multi-dimensional achievement motivation, levels of ownership, and cooperative relationships", *Entrepreneurship and Regional Development,* Vol 1, No. 3, pp 237-244.

Chlosta, S., Patzelt, H., Klein, S.B. and Dormann, C. (2012) "Parental role models and the decision to become self-employed: The moderating effect of personality", *Small Business Economics*, Vol 38, pp 121-138.

Collins, C., Hanges, P. and Locke, E. (2004) "The Relationship of Achievement Motivation to Entrepreneurial Behavior: A Meta-Analysis", Human Performance, Vol 17, No. 1, pp 95-117.

DeMartino, R., Barbato, R. and Jacques, P. (2006) "Exploring the Career/Achievement and Personal Life Orientation Differences between Entrepreneurs and Nonentrepreneurs: The Impact of Sex and Dependents", *Journal of Small Business Management,* Vol 44, No. 3, pp 350-368.

Falck, O., Heblich, S. and Lüdemann, E. (2009) "Identity and entrepreneurship", *CESinfo Working Paper*, No. 2661, May 2009.

Ferreras-Garcia, R., Hernández-Lara, A.B and Serradell-López, E. (2019) "Entrepreneurial competences in a higher education business plan course", *Education + Training*, Vol 61, pp 850-869.

Hair, J.F., Black, B., Babin, B. and Anderson, R.E. (2010) *Multivariate Data Analysis: Global Edition, 7th, edition,* Pearson Education, London.

Helmreich, R. and Spence, J. "The work and Family Orientation Questionnaire: An objective instrument to assess components of achievement motivation and attitudes toward family and career", *JSAS Catalog of Selected Documents in Psychology*, Vol 8, No. 35, MS No. 1677.

Hilbe, J. (2009) *Logistic Regression Models,* CRC Press, Taylor & Francis Group, London.

Ismail, V. Y., Zain, E. and Zulihar. (2015) "The Portrait of Entrepreneurial Competence on Student Entrepreneurs", *Procedia – Social and Behavioral Sciences*, Vol 169, pp 178-188.

Joensuu-Salo, S., Varamäki, E. and Viljamaa, A. (2015) "Beyond intentions. What makes a student start a firm?", *Education + Training*, Vol 57, No. 8/9, pp 853-873.

Joensuu-Salo, S., Viljamaa, A. and Varamäki, E. (2021) " Understanding Business Takeover Intentions—The Role of Theory of Planned Behavior and Entrepreneurship Competence", Administrative Sciences, Vol 11, No. 3, 61, https://doi.org/10.3390/admsci11030061

Joensuu-Salo, S., Viljamaa, A. and Varamäki, E. (2022) "Testing the EntreComp framework and its relation to start-up behaviour in seven European countries", *Journal of Small Business and Enterprise Development*, Vol ahead-of-print, No. ahead-of-print. https://doi.org/10.1108/JSBED-04-2021-0156

Kakouris, A. and Liargovas, P. (2021) "On the About/For/Through Framework of Entrepreneurship Education: A Critical Analysis", *Entrepreneurship Education and Pedagogy,* Vol 4 No. 3, pp 396-421.

Lackeus, M. (2015) "Entrepreneurship in education—What, why, when, how", *Background paper for OECD-LEED*. https://www.oecd.org/cfe/leed/BGP_Entrepreneurship-inEducation.pdf

Laspita, S., Breugst, N., Heblich, S. and Patzel, H. (2012) "Intergenerational transmission of entrepreneurial intentions", *Journal of Business Venturing*, Vol 27, pp 414-435.

McClelland, D. C. (1961) *The achieving society,* Van Nostrand, Princeton, NJ.

Man, T.W.Y., Lau, T. and Chan, K.F. (2002), "The competitiveness of small and medium enterprises a conceptualization with focus on entrepreneurial competencies", *Journal of Business Venturing*, Vol 17 No. 2, pp 123-142.

McCallum, E., Weicht, R., McMullan, L. and Price, A. (2018) *EntreComp into action - Get inspired, make it happen: A user guide to the European Entrepreneurship Competence Framework*, Publications Office of the European Union, Luxembourg.

Menard, S. (2010) *Logistic regression. From Introductory to Advanced Concepts and Applications,* SAGE Publications, Thousand Oaks, California.

Mitchelmore, S. and Rowley, J. (2010) "Entrepreneurial competencies: a literature review and development agenda", *International Journal of Entrepreneurial Behavior & Research*, Vol 16, pp 92-111.

Moreno-Gómez, J., Gómez-Araujo, E. and Castillo-De Andreis, R. (2020) "Parental role models and entrepreneurial intentions in Colombia: Does gender play a moderating role?", *Journal of Entrepreneurship in Emerging Economies,* Vol 12, pp 413-429.

Nowiński, W. and Haddoud, M.Y. (2019) "The role of inspiring role models in enhancing entrepreneurial intention", *Journal of Business Research,* Vol 96, pp 183-193.

Nunnally, J. C. (1978) *Psychometric theory,* McGraw-Hill, New York.

Oosterbeek, H., van Praag, M. and Ijsselstein, A. (2010) "The impact of entrepreneurship education on entrepreneurship skills and motivation", *European Economic Review,* Vol 54, pp 442-454.

Podsakoff, P. M., MacKenzie, S.B., Lee, J-Y. and Podsakoff, N.P. (2003) "Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies", *Journal of Applied Psychology*, Vol 88, No. 5, pp 879-903.

Schelfhout, W., Bruggeman, K. and De Maeyer, S. (2016) "Evaluation of entrepreneurial competence through scaled behavioural indicators: Validation of an instrument", *Studies in Educational Evaluation*, Vol 51, pp 29-41.

Staniewski, M.W. and Awruk, K. (2019) "Entrepreneurial success and achievement motivation – A preliminary report on a validation study of the questionnaire of entrepreneurial success", *Journal of Business Research,* Vol 101, pp 433-440.

Engaging Literature Students in Entrepreneurship: Could use of art Help?

Alexandros Kakouris and Panagiotis Liargovas
Department of Management Science and Technology, University of Peloponnese, Greece
a.kakouris@uop.gr

Abstract: Entrepreneurship educators seek innovative teaching in entrepreneurship in order to engage youth populations in venturing by instilling them the entrepreneurial mindset whilst the contemporary progression of entrepreneurship education encompasses its embedded form to other discipline curricula. At a Greek central university, such courses are massively attended by foreign language and literature students during the last decade. In the present implementation, literature students were encouraged to either perform the usual business plan or to analyse a piece of art for their entrepreneurial courses' project. Pre/post measurements (N=64) for entrepreneurial self-efficacy, entrepreneurial success beliefs and entrepreneurial intention were conducted in order to compare the two groups. T-tests indicate that changes to the entrepreneurial constructs do not significantly vary between the groups. Through a binary logistic regression model, it was found that art-projects were chosen by those who rely more on personal abilities for the success of their initiatives. The article concludes that introducing art in entrepreneurial teaching conforms with some curricular contexts, like literature, affects students in a similar manner with the business plan, but also confronts different learning needs and enables critical thinking and personal autonomy on entrepreneurial meaning-making. The present study offers quantitative insights on how art-based entrepreneurship education could be employed in classrooms compounded with interactive lectures offering new perspectives for enriching the entrepreneurial teaching toolbox.

Keywords: entrepreneurship education, embedded entrepreneurship, art-based education, aesthetic experience, humanities, critical thinking

1. Introduction

A current classification of different forms of entrepreneurship education pertains to its "about", "for" and "through" forms (Kakouris and Liargovas 2021a). There is also the *embedded* (or *in*) form of entrepreneurship education when entrepreneurship is embedded or integrated in other disciplines across the curricula that aligns with its "through" form (Pittaway and Edwards 2012). Concerning the last two forms of entrepreneurship education (*for* and *through*), there are many studies which support that entrepreneurial courses increase the students' entrepreneurial intention (e.g. Wilson, Kickul and Marlino 2007), others that doubt it (Bae et al. 2014; Rideout and Gray 2013) and some with mixed results (e.g. Fayolle and Gailly 2015, Nabi et al. 2018). Concurrently, there are studies which suggest effective entrepreneurship education has to become more context-aware (Ramsgaard and Blenker 2021, Saukkonen and Kakouris 2022, Thomassen et al. 2020, Welter 2011). Hence, embedding entrepreneurship to other disciplines has to adapt to different contexts both in teaching content and methods without sufficient educational research on how these adaptations are possible and efficient. Thus, the present article focuses to entrepreneurial teaching to literature students and the wider field of humanities. Drawing upon a previous article for utilising art-based education in entrepreneurship (Kakouris and Liargovas 2021b) art-based projects were implemented in entrepreneurial teaching to literature students as alternatives to the common business plans. This is actually follow-up research of Kakouris and Liargovas (2021b) implementing teaching through the arts to humanities students in a central Greek university who attended an optional entrepreneurial course. The current research questions could be: (a) who prefer not to conduct a business plan? and (b) does teaching through the arts in entrepreneurship facilitate students from humanities and in what way? The adoption of art in relevant projects might be considered an entrepreneurial teaching innovation along with adaptation of entrepreneurial teaching methods to the specific discipline's context. The research approach is quantitative in order to map pre/post measurements of basic entrepreneurial constructs affected, or not, for the two groups of trainees, i.e. those who preferred the business plan project (hereafter BP) versus those who preferred the analysis of art projects (hereafter ART).

In the remaining of the article, first the theoretical framework with research hypotheses is developed and afterwards the research methodology is presented. The quantitative data are statistically analysed and the results are presented. In the last part of the article a discussion of the findings along with implications for educators, educational bodies and researchers is provided before the final conclusions. The present research is

explorative aiming at introducing learning innovations in the field that could be adopted further in the educational practice.

2. Theoretical framework and research hypotheses

Entrepreneurship education has rapidly grown during the last twenty years with an emergency for systematic literature review to identify which aspects of it have been consistently developed and which others still need research and improvement (Kakouris and Georgiadis 2016, Nabi et al. 2017). As many scholars agree (e.g. Neck and Corbett 2018) the high pressure from educational policies and the high demand from worldwide populations to be educated entrepreneurially led to a dramatic expansion of entrepreneurship education without the temporal convenience for educators to engage in learning theories (Kakouris and Morselli 2020) and the pedagogical pretensions of this new type of education.

In modern teaching of entrepreneurship, it has been revealed that experiential learning induces a higher impact on trainees' self-efficacy and entrepreneurial intention compared to traditional teaching (Piperopoulos and Dimov 2015). Thus, many courses adopt experiential learning techniques usually conducted through the widespread synergistic business plan. Deviations from this can be considered as learning innovations. In a recent article, Kakouris and Liargovas (2021b) developed a theoretical framework for the adoption of art-based projects in entrepreneurial teaching. According to their study, utilisation of pieces of art could facilitate: (a) stimulation and entertainment, (b) comprehension or (c) critical reflection. Nonetheless, there is no empirical research to spot how these three possibilities might affect the trainees' entrepreneurial self-efficacy (McGee et al. 2009), entrepreneurial intention (e.g. Kakouris 2016), or other relevant constructs affected through the instruction. Excluding the first option (i.e. using art for stimulation and entertainment), art-based projects could be adopted as alternatives to business plan in encompassing experiential learning to custom teaching through interactive lectures. Kakouris and Liargovas (2021b) contend also that business plan projects are undertaken by those who seek for (task-specific) entrepreneurial knowledge and skills whilst art-based projects are undertaken by those who seek for personal pleasure and enjoyment along with deeper thinking and new ideas. Besides, the latter group seeks for competencies like analytical thinking, observation and objective reasoning. Consequently, apart from the demographic variables of gender and age, entrepreneurial intention and entrepreneurial self-efficacy of trainees could be determinants of their project choice. Thus, for the first research question articulated in the introduction (who would prefer ART project instead of BP) we may assume:

H1a: Different project preference depends on gender and age.

H1b: Difference project preference depends on entrepreneurial intention.

H1c: Different project preference depends on entrepreneurial self-efficacy

Likewise, entrepreneurial beliefs for the success/failure of new businesses are known to interweave with knowledge in mental schemes that affect entrepreneurial decision making (e.g. Laukkanen and Liñán 2022). Concerning entrepreneurial success beliefs, Kakouris (2018, 2019) has developed a framework called ASKO where in the individualistic dimension knowledge is dialectically opposed to ability and in the social dimension opportunity is dialectically opposed to support. In this framework four complementary entrepreneurial styles (or mindsets) emerge. Accordingly, the choice between ART and BP may be affected by these styles (beliefs) and types of ventures that are compatible with them. It is reasonable to presume that those who consider knowledge and opportunity as important success factors are more likely to choose the BP unlike those who consider ability and support as the most determinant factors. Accordingly, the following research hypotheses are articulated:

H1d: Those who score more on ability and support success factors are more likely to choose the ART project instead of the BP one.

H1e: Those who intend to start businesses compatible with the ability-support mindset (style) are more likely to choose the ART project instead of the BP one.

Furthermore, the instruction affects the previous constructs and pre/post measurements could identify the changes. The second research question in the introduction refers to the pre/post course change in certain entrepreneurial constructs (as entrepreneurial self-efficacy, intention, success beliefs). Based on the copious literature on business planning in entrepreneurship education, the following research hypothesis assumes that business plan influences more than the art-projects the increase in trainees' entrepreneurial intention and

self-efficacy. The opposite can be assumed for the shift towards the ability pole of the ASKO framework and compatible types of businesses.

H2a: BP-projects are more likely to increase trainees' entrepreneurial self-efficacy and intention.

H2b: ART-based projects are more likely to induce a shift towards the ability pole of the ASKO representation and compatible types of intended ventures.

3. Methodology

3.1 Description of the course

An entrepreneurial optional course was offered online (due to the COVID-19 pandemic) to foreign language literature students at a central Greek university during the spring semester of 2020-2021. The course was based on interactive lectures supplemented by group projects that accounted for the 70% of the final grade (the rest 30% was derived from final written exams). Participants (around 130) were asked to deliberately form the groups (1-5 persons) and choose whether to perform a BP or to work with a piece of ART. The students declared that they were familiar with analysis of art which was also used in other courses of their curriculum. Hence, working with art pieces is considered an adaptation of teaching methods to the context of literature studies. Work with art for the specific course concerned connections and reflection on entrepreneurial concepts either for comprehension or for critical reflection. Each group initially articulated relevant questions to entrepreneurship, then it analysed a self-chosen piece of art whilst in the last part of the project a reflection on the questions was performed in order to derive meanings, conclusions and suggestions. All groups presented their projects by the end of the course. Pieces of art included movies, theatrical plays, paintings, poems, songs and others. A pre/post measurement was performed using the instrument of Table 1. Based on the exploitable responses, N = 64 participants responded in the survey (around 50% of the student population) who worked in groups for their projects: 19 groups of BP and 10 groups of ART.

3.2 The research instrument

To assess the impact of the course to trainees and to reveal differences between the groups of ART and BP, the instrument of Table 1 was used for pre/post measurement. The scales for entrepreneurial nascence and type of venture are agree/disagree Likert scales.

Table 1: Instruments' constructs

Constructs	Items	Scale	Description	Internal consistency	Reference
Demographics	9	Various			
ASKO Success Beliefs	8	Ranking 1 to 8 (ipsative)	Two orthogonal variables (X: A-K, Y: O-S) with 2 sub-variables (psy, mar)		Kakouris (2018, 2019)
Entrepreneurial self-efficacy	20	10-point (normative)	Five dimensions	alpha=.945	McGee et al. (2009)
Entrepreneurial nascence	6	5-point Likert (normative)	Six questions related to start-up	alpha=.816	Kakouris (2016)
Type of venture	8	7-point Likert (normative)	Eight questions for different venture types (NVi)	alpha=.716	

Entrepreneurial constructs included in the instrument encompassed: (a) the ASKO measurement for success beliefs (Bousmpou, Kakouris and Samathrakis 2019, Kakouris, 2018, 2019), (b) entrepreneurial self-efficacy (McGee et al. 2009), (c) entrepreneurial nascence index (Kakouris 2016) and (d) types of ventures compatible with the ASKO domains (2 per domain). Except ASKO that uses an ipsative scale, all constructs exhibit acceptable internal consistency (Cronbach's alpha > .7). ASKO is based on the ranking (1 to 8) of eight entrepreneurial factors (i.e. innovation, market search, tolerance of ambiguity, communication, initial capital, partnerships, business planning, consultancy) which are grouped in the four dialectically opposed poles of opportunity, ability, support and knowledge as shown in Figure 1. The individualistic variable X = A-K is formed by the subtraction of knowledge scores from the ability ones and the social variable Y = O-S by the subtraction of support scores from the opportunity ones. In this way, a unique trace for each respondent is captured on the ASKO framework indicative for her/his underlying beliefs for the most crucial factors for the success of a new business. As shown in Figure 1, four domains (styles or mindsets) appear which offer the possibility for association with different types of ventures met in the literature of entrepreneurship. These different venture types, two per ASKO domain, are shown in Figure 1 (NV1-NV8).

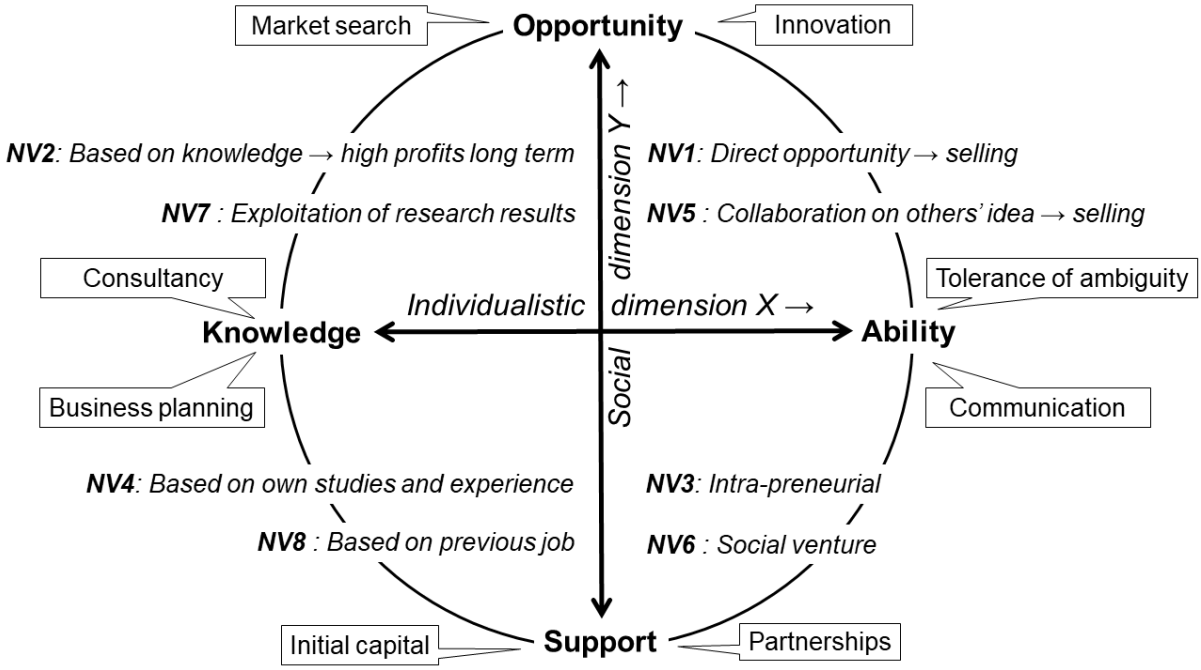


Figure 1: ASKO success beliefs (Kakouris 2018, 2019) and Types of venture (NVi) used in the instrument of Table 1

Furthermore, entrepreneurial nascence is used as an index for entrepreneurial intention and it is measured through the Kakouris (2016) continuous scale which adopts six items with a total outcome that classifies the respondents as rejectors, undetermined, latent or nascent entrepreneurs complemented with self-employed and real entrepreneurs. McGee's (2009) scale for entrepreneurial self-efficacy (ESE) utilises 20 items grouped in five dimensions: i.e. search, plan, marshalling, implementing people and implementing financial.

3.3 Sample

At the beginning of the course the questionnaire of Table 1 was administered online to all attending students. After the completion of the course the same questionnaire was administered to those who completed their group project and were successful in the course. In this way N = 64 exploitable answers were received. From them, 38 trainees worked on BP and 26 on ART projects. The average age of the sample is 27.8 years old (S.D. = 11.8) and consists of 11 males and 53 females. 57 respondents were non-entrepreneurs, 5 were self-employed and 2 were entrepreneurs whilst 26 respondents come from business families. 37.5% has poor work experience whilst 30.6% were unemployed. No statistically significant dependence was found between these variables from gender whilst the male population that is slightly older than the female ($t(82)=2.062$, $p=.043$). Those who are currently employed are older ($t(60)=2.445$, $p=.017$). The sample exhausts the groups which successfully completed the projects, it is representative of the student population and thus, the data can be analysed further.

4. Results

4.1 Descriptive statistics and correlations

Concerning the measurement before the course, Spearman correlations between constructs of Table 1 and age indicate that the older marginally score more the knowledge end of Xasko ($r_s=-.241$, $p=.055$), feel more self-efficient towards planning (ESEplan) ($r_s=.267$, $p=.033$) and financial implementation (ESEfin) ($r_s=.264$, $p=.035$) whilst they marginally score less on NV5 ($r_s=-.246$, $p=.05$) (i.e. collaboration on others' idea). Likewise, correlations with NASC indicate that those with higher entrepreneurial intention emphasize more the opportunity end of Yasko ($r=.300$, $p=.016$), feel more self-efficient towards searching, planning and marshalling (coefficients are omitted), whilst they score less on NV3 ($r_s=-.249$, $p=.048$) (i.e. intrapreneurship). The previous dependencies are expected and well understood. Since no statistically significant dependence on gender and age was found for the dichotomous dependent variable ASSIGN (1=BP, 2=ART), which addresses the project preference, research hypothesis H1a is rejected.

Furthermore, to check hypotheses H1b-H1e a one-way MANOVA test for the variable ASSIGN was performed with all variables of Table 1 (except demographics). The result is significant: $F(16,47) = 2.449$, $p < .009$; Wilk's $\Lambda = .545$, partial $\eta^2 = .455$ (small to medium effect size). Independent t-tests reveal dependencies of Yasko ($t(62)=2.034$, $p=.046$), financial self-efficacy ESEfin (marginal, $t(62)=1.795$, $p=.078$), entrepreneurial intention NASC (marginal, $t(62)=1.976$, $p=.053$), and venture types NV1 ($t(62)=-2.849$, $p=.006$), NV3 ($t(62)=-2.118$, $p=.038$), NV4 (marginal, $t(62)=1.74$, $p=.087$) and NV5 ($t(62)=-2.116$, $p=.038$). Accordingly, those who emphasized more the ASKO opportunity end selected the BP, similar to those with higher entrepreneurial intention or those with higher financial self-efficacy. Likewise, those who scored higher in NV4 (i.e. based on own studies and experience) selected the BP. Contrary, those who scored higher in either NV1 (i.e. direct opportunity → selling), NV3 (i.e. intrapreneurship) or NV5 (i.e. collaboration on others' idea) preferred the ART project. Therefore, H1b is marginally supported, H1c is supported only for the financial self-efficacy, H1d is partially supported for the ASKO support factors and H1e is supported suggesting confidence to abilities promotes ART-projects.

4.2 Logistic regression model

In order to infer the selection of project (variable ASSIGN) from predictive variables, a binary logistic regression model is adopted. After a series of tests with different variables of Table 1, the regression model encompassed the following predictors: Xasko, Yasko, ESEfin, NV1, NV3, and NV4. Overall, the one-way MANOVA test for this model is statistically significant: $F(6,57) = 4.341$, $p < .001$; Wilk's $\Lambda = .686$, partial $\eta^2 = .314$ (small effect size). The logistic regression model is statistically significant ($\chi^2(6)=25.735$, $p<.001$), Hosmer and Lemeshow's goodness of fit test $\chi^2(8)=1.993$, $p=.981>.05$, the model explains 44.7% of the variance (Nagelkerke $R^2=.447$) and correctly classified 71.9% of cases.

Table 2: Binary logistic regression model coefficients for ASSIGN (1=BP, 2=ART)

Predictor	Beta	Standard Error	Wald	Sig.	Exp(B)	Lower 95% C.I.	Upper 95% C.I.
Constant	1.842	1.855	.987	p<.321	6.311		
Xasko	.197*	.093	4.519	p<.034	1.218	1.016	1.461
Yasko	-.208*	.083	6.302	p<.012	.812	.691	.955
ESEfin	-.342[a]	.178	3.682	p<.055	.710	.501	1.007
NV1 (direct opportunity → selling)	.451*	.225	4.014	p<.045	1.570	1.010	2.439
NV3 (intrapreneurship)	.429[a]	.254	2.861	p<.091	1.536	.934	2.525
NV4 (based on own studies and experience)	-.447[a]	.256	3.047	p<.081	.640	.387	1.056
df=1, [a]p<.1, *p<.05							

From the beta coefficients of Table 2 robust slopes are derived, positive for Xasko and negative for Yasko strengthening the validity of H1d. NV1 also exhibits a positive robust slope and along with NV3 support H2e regarding the ability end of the ASKO representation (Figure 1). The negative slope of NV4 indicates that those who prefer BP-projects intent to start businesses without great expectations for growth. As expected, financial self-efficacy exhibits negative slope (i.e. preference to BP). Conclusively, ART-projects were chosen by trainees who consider entrepreneurial abilities as more crucial for business success (contrasted to entrepreneurial knowledge).

4.3 Pre/post analysis

Beyond the explanation of the different choices in projects, it is interesting to examine how the course affects the entrepreneurial constructs of Table 1. The course is partly based on projects and partly on lectures, thus it influences both types of groups accordingly. Concerning entrepreneurial self-efficacy, the pre/post measurement is shown in Figure 2. ESE is magnified for both groups in a similar manner in all dimensions. Figure 2b shows the percentage change in each dimension for both groups with a prevalence of BP in searching, planning and marshalling and a very small precedence of ART in searching and implementing financial. Nonetheless, the results are just indicative and not statistically significant. Concerning entrepreneurial intention, paired t-teats for the two groups indicate significant increase: (a) $\Delta M=1.22$ (27.7% increase), S.D.=1.66, $t(37)=-4.522$, $p<.001$ for BP and (b) $\Delta M=.69$ (19.6% increase), S.D.=1.5, $t(25)=-2.343$, $p<.027$, but the difference between the two groups is not statistically significant ($t(52)=1.554$, $p<.126$). Thus, we conclude that changes in ESE and NASC are not affected by the project-choice and thus, H2a is rejected.

Similarly, changes between groups for all constructs were found non-significant except NV5 (Mann-Whitney U=463.5, p<.037) where BP groups are more influenced towards collaboration on others' idea. Under these results, research hypothesis H2b is rejected.

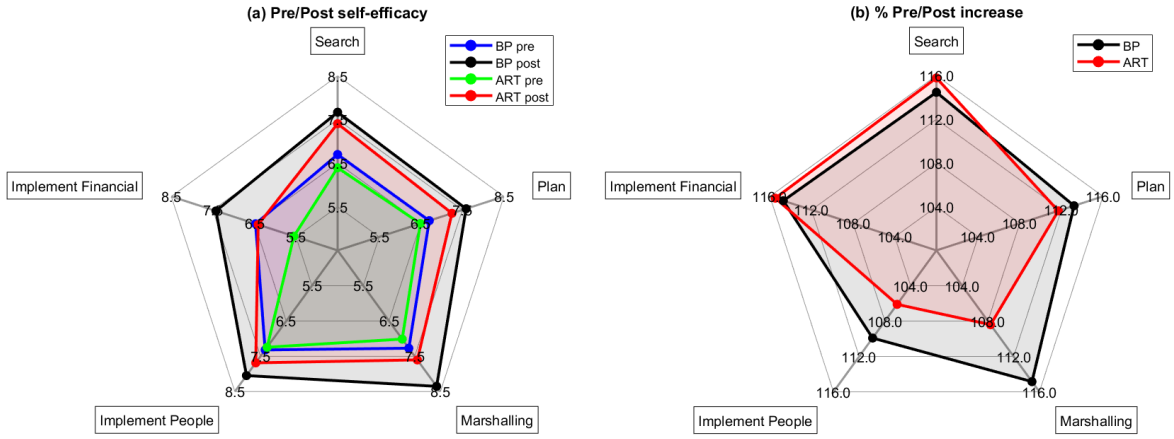


Figure 2: Radar plots for pre/post entrepreneurial self-efficacy measurement (McGee et al. 2009) for the two groups (BP, ART)

Furthermore, paired t-tests for the constructs of Table 1 indicate that through overall data: (a) the chance in ASKO representation is non-significant, (b) there is an increase in entrepreneurial intention (ΔM=1, S.D.=1.61, t(63)=-4.995, p<.001), (c) all self-efficacy dimensions are significantly magnified (p<.001), as shown in Figure 2, and (d) there is significant increase for NV1 (i.e. direct opportunity → selling) (Wilcoxon Z=-3.029, p<.002) and NV5 (i.e. collaboration on others' idea) (Wilcoxon Z=-1.966, p<.049). Thus, we conclude that the course does affect entrepreneurial constructs but without significant differences between the groups of BP and ART.

5. Discussion

The introduction of art-based projects in entrepreneurship education, instead of business plans, is a learning innovation in entrepreneurial teaching. It is also an adaptation to the context of humanities (Ramsgaard and Blenker 2021, Thomassen et al. 2020) and specifically literature curricula where students deal with analysis of art. The widely attended course by literature students described in this work offered the possibility to employ art-based projects as alternatives to business plans for the experiential learning part of the instruction. Remarkably, the course affected similarly the trainees independently from the chosen project type. An overall increase in entrepreneurial self-efficacy and intention was found corroborating previous findings of Wilson, Kickul and Marlino (2007) or Piperopoulos and Dimov (2015) for the impact of entrepreneurial courses. Since no statistically significant difference was found between BP and ART groups regarding the impact of the course (i.e. pre/post change), it could be construed that lectures appear to have dominated the outcome. A future replication pursuing a pure experiential learning pedagogy (i.e. release of lectures) is needed to determine whether art-based projects affect differently than business plans the trainees.

As expected, the art-based projects were chosen by those who would rely on personal abilities (in contrast to knowledge) for the success of their start-ups. Conversely, business plans were chosen by those who would rely on personal knowledge. This result is in agreement with Kakouris and Liargovas (2021b) expectations for the use of art in entrepreneurial teaching. It has to be noted that in the case of business plans, where students seek more for business knowledge acquisition and task-specific skills, the support factor of ASKO is present indicating that the scheduled ventures are modest (e.g. small shops, translation facilities, tutorial lessons, etc.) featured by the knowledge/support mindset of Figure 1 which is different than the 'ambitious' knowledge/opportunity one often met in technological start-ups. This finding is plausible given that literature students are traditionally self-employed engaging in these kinds of services.

The present study focused on the cognitive effects of instruction since emergent conceptualisations from courses are not unique and also depend on the discipline (e.g. Agapitou et al. 2010). Future replication should also encompass sentiments that might be different between the two types of projects. In this way a more complete understanding for the potential of art-based entrepreneurial teaching will be achieved. But even in the cognitive domain, art is known to facilitate reflection which could occasionally become critical reflection.

Thus, it enables dealing with the 'why' questions of entrepreneurship (e.g. Williams Middleton and Donnellon 2014) and conforms with the rising 'through' mode of entrepreneurship education (Kakouris and Liargovas 2021a) which underpins embedded entrepreneurship. In contrast, business plans conform with the 'for' mode of entrepreneurship education and have been largely used in the establishment of entrepreneurial courses long ago (e.g. Kakouris 2008). The present work revealed that art-based projects compounded with interactive lectures affect the students similarly with business plans introducing new ways to confront learning needs and render entrepreneurship education more inclusive to contexts and audiences without loss of its essentials. Implications pertain to educators who seek to enrich their toolbox towards teaching entrepreneurship and to educational agencies which seek to innovate in fostering the entrepreneurial mindset to their students. The latter might encourage educators to adopt art in teaching and create conductive learning environments that inspire trainees. Theoretical implications refer to new tools for the development of sociocultural learning environments (e.g. Morselli and Kakouris 2022) supportive to students' zone of proximal development.

Finally, in the majority of previous ASKO measurements (e.g. Bousmpou et al. 2019, Kakouris 2018) the domain of knowledge/opportunity (Figure 1) appears overpopulated. This result reflects a quite 'stereotypical' consideration of modern entrepreneurship, especially from the youth, underestimating the role of personal abilities in the success of ventures. A possible 'shift' towards the ability pole in educational settings needs active teaching methods with art included as a possibility amongst them.

A limitation of the present study pertains to art-based teaching in a single audience and national context. The sample (N=64) may exhaust the specific course and audience; however, it needs future replications and extensions to other audiences and national contexts from which consistent comparisons could be possible (e.g. Fleck et al. 2021).

6. Conclusion

The present quantitative research focused on pre/post tests of literature students who attended an optional entrepreneurial course. The students were asked to choose between the business plan and analysis of art pieces for their projects. This is a first attempt of this kind and the main finding is that both groups (BP and ART) exhibit a similar change in entrepreneurial constructs such as success beliefs, entrepreneurial self-efficacy and intention. This fact legitimates art-based teaching amongst the instructional methods of entrepreneurship education without certain losses in content. Art-based projects were chosen from students who rely more on own abilities for the success of their initiatives. Hence, adoption of art in entrepreneurial teaching provides a learning innovation capable of meeting different learning needs, facilitating reflective practices, enabling critical thinking and personal autonomy on entrepreneurial meaning-making, along with adapting to contexts (here to the field of literature/humanities). Thus, it appears helpful towards horizontally embedding entrepreneurship in tertiary education and promising for significant innovations in entrepreneurship education. The present results need future replications in other educational settings and cultures in order to develop more effective and more inclusive methods for teaching entrepreneurship.

Acknowledgements

The authors acknowledge financial support from the University of the Peloponnese towards participating in the ECIE conference.

References

Agapitou, C., Tampouri, S., Bouchoris, P., Georgopoulos, N., and Kakouris, A. (2010), "Exploring underlying beliefs on youth entrepreneurship of higher education graduates in Greece", Paper read at *5th European Conference on Innovation and Entrepreneurship*, edited by A. Kakouris, Academic Conferences Limited, Reading, UK, pp 10-17.

Bae, T.J., Qian, S., Miao, C. and Fiet, J.O. (2014), "The relationship between entrepreneurship education and entrepreneurial intentions: A meta–analytic review", *Entrepreneurship Theory and Practice*, Vol 38 No 2, pp 217-254.

Bousmpou, D., Kakouris, A., and Samathrakis, V. (2019) "Connecting ASKO beliefs and entrepreneurial self-efficacy with entrepreneurial intention", Paper read at *14th European Conference on Innovation and Entrepreneurship*, edited by P. Liargovas and A. Kakouris, Academic Conferences Limited., Reading, UK, pp 1245-1249.

Fayolle, A. and Gailly, B. (2015), "The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence", *Journal of Small Business Management*, Vol 53 No 1, pp 75-93.

Fleck, E., Kakouris, A. and Winkel, D. (2021), "Cultural traits of entrepreneurship education: a cross-national study", *Journal of Entrepreneurship in Emerging Economies*. Vol 13 No 5, pp 838-863. DOI: 10.1108/JEEE-02-2020-0030

Kakouris, A. (2008), "On initial implementations of innovation and entrepreneurship courses: a case study for undergraduates at the University of Athens", Paper read at *3rd European Conference on Entrepreneurship and Innovation*, edited by N. Marriott, Academic Conferences Limited., Reading, UK.

Kakouris, A. (2016), "Exploring entrepreneurial conceptions, beliefs and intentions of Greek graduates", *International Journal of Entrepreneurial Behavior & Research*, Vol 22, No 1, pp 109–132.

Kakouris, A. (2018) "The ASKO dialectical framework for inter-comparisons between entrepreneurial courses: Empirical results from applications", *Entrepreneurship Education*, Vol 1, No 1/4, pp 41-60.

Kakouris, A. (2019) "The ASKO dialectical framework for entrepreneurial courses construction: theoretical foundation", *Entrepreneurship Education*, Vol 2, No 1/2, pp 51-69.

Kakouris, A. and Georgiadis, P. (2016), "Analysing entrepreneurship education: a bibliometric survey pattern", *Journal of Global Entrepreneurship Research*, Vol 6, No 1, pp 6. DOI: 10.1186/s40497-016-0046-y

Kakouris, A. and Liargovas, P. (2021a), "On the about/for/through framework of entrepreneurship education: a critical analysis ", *Entrepreneurship Education and Pedagogy*, Vol 4 No 3, pp 396-421. DOI: 10.1177/2515127420916740

Kakouris, A. and Liargovas, P. (2021b), "Introducing art in entrepreneurial teaching: A theoretical framework", Paper read at *16th European Conference on Innovation and Entrepreneurship*, edited by F. Matos, M.F. Ferreiro, A. Rosa and I. Salavisa, Academic Conferences Limited, Reading, UK, pp 468-475.

Kakouris, A. and Morselli, D. (2020), "Addressing the pre/post-university pedagogy of entrepreneurship coherent with learning theories", in Sawang, S. (Ed.) *Entrepreneurship Education: A lifelong learning approach*, Springer, pp 35-58, DOI: 10.1007/978-3-030-48802-4_3

Laukkanen, M. and Liñán, F. (2022), "Uncovering entrepreneurial belief systems through cognitive causal mapping", in A. Caputo, M.M. Pellegrini, M. Dabić and L.P. Dana (Eds.) The *International Dimension of Entrepreneurial Decision-Making*, Springer, pp. 37-63.

McGee, J.E., Peterson, M., Mueller, S.L., and Sequeira, J.M. (2009), "Entrepreneurial self–efficacy: refining the measure", *Entrepreneurship Theory and Practice*, Vol 33 No 4, pp 965-988.

Morselli, D. and Kakouris, A. (2022), "Teaching entrepreneurship to undergraduates: a Vygotskian perspective", in G.J. Larios-Hernandez, A. Walmsley and I. Lopez-Castro (Eds.) *Theorising Undergraduate Entrepreneurship Education*, Palgrave, pp 49-68.

Nabi, G., Liñán, F., Fayolle, A., Krueger, N. and Walmsley, A. (2017). The impact of entrepreneurship education in higher education: A systematic review and research agenda. *Academy of Management Learning & Education*, Vol 16 No 2, pp 277-299.

Nabi, G., Walmsley, A., Liñán, F., Akhtar, I., and Neame, C. (2018), "Does entrepreneurship education in the first year of higher education develop entrepreneurial intentions? The role of learning and inspiration", *Studies in Higher Education*, Vol 43 No 3, pp 452-467.

Neck, H.M., and Corbett, A.C. (2018), "The scholarship of teaching and learning entrepreneurship", *Entrepreneurship Education and Pedagogy*, Vol 1 No 1, pp 8-41.

Piperopoulos, P. and Dimov, D. (2015) "Burst bubbles or build steam? Entrepreneurship education, entrepreneurial self-efficacy, and entrepreneurial intentions", *Journal of Small Business Management*, Vol 53 No 4, pp 970-985.

Pittaway, L., and Edwards, C. (2012), "Assessment: examining practice in entrepreneurship education", *Education + Training*, Vol 54 No 8-9, pp 778-800.

Ramsgaard, M.B., and Blenker, P. (2021) "Reinterpreting a signature pedagogy for entrepreneurship education", *Journal of Small Business and Enterprise Development*, Vol 29 No 2, pp 182-202.

Rideout, E.C., and Gray, D.O. (2013), "Does entrepreneurship education really work? A review and methodological critique of the empirical literature on the effects of university-based entrepreneurship education", *Journal of Small Business Management*, Vol 51 No 3, pp 329-351.

Saukkonen J., and Kakouris, A. (2022), "Context-aware entrepreneurship education: exploring the educators perspective", Paper to be read at *17th European Conference on Innovation and Entrepreneurship*, Academic Conferences Limited, Reading, UK, forthcoming, this volume.

Thomassen, M.L., Williams Middleton, K., Ramsgaard, M.B., Neergaard, H., and Warren, L. (2020) "Conceptualizing context in entrepreneurship education: a literature review", *International Journal of Entrepreneurial Behavior & Research*, Vol 26 No 5, pp 863-886.

Welter, F. (2011) "Contextualizing entrepreneurship - conceptual challenges and ways forward", *Entrepreneurship Theory and Practice*, Vol 35 No 1, pp 165-184.

Williams Middleton, K. and Donnellon, A. (2014), "Personalizing entrepreneurial learning: A pedagogy for facilitating the know why", *Entrepreneurship Research Journal*, Vol 4 No 2, pp 167-204.

Wilson, F., Kickul, J., and Marlino, D. (2007), "Gender, entrepreneurial self–efficacy, and entrepreneurial career intentions: Implications for entrepreneurship education", *Entrepreneurship Theory and Practice*, Vol 31 No 3, pp 387-406.

Innovation in Healthcare: Success Factors for Innovative Healthcare Change Processes

Stefan Lagrosen[1] and Yvonne Lagrosen[2]
[1]Linnaeus University, Kalmar, Sweden
[2]Malardalen University, Eskilstuna, Sweden
stefan.lagrosen@lnu.se
yvonne.lagrosen@mdu.se

Abstract: Many factors contribute to increasing the need for innovation in healthcare. Global demographic developments with falling birth rates and increasing lifespan mean that the proportion of elderly in society is expected to increase dramatically in all developed countries. Moreover, continuous scientific advances afford possibilities for higher effectiveness in healthcare processes. Innovation can and does take place in the form of medical discoveries which enhance the efficiency of treatments or in the form of technological advances, for instance, in ehealth, which provide increased options for healthcare delivery. However, innovation can also be of an organisational nature since healthcare organisations are complex organisations with legal and ethical constraints that are difficult to manage effectively. Organisational innovation requires change processes of various kinds. The purpose of this paper is to explore success factors for innovative change processes in healthcare organisations. Change processes related to digitalisation are of particular interest. Qualitative methodology was chosen in order to gain a deeper understanding of the area and not to exclude aspects based on preconceptions. A multiple case study has been carried out. To achieve focus, the study population was limited to public hospitals in Sweden. Change processes, usually involving digitalisation, in seven hospitals of various sizes have been studied. Individual qualitative interviews were chosen as the method of data collection. Between two and nine interviews were conducted, giving a total of forty interviews. The respondents were people who had participated in the change processes, mainly nurses, physicians, and administrative staff, some of whom had managerial positions on lower levels. The data from the interviews were analysed using the constant comparative method from the grounded theory approach. The analysis yielded a number of categories depicting success factors under different conditions. A framework was constructed depicting the factors and their internal relationships. The categories and the framework should be valuable for managers of healthcare organisations as well as for increasing the conceptual understanding of the field.

Keywords: innovation, change, hospitals, healthcare, digitalisation

1. Introduction and purpose

Globally, we can see an increasing need for innovation in healthcare. Many factors of various kinds contribute to this. In the majority of countries in the world, there is a demographic development characterised by falling birth rates and increasing lifespan. The consequence is that the proportion of elderly in society is expected to increase dramatically in all developed countries during the rest of this century. In consequence, growing demand for healthcare leading to higher costs for society is expected (Christensen and Kenagy 2000).

In a separate development, continuous scientific advances afford possibilities for higher effectiveness in healthcare processes. These developments can be of various kinds. The development within the fields of medicine and technology is perhaps most apparent. Innovation can and does take place in the shape of medical discoveries which enhance the efficiency of treatments but also in the form of technological advances, for instance, in ehealth, which provide increased options for healthcare delivery. However, innovation can alternatively be of an organisational nature. Healthcare organisations are complex organisations with legal and ethical constraints. This makes effective management of them challenging.

Consequently, organisational development is valuable. Innovational organisational initiatives may be helpful. Organisational innovation requires change processes of various kinds. However, change processes in complex organisations are complicated, and they often fail to a greater or smaller extent. Organisational innovation in healthcare may be exceptionally difficult since changing the behaviour of clinicians, medical practices, and organisations add additional challenges (Lansisalmi et al. 2006). Changing clinical practices and implementing new management systems in healthcare has thus been found to be complex (Ovretveit et al. 2012). Studying ways of successfully changing healthcare organisations should therefore be valuable. In healthcare, ehealth, using digital tools of various kinds for health purposes, is becoming increasingly popular (Vial 2019). However, the organisational consequences of implementing ehealth solutions are not well understood.

Organisational change processes can be in the form of significant restructuring, such as implementing value-based health care (Porter and Teisberg 2006) which has been experienced as contentious in Sweden (Ovretveit et al. 2012). However, smaller change initiatives that are far more common are equally valuable to study. Patterns of implementation differ according to the type of innovation, and internal context factors are vital (Ovretveit et al. 2012).

The purpose of this paper is to explore success factors for innovative change processes in healthcare organisations. Change processes related to digitalisation are of particular interest. The remainder of the paper is structured as follows. First, the theoretical framework that the study is based on is briefly introduced. Next, the methodology that has been employed in the study is described. Subsequently, the findings and analysis are presented. On this basis, a framework has been constructed, and it is presented in the next section. Then limitations and implications for practise are discussed. Finally, the conclusions are presented.

2. Theoretical framework

The theoretical framework is based on contributions from quality management theory. Associations between strategic quality management and technology transfer competence have been identified in research (Bolatan et al. 2022). In addition, implementing quality management has been found to be beneficial for productivity (Ruales Guzmán and Castellanos Domínguez 2022). Modern quality management is a system that consists of different components (Hellsten and Klefsjö 2000). It has been argued that the different components are at different levels depending on how profound the effect on the organisation as a whole is and how clearly visible and concrete they are (see Figure 1) (Lagrosen and Lagrosen 2003).

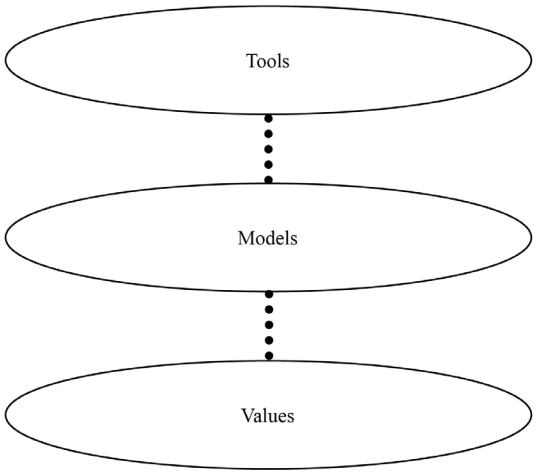


Figure 1: The levels of quality management

At the most superficial and most obvious level, there are a number of techniques of various kinds. They can be statistical methods, decision support, creative meeting techniques etc. They are useful and often practical, but they have a limited effect on the organisation as a whole. The next level contains models. These are more cohesive systems that consist of a large number of points from which to analyse different parts of the organisation. This gives a more radical effect on the organisation, and when used correctly, the models can contribute to extensive improvements. The deepest level contains the values - what mindsets managers and employees should have and what basic principles they should follow. It is these values that determine whether organisations succeed in creating quality. The presence of them is a prerequisite for the other two levels to be able to have their total value. At the same time, the techniques and models can be a help in building the values in the organisation. Thus, all three levels are connected.

The values are sometimes called principles (Dale 1999) or cornerstones (Bergman and Klefsjö 2001). In a review of the literature, the following six were found to be the most common (Lagrosen 2006):

- Customer orientation. This is about the organisation's need to consider whom it should create value for - whom it exists for - and then focus its activities on satisfying its needs and desires.

- Committed leadership. Managers at all levels throughout the organisation should have quality as their primary focus.
- Everyone's participation. A quality department cannot keep track of or understand everything that happens everywhere in the organisation. Therefore, all employees must be involved in quality work.
- Continuous improvement. This part comes from the Japanese influence, and together with the previous value, it forms what is called kaizen. It's about not settling for a quality level but always trying to find ways to get better.
- Process orientation. Organisations should focus on the activities that take place and not lock themselves into fixed structures. The most critical processes need to be mapped out, and management has to make sure that there are process owners - someone who takes responsibility for each process so that nothing falls between the seats.
- Fact-based decisions. Basically, this assessment is about having a good decision basis for the decisions that are made.

Research has shown that the values above are crucial for well-functioning quality (Lagrosen and Lagrosen 2005). But it may be worth bearing in mind that beneath them are deeper core values such as trust and confidence, which can also be essential to understand in order to create a quality culture (Lagrosen and Lagrosen 2012). Studies of the most successful and innovative companies in Silicon Valley have shown that they have a strong culture based on an engaging vision where innovation and entrepreneurship are at the centre (Steiber and Alange 2016). If there is a strong quality culture, no extensive control mechanisms are needed.

3. Methodology

The study was carried out in the Swedish public healthcare system. Qualitative methodology was chosen in order to explore the area without being limited by preconceptions. Students trained by the authors carried out in-depth interviews in seven Swedish hospitals. The hospitals were of varying sizes, but the majority were fairly large hospitals located in major cities. Between two and nine interviews were carried out at each hospital, giving a total of 49 interviews. The respondents were mainly clinic managers, project leaders, and nurses. In addition, some physicians, assistant nurses, ICT staff, and paramedics were interviewed.

4. Findings and analysis

The interviews yielded a large amount of data which was condensed into summaries. These were analysed using the constant comparative method from the grounded theory methodology. This analysis of the data yielded the following categories.

4.1 Inclusion

Including the users in the procurement of digital equipment is vital in order for them to appreciate the change that the technology brings. In the same way, concerning organisational change processes, involving those employees that are affected by the change is vital. This is also connected to empowerment. The employees need to be empowered so as to have the possibility to really influence the way the projected changes affect their work situation. Moreover, if the employees are empowered to initiate potential change projects, their engagement will be higher, and the possibility that the change process will be successful will increase.

4.2 Engaged managers

Managers at all levels should be committed to achieving the best possible outcome of the project. In close collaboration with their subordinates, they should make sure that the projected change is of maximum value to employees as well as to patients and to the health system at large. For this to be feasible, they need to be familiar with, and themselves have ample knowledge about the processes that they are leading. Thus, they need to be trained health professionals, e.g., nurses, physicians, or physiotherapists, themselves. Having managers with purely economic or managerial training will not be sufficient. The leaders should also be close to the operations that they are leading physically as well as organisationally. Furthermore, continuity is crucial. Therefore, managers should not be changed too often. They should stay on their posts long enough to gain complete familiarity with the processes and the people that they are managing. Also, when conducting change processes, it is vital that the managers do not leave while the project is not yet completed. Instead, they

should stay during the entire process and make sure that it is developing in a suitable way, that the employees are involved and satisfied, and that all stakeholders' viewpoints are considered.

4.3 The connection between people and technology

Concerning changes that involve digital tools or technologies, there is a common contradiction between the local needs and wants of the various clinics on the one hand and the need for the central IT department to have a manageable portfolio of digital alternatives. Often specific clinics have special needs for IT solutions, and they are unsatisfied with the way that the IT department handles those needs. While the clinics want customised solutions for their specific situation, the IT department wants more standardised tools in order not to have a rampant flora consisting of countless different systems, which they cannot handle and update in an appropriate way. This sometimes leads to the clinics themselves, or with externals IT providers, developing their own digital systems. The IT department usually does not approve of this, and a conflict ensues. Consequently, it is vital that higher managers ensure that the IT department and the various clinics that it is serving work closely and effectively together based on a mutual understanding of each other's needs and possibilities.

More general technical issues are also included in this category. Many employees have a particular “fear” of technology, feeling very insecure when having to learn new systems. This must be handled with a certain delicacy. Furthermore, new technology needs to function correctly from the start without irritating bugs etc. All systems should also be user friendly, and there should be interoperability between different systems so that they fit together into an integrated wholeness.

4.4 Organisational structure

The way the change project organisation was structured, as well as the overall organisational structure of the organisation, was found to be pertinent to the success of the change initiatives. In general, change processes need to be handled by a strong project group with ample authority, clear purpose, and clear guidelines in order to be successful. In some circumstances, employing external project leaders for a specific project was found to be useful. Focusing on the process rather than on the result was often helpful. In the case of digital tools, pilot testing on a small scale before broad implementation is desirable. A well-developed system for assessing the results of the change process, including economic measures, is also helpful. Sufficient resources are also necessary. If the change implies that the employees will learn new ways of working, training is obviously of utmost importance.

For the general structure of the organisation, stable organisational conditions were usually considered preferable. Nevertheless, sometimes the change process may imply a more overarching restructuring of the organisation. In any case, the organisation should ideally work continuously to improve its products and processes. Bureaucratic structures that complicate processes and require time spent in an unproductive way must be shunned.

4.5 Organisational culture

Having a strong organisational culture based on strong and common core values is a great benefit when implementing change processes. Ideally, the employees should be enthusiastic regarding the changes and engage wholeheartedly in them. On this basis, endurance and pragmatism can be built. In this way, adaptability and flexibility can be achieved. This is necessary since change processes often meet unexpected hurdles and deviations. Thus, a combination of stability and adaptability is needed, and this can only be achieved when the organisational culture is strong and there is a base of shared core values.

5. A framework

Combining the findings from the interviews and the categories thus developed with the theoretical framework. We can see that there are many common areas. Again, we see that the values, this time expressed in the form of the organisational culture, form a basis for success which the other aspects depend upon. Therefore, we would like to propose the framework depicted in Figure 2.

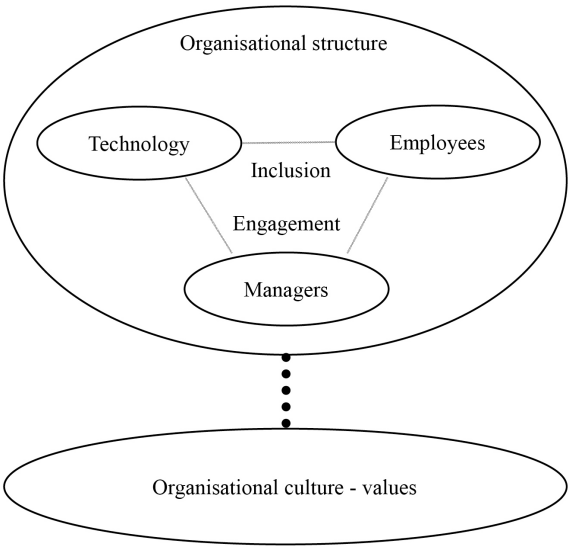


Figure 2. A framework for successful organisational innovation in healthcare

The basis is the organisational culture which heavily depends on the values in the organisation. On this basis, a suitable organisational structure should be constructed. The vital parts of the organisation are the managers, the employees, and the technology. The interaction between them should be characterised by inclusion and engagement. In this way, an organisation that is both stable and adaptable can be formed. This will give change processes maximum possibility of succeeding. For a more elaborate understanding of the framework, the categories above should always be included.

6. Discussion, limitations, and implications for practice.

The study has identified several categories, and a framework has been developed. The framework should be useful for managers of hospitals and other healthcare organisations when planning for change processes in their organisations. By studying the framework and the categories that it is built on, managers can frame their organisations in a suitable way for undertaking change processes.

There are several limitations to the study. Most importantly, it was carried out in seven hospitals in Sweden. The possibility of generalising the findings to hospitals in other countries or to different kinds of organisations is uncertain.

7. Conclusions and suggestions for further research

To a large extent, the conclusions reside in the framework that was developed. It shows the findings of the study in a graphic form. Together with the five categories that were found; inclusion; engaged managers; the connection between people and technology; organisational structure, and organisational culture, this constitutes the findings of the study.

For future research, it would be valuable to conduct similar studies in other countries as well as in other healthcare organisations.

References

Bergman, B. and Klefsjö, B. (2001), *Quality from Customer Needs to Customer Satisfaction,* 2 ed.*,* McGraw-Hill, London.

Bolatan, G.I.S., Golgeci, I., Arslan, A., Tatoglu, E., Zaim, S. and Gozlu, S. (2022), "Unlocking the relationships between strategic planning, leadership and technology transfer competence: the mediating role of strategic quality management", *Journal of Knowledge Management,* Vol. 26 No. 11, pp. 89-113.

Christensen, C.M. and Kenagy, J. (2000), "Will disruptive innovations cure health care?", *Harvard Business Review,* Vol. 78, pp. 102-12.

Dale, B.G. (1999), *Managing Quality,* Blackwell Publishers Ltd., Oxford.

Hellsten, U. and Klefsjö, B. (2000), "TQM as a management system consisting of values, techniques and tools", *The TQM-Magazine,* Vol. 12 No. 4, pp. 238-44.

Lagrosen, S. and Lagrosen, Y. (2003), "Quality Configurations - a Contingency Approach to Quality Management", *International Journal of Quality and Reliability Management,* Vol. 20 No. 7, pp. 759-73.

Lagrosen, S. and Lagrosen, Y. (2012), "Trust and quality management - perspectives from marketing and organisational learning", *Total Quality Management & Business Excellence,* Vol. 23 No. 1, pp. 13-26.

Lagrosen, Y. (2006), *Values and Practices of Quality Management - Health implications and organisational differences, Ph.D. thesis,* Chalmers University of Technology, Division of Quality Sciences, Gothenburg.

Lagrosen, Y. and Lagrosen, S. (2005), "The effects of quality management - a survey of Swedish quality professionals", *International Journal of Operations and Production Management,* Vol. 25 No. 10, pp. 940-52.

Lansisalmi, H., Kivimaki, M. and Aalto, P. (2006), "Innovation in healthcare: a systematic review of recent research", *Nursing science quarterly,* Vol. 19 No. 1, pp. 66-72.

Ovretveit, J., Andreen-Sachs, M., Carlsson, J., Gustafsson, H., Hansson, J., Keller, C., Lofgren, S., Mazzocato, P., Tolf, S. and Brommels, M. (2012), "Implementing organisation and management innovations in Swedish healthcare: Lessons from a comparison of 12 cases", *Journal of Health Organization and Management,* Vol. 26 No. 2, pp. 237-57.

Porter, M.E. and Teisberg, E. (2006), *Redefining health care: creating value-based competition on results,* Harvard Business School Press, Watertown.

Ruales Guzmán, B.V. and Castellanos Domínguez, O.F. (2022), "Benefits on productivity indicators after quality management implementation: evidence in the dairy industry", *International Journal of Productivity and Performance Management,* Vol. ahead of print.

Steiber, A. and Alange, S. (2016), *The silicon valley model: Management for entrepreneurship,* Springer, Heidelberg.

Vial, G. (2019), "Understanding digital transformation: A review and a research agenda", *The Journal of Strategic Information Systems,* Vol. 28 No. 2, pp. 118-44.

Calibrating Entrepreneurship Education for a Constantly Changing World

Matthew Lynch[1], Nils Sanne[1], Øystein Stavo Hovig[2] and Kari Håvåg Voldsund[2]
[1]Business School, Norwegian University of Life Sciences, Ås, Norway
[2]Mohn Centre for Innovation and Regional Development, Western Norway University of Applied Sciences, Bergen, Norway
matthewl@hiof.no

Abstract: A key purpose of education has long been to ensure that students are well prepared for the workforce. In an unchanging context where tasks, roles, and expectations are stable, creating an education program that prepares students for the workforce can be achieved relatively easily, and once in place will remain appropriate if the context is stable. The challenge is in educating students for work environments that are rapidly changing and where the expectations placed on them are uncertain and ambiguous. The concept of calibration is the process of ensuring something is in tune or in sync in the intended way. An example from music would be calibrating an instrument to ensure it generates the intended notes. The same approach can be applied to education to ensure that educational approaches used are in tune with the requirements of students who enter the workforce. This research therefore sought out students who had graduated from two master's programs and had been in the workforce for less than a year to better understand what skills and education they felt were missing from their education and what skills they felt their education had provided. In short to hear how well equipped the students felt and whether the program was calibrated to their needs, in carrying out this research it highlighted several conundrums relevant to all entrepreneurship educators.

Keywords: entrepreneurship education, practical pedagogy, career preparation, employability

1. Introduction

The world is far from stable, and in the rapidly changing environment of new technologies, global health scares, and newly started wars many people find themselves transitioning from studying to working (Fernandes and Afonso, 2020). These kinds of environments are those in which entrepreneurs have traditionally operated and arguably thrived in. Entrepreneurs are antifragile in that the greater the instability the more they tend to thrive in the environment that challenges more static operators (Taleb, 2012).

The question of how to educate people for these environments is one that has garnered considerable attention, and innovation and entrepreneurship education (EE) programmes have been put forward as one context that can be particularly helpful (Fernandes and Afonso, 2020, Bacigalupo et al., 2016). Going through an entrepreneurial learning processes leads to the development and demonstration of entrepreneurial competencies (Kubberød and Pettersen, 2018, Lackéus, 2014, Morris et al., 2013). Entrepreneurial competencies have been defined as 'knowledge, skills and attitudes that affect the willingness and ability to perform the entrepreneurial job of new value creation' (Lackéus, 2014, p. 377). While a definition of entrepreneurship in a higher education context "is about making students more creative, opportunity oriented, proactive and innovative, adhering to a wide definition of entrepreneurship relevant to all walks in life" (Bacigalupo et al., 2016).

Scholars have highlighted that those who study entrepreneurship often do not start their own firm, or at least not initially (Killingberg et al., 2020, Neck and Corbett, 2018). Instead they often end up working for large organisations in the early stages of their career. While preparing students for an uncertain world is important, what skills they need is still open for clarification (Pittaway and Cope, 2007).

Studies highlight skills such as creativity, problem solving, innovation skills, general business knowledge, team working skills, interpersonal skills and learning skills – competencies frequently associated with EE – are valuable to employers (Lowden et al., 2011, Wickramasinghe and Perera, 2010, Bacigalupo et al., 2016). Yet scant evidence exists about whether students are equipped with these skills at the end of their education in entrepreneurship (Killingberg et al., 2020). Mwasalwiba (2010) explicitly called for more research on the links between EE and workplace context, a call which has largely gone unheeded.

We do not wish to suggest there is no research on this subject, as prior studies do exist that explore entrepreneurial competencies developed through EE (Lackéus, 2014, Kubberød and Pettersen, 2018, Morris et

al., 2013). Yet these do no specifically look at the alignment between skills developed through EE and the skills needed for those who directly enter the workforce after their studies. There are also studies looking at skills developed from individual courses (Fernandes and Afonso, 2020, Lynch et al., 2019). However, there seems to be room for further exploration at the study programme level. We therefore undertake a qualitative explorative study. Our research question is therefore, in what ways do students feel prepared for their initial career choices and the ways do they feel underprepared. The results highlights that students feel mostly prepared, but the data raises interesting conundrums relevant for all those involved in delivering entrepreneurship education.

2. Established perspectives

The growth in EE and the proliferation of courses is not necessarily due to so many students wanting to start businesses but rather by the skills and capabilities that develop through EE, which are transferable to all types of organizations and career endeavours (Neck and Corbett, 2018). Being entrepreneurial and having an entrepreneurial mindset is not solely isolated to starting a business, but is more of a general life skill (Costello et al., 2012). Indeed there is a misnomer that it is not legitimate entrepreneurship if you end up working for someone else and that some people feel like making the choice to work for others might somehow be perceived as failure (Costello et al., 2012). Yet there has long existed an acknowledgement that professionals struggle with innovation and particularly in bridging new technologies and business (Thursby et al., 2009). In this sense preparing individuals, who plan on entering into the workforce, to be more entrepreneurial is an important task of EE (Neck and Corbett, 2018).

In a study examining the use of design thinking (DT) in a masters entrepreneurship program, Lynch et al., found that students developed what they labelled as tangential skills. Based on student reflections and interviews the study examined what it was that students were learning from DT. The students named the obvious elements connected to the DT methodology, but most of the reflections were focussed on other elements such as dealing with ambiguous challenges, the challenges of teamwork and communication. The authors labelled these skills as ‘tangential’ in that they were not the intended learning outcomes based on the course description, yet these so-called tangential skills were some of what the students considered to be most important and valuable. Which highlights that EE education is not always about traditional learning, but rather about preparing students for the ‘soft skills’ they will need in the workplace. While this highlights the role of EE in helping students develop soft skills, the study says nothing about whether these skills are relevant for the workplace, or whether students carry these skills into the workforce.

One of the key arguments as to why EE represents a good study direction for students is because it prepares students for rapid changes, different challenges and uncertainty in work life. Increasingly, all organizations are experiencing demands for rapid change and various challenges in the work of developing and surviving. This points to an interesting challenge for educators, what students’ needed when the study program was designed might not be the same as what is appropriate for the current changing context. In setting a research agenda for the connection between EE and preparing for a future career, Killingberg et al. (2020) highlight a number of propositions that they argue to be true. The overriding theme is that EE is well suited to training students for shifting environments because the skills trained are not for static environments, but rather environments where they are required to adapt quickly (Neck and Greene, 2011). We therefore sought to investigate in an explorative manner whether students felt well prepared for their early careers.

3. Study context

This study was carried out across two masters' programs in Norway. The two programs are a Masters of Innovation & Entrepreneurship at the Norwegian University of Life Sciences (NMBU) and Masters of Innovation and Entrepreneurship at the Western Norway University of Applied Sciences (HVL). Both programs are relatively small, with yearly enrolments of around 30 people per year. The master program at HVL recruit students with a bachelor's degree in engineering science or natural science, and the master program at NMBU recruit students with a variety of bachelor backgrounds.

The study programmes can be typified as practical based study programmes where there is a strong emphasis on learning through doing (Lackéus, 2015) and socially constructed learning through reflection groups (Burgoyne, 1995). Many of the assessments on program are based on reflection notes where students are asked to use theory to reflect on their practical experiences in projects.

The programs are closely aligned in both their teaching style and stated aims. Both programs are not venture creation programs, but broad master's programs that educate for a larger labour market. Both programs include a combination of theoretical courses on innovation and entrepreneurship (education *about* entrepreneurship) and practice-oriented courses where innovative teaching methods "through" entrepreneurship are applied. These are process-based and often experiential approaches where students go through an actual entrepreneurial learning process and engage in project-based learning. The students work with real-life projects (own or others' ideas) and learn through student active learning in teams where they develop entrepreneurial skills. Through the practice courses, students are also given required knowledge and skills for pursuing entrepreneurship, such as knowledge about innovation methods etc.

4. Methodology

Interviews at one institution was carried out with a total of 7 students in a semi structured format, with 6 guiding questions and space given for students to answer in an open way. An additional 4 responses were gained from students who were unable or unwilling to attend an interview and therefore chose to respond in a written format. Similarly, at the second institution, a total of 4 students were interviewed in a semi-structured format. Making the total basis for the study 11 interviews which ranged from 25 minutes to 1 hour. The participants were made up of 4 men and 7 women, with 8 participants under the age of 30, 1 participant between 30 and 35 years old and 1 between 36-45 years old.

The semi-structured questions were focussed on asking students to answer in relation to their current job. The results of these questions were recorded throughout the interview and were checked after the interview for fullness and clarity. Based on these written results (and those sent in directly), the data was examined for common and recurring themes. These themes are highlighted in our data section and expanded upon during the discussion. The interviews and data analysis were carried out in Norwegian, with key quotes then translated by one of the authors who is a native English speaker. The translation was then checked by a second author whose mother tongue is Norwegian.

We wish to highlight that all of the authors work on the two entrepreneurship programmes from which graduates interviewed had attended. We acknowledge the likely bias this has caused, but consider our insider perspective to be valuable in the pursuit of better understanding the rich environment in which we attempt to study (Van Maanen, 2011, Watson, 2011). Social researchers are part of the world they study (Hammersley and Atkinson, 2007), and their orientations both within and outside the area of interest is an unavoidable reality (Paechter, 2012). Even as insiders in the study programs, the process of researching our own program challenges this status of being an insider (Humphrey, 2007; Taylor, 2011; Watts, 2006). Labaree (2002) suggests that, while the mainly outsider researcher has to 'go native' in order to understand the local culture, insiders have to, by corollary, to 'go observationalist', distancing themselves introspectively from phenomena. We have aimed therefore to balance the inevitable and valuable situation of being insiders with the need to be 'observationalist' in our approach. Here we use the term 'observationalist' in the sense that it suggests distance and objectiveness from the data, not in the sense of visually watching activities. Our research design reflects this attempt at balancing distance and closeness through using an explorative method where we asked open questions. This was to create sufficient space for graduates to discuss that which they felt was relevant, without trying to lead them down the path of having them confirm the propositions we ultimately were interested in. Which this resulted in a data that was not always relevant, we found it to strike a balance between being 'on topic' and not 'leading the witness' towards answering in a way we desired.

5. Data - Results

We have chosen to structure the data section in linear order of the questions asked. We wish to highlight that this is an explorative study, therefore the data is intended to highlight areas for further research.

Q1: Which tasks or processes do you feel well prepared for based on what you learnt in your studies/ master program?

PROGRAM 1 key points:
I felt well prepared to tackle stress and difficult situations
The entrepreneurial attitude we learnt in our studies helped me to quickly tackle new work tasks
It wasn't scary to meet others businesses, such as those working in the area of environmental certification of framing timber or others areas I have never heard of before

I feel safe in meeting new people
I feel like I have a sense of independence, resilience and drive
All of the students also mentioned that they felt well prepared for their first job after studying
PROGRAM key points:
I felt well prepared to start own innovation project or startup (soft and hard skills)
I felt well prepared to work interdisciplinary - at the intersection of technology and economics
Well prepared to tackle challenges combining technology and business development
Motivation and self-efficacy to start own venture
Teamwork, interdisciplinary cooperation
All of the students also mentioned that they felt well prepared for their first job after studying

The result from Q1 was that most of the students felt well prepared for their first job and the task they were responsible to. The students were working in different organizations when it comes to size or complexity.

The second question had students answer which tasks or processes they felt underprepared, or poorly prepared for. Generally, the students seemed to struggle to answer this question, and instead many of them gave more positive answers about the ways in which they felt prepared. We highlight some of the common answers from students below.

Q2: Which tasks or processes do you feel underprepared, or poorly prepared for?

PROGRAM 1 key points:
One student highlighted that they felt underprepared for a different work culture (they worked in a Swedish firm that they said was more structured and process orientated than they were used to)
Implementation strategy and implementing/delivery phase of design thinking. As well economic analysis and profitability analysis.
How to work with people who are unwilling to change, or are unenthusiastic about reaching goals
Technical solutions in their particular field
Computation and data analysis.
How to collaborate with engineers
PROGRAM 2 key points:
I felt too light in economics and accounting (lack of skills).
More practice/training in facilitating groups (including specialists).
Practice/Training in different tools, methods and how to facilitate innovation workshops/projects easier
Lack of knowledge about formal requirements of establishing a venture

The results from Q2 highlight the common theme of needing greater technical competence, yet the students were working in different fields, meaning the technical competence relevant for one student was likely irrelevant to the rest. Soft skills around communication, culture and collaboration were mentioned by 3 students, however these mentions were related to specific scenarios, and less broad generalisable situations. 2 students would like to have more practice and training in classroom before entering real life cases/projects.

3) What should have been included in the masters' program which is currently not a part of the program

PROGRAM 1 key points:
The chance to interact more in person (Covid related). Openness in relation to group dynamics. More on sustainability.
Nothing. Were satisfied with the content and structure.
Financial knowledge
Even more environmental focus
Collaboration with engineers
PROGRAM 2 key points:
I'd like have more subject-specific topics, such as regulations / laws etc. In my job I've felt 'too light' / lack of competence in some areas
A lot of practice and a lot of theory in the master, but I would have liked a better connection by running several cases as a starting point to be trained on the theory.
More discussions and work in interdisciplinary teams where students are required to combine different perspectives in order to solve challenges.
More use of external business actors in teaching to bring in an 'outsider' perspective

Students seemed hard pressed to highlight areas that felt insufficient, with most students emphasising that they thought the current structure of the course was well designed and suitable for preparing them for the workforce. In highlighting the areas where a greater focus could have been placed most students added caveats to their answers that they understood these areas were not the key areas of focus for the masters' program.

Question 4 focussed on what students think should be dropped from the current study program. Three students from NMBU said the same answer here, which was one particular course on intellectual property rights. This course has already been removed from the master program. It is worth noting that students had earlier expressed their dissatisfaction with a teaching approach on this course that differed in pedagogy from the rest of the masters. In the final version of the course (before it was removed) a different pedagogy was used that was more in alignment with the entire program, resulting in positive students reviews in the course feedback. Students from HVL did not point to any particular elements which should be dropped from the current study program.

5) What was the best elements of the study program you took?

PROGRAM 1 key points:
The student culture in the class (mentioned twice)
Practical learning and use of innovative methods (mentioned three times)
Practical approach combined with theoretical support (mentioned twice)
The ability to choose much of the study direction themselves
Practical and useful work experience
PROGRAM 2 key points:
Writing the master's thesis had provided valuable training in writing and formulating long texts. This had been a useful and work-relevant experience (mentioned twice)
Work interdisciplinary teams
Network
Trained in cooperation and working in teams

The results from Q5 several students mentioned that practical approach and useful work experience as the best elements of the study program could give them. Two students mentioned that the work of writing the master's thesis had provided valuable training in writing and formulating long texts. This had been a useful and work-relevant experience.

The final question Q6 was left open to allow students to answer in a way that they could highlight anything else they considered important. The common themes were:

6) Is there anything else you would like to add?

PROGRAM 1 key points:
They enjoyed the practical elements
They would like to keep up contact with earlier and current students
That the program emphasised that there is no 'single' answers to many questions connected to innovation.
PROGRAM 2 key points:
Writing of master's thesis provided valuable experience
The master program provided students with motivation and faith in own capabilities to pursue entrepreneurship

The last question Q6 gave us just positive results and also showed differences and variations in experiences from the masters' programs.

6. Discussion

The general argument of Killingberg et al. (2020) was that an EE education prepares students well for entering the workforce. Our own examination generally supports this assertion. At the general level graduates relayed that they were content with the education they received and felt well prepared. Thus, suggesting there is general alignment between the education program and the needs of graduates, at least in the early stages of their career. While the authors welcome this generally positive result, this article is not intended as bragging or self gratulatory in the sense that the authors are closely connected to the program. Instead that aim was to consider whether EE is appropriate to the needs of those who plan on spending at least the initial part of their career in the workforce.

If we view the ideal education as a kind of target, then we could visualise the results of individuals courses as shots on target, and can begin to ask the question whether these shots are bullseyes or wide of the mark. The data gathered suggest most of these courses are landing on target, a perhaps more interesting philosophical question though is how do you prepare courses when the target is constantly shifting in an uncertain world. If you draw the analogy a step further, we can argue that actually in preparing courses we are firing shots on where a target was based previously and in doing so, an assumption is made that the target will continue to be relevant for the future. The reality though is that no educator has a crystal ball through which they can predict what will be relevant for tomorrow's EE students.

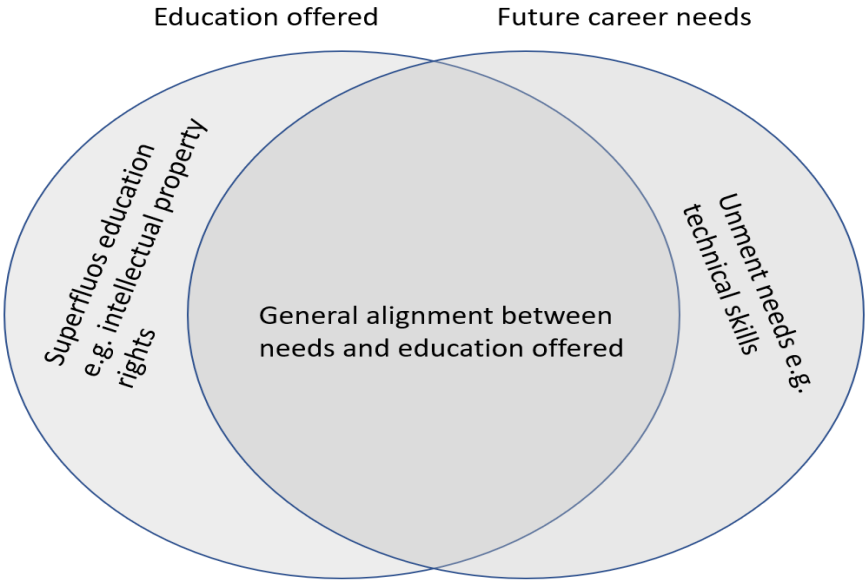


Figure 1: Alignment of the EE content with career needs

One of the key points that arose from the data was this idea that graduates were generally happy with the study program in the way it had prepared them to have the right mindset or attitude in their work. The felt comfortable with new tasks and in interacting with other business representatives and colleagues (or at least those not in technical roles). The areas where they seemed to be most challenged though was in interacting with more technically specific elements of their role. If we consider the feedback to fall under context specific knowledge it raises a tension that exists with broad focussed entrepreneurship programs. That tension is that preparing students for different roles requires preparing them for a mix of soft skills and technical skills.

The soft skills tend to translate well across domains, but have traditionally been more challenging to teach and measure. While technical skills have traditionally been easier to teach but have a narrower range of applicability. In addition, there is greater variation in which specific technical skills are needed based on role and industry. This raises a tension between which technical skills to teach. In order to create alignment between needs of the future graduates and their study program, there needs to be knowledge of which career trajectory the person will take. Most young people seem to struggle with the question 'what will you do when you graduate' – which corresponds with a struggle at the program level to ensure that the education needs of that person is met. In addition, given there is variation in technical skills needed, then there is a larger chance that if technical skills are taught arbitrarily then they will not be relevant. Although there is evidence to suggest that some programmes are managing to find the balance between technical/hard and soft skills (Fernandes et al., 2017).

If the student is unaware of what career trajectory they will choose then selecting appropriate 'elective' courses (which currently exist in the program) will always be a challenge, and may in some ways come down to chance. One of the students mentions this stating that they 'guess they could have taken an elective', but this highlights that when this person was a student they obviously never saw the elective as being relevant. This comes as back to a central idea connected to innovation which is that of dealing with ambiguity and uncertainty, which is how best to prepare students for the unknown.

There are two possible solutions to this. The first is practising the skill of learning how to learn technical skills. This could be through courses designed to place students in unfamiliar technical complex situations, and have them learn how to come to grips with the field through self-directed study in a relatively quick way. There is evidence this can be done, and is perceived as valuable by students (Lynch et al., 2019).

The other alternative is to have EE incorporate future casting skills where students can apply DT skills to their own life and generate future career scenarios and prototype these career trajectories. There is a known example of such a course being run through Stanford's Life Design Lab. There are also courses called 'design your life' run through a private company. Both examples highlight a possible path forward to help students gain clarity about their own path forward, which in turn might correlate with a greater sense of agency about how they want to prepare for future career trajectories.

Both solutions aim to increasing a sense of agency and engagement from students in order to ensure they are well prepared for changing environments. Meta cognition has been labelled as one skill which is important in this regards, whereby students are not only taught knowledge but equally taught about the skill of learning how to learn (Haynie et al., 2010). That is through reflective practice they can increase their understanding of their own weaknesses, and develop strategies and learning plans on how to achieve the required knowledge (Burgoyne, 1995).

7. Limitations and further research

The limitations with this study are many including the small sample size, the explorative research method and the geographic isolation of the study only looking at Norway. As an explorative study though the intention was never to provide clear answers, but to begin the process of investigating whether EE is suitable to prepare students for careers inside industry. Further research could follow up these same students at later points in their career in an attempt to understand if their attitudes differ over time. In addition, the geographical location of the study should be broadened and the sample size increased.

8. Summary

This study looks at a small sample across two programmes. The data so far suggest that EE seems to be preparing students for their early careers and that students see their education as largely having been beneficial. Unsurprisingly they find areas for fine tuning with regards to calibrating the courses to their particular needs. The needs of each graduate differ and there was no strong overriding theme of something being missing from the studies or having been superfluous. The fine tuning relates to ensuring students have the requisite technical skills combined with the soft skills. In general, the data suggest they had strong soft skills, but that several of them highlighted differing areas of technical skills. As discussed, no one size fits all. Study programs can mitigate this challenge by ensuring a sufficient focus on learning how to learn or what is often labelled as meta cognition. As an exploratory study, this article highlights an under researched area with potential for further insights for the EE field.

References

Bacigalupo, M., Kampylis, P., Punie, Y. & Van Den Brande, G. 2016. Entrecomp: The Entrepreneurship Competence Framework. Luxembourg: Publication Office Of The European Union.

Burgoyne, J. G. 1995. Learning From Experience: From Individual Discovery To Meta-Dialogue Via The Evolution Of Transitional Myths. *Personnel Review,* 24**,** 61-72.

Costello, C., Neck, H. & Dziobek, K. 2012. Elements Of The Entrepreneurs Inside Experience. *Babson Entrepreneur Experience Lab*.

Fernandes, J. M. & Afonso, P. A Software Engineering Course That Promotes Entrepreneurship: Insights From A Vuca Perspective. 2020 2020. Springer, 159-174.

Fernandes, J. M., Afonso, P., Fonte, V., Alves, V. & Ribeiro, A. N. 2017. Promoting Entrepreneurship Among Informatics Engineering Students: Insights From A Case Study. *European Journal Of Engineering Education,* 42**,** 91-108.

Hammersley, M. & Atkinson, P. 2007. *Ethnography: Principles In Practice*, Routledge.

Haynie, M., Shepherd, D., Mosakowski, E. & Earley, P. C. 2010. A Situated Metacognitive Model Of The Entrepreneurial Mindset. *Journal Of Business Venturing,* 25**,** 217-229.

Killingberg, N. M., Kubberød, E. & Blenker, P. 2020. Preparing For A Future Career Through Entrepreneurship Education: Towards A Research Agenda. *Industry And Higher Education,* 35**,** 713-724.

Kubberød, E. & Pettersen, I. B. 2018. The Role Of Peripherality In Students' Entrepreneurial Learning. *Education+ Training*.

Lackéus, M. 2014. An Emotion Based Approach To Assessing Entrepreneurial Education. *The International Journal Of Management Education,* 12**,** 374-396.

Lackéus, M. 2015. Entrepreneurship In Education-What, Why, When, How. Background Paper For Oecd-Leed.
Lowden, K., Hall, S., Elliot, D. & Lewin, J. 2011. Employers' Perceptions Of The Employability Skills Of New Graduates. *London: Edge Foundation*.
Lynch, M., Kamovich, U., Longva, K. K. & Steinert, M. 2019. Combining Technology And Entrepreneurial Education Through Design Thinking: Students' Reflections On The Learning Process. *Technological Forecasting And Social Change*, 119689.
Morris, M. H., Kuratko, D. F. & Cornwall, J. R. 2013. *Entrepreneurship Programs And The Modern University*, Edward Elgar Publishing.
Mwasalwiba, E. S. 2010. Entrepreneurship Education: A Review Of Its Objectives, Teaching Methods, And Impact Indicators. *Education+ Training*.
Neck, H. M. & Corbett, A. C. 2018. The Scholarship Of Teaching And Learning Entrepreneurship. *Entrepreneurship Education And Pedagogy,* 1**,** 8-41.
Neck, H. M. & Greene, P. G. 2011. Entrepreneurship Education: Known Worlds And New Frontiers. *Journal Of Small Business Management,* 49**,** 55-70.
Paechter, C. 2012. Researching Sensitive Issues Online: Implications Of A Hybrid Insider/Outsider Position In A Retrospective Ethnographic Study. *Qualitative Research,* 13**,** 71-86.
Pittaway, L. & Cope, J. 2007. Entrepreneurship Education: A Systematic Review Of The Evidence. *International Small Business Journal,* 25**,** 479-510.
Taleb, N. N. 2012. *Antifragile: Things That Gain From Disorder*, Random House Incorporated.
Thursby, M. C., Fuller, A. W. & Thursby, J. 2009. An Integrated Approach To Educating Professionals For Careers In Innovation. *Academy Of Management Learning & Education,* 8**,** 389-405.
Van Maanen, J. 2011. Ethnography As Work: Some Rules Of Engagement. *Journal Of Management Studies,* 48**,** 218-234.
Watson, T. J. 2011. Ethnography, Reality, And Truth: The Vital Need For Studies Of 'How Things Work'in Organizations And Management. *Journal Of Management Studies,* 48**,** 202-217.
Wickramasinghe, V. & Perera, L. 2010. Graduates', University Lecturers' And Employers' Perceptions Towards Employability Skills. *Education+ Training*.

Fashion Upcycling and Social Impact: A Case Study

Diana Machado, Marisa Ferreira, Amélia Carvalho, Alexandra Braga and Vítor Braga
CIICESI, ESTG, Politécnico do Porto
dianac.s.machado@hotmail.com
mferreira@estg.ipp.pt
acarvalho@estg.ipp.pt
abraga@estg.ipp.pt
vbraga@estg.ipp.pt

Abstract: To upcycle is to take something already made and then improve upon it, or turn it into a fresh item, so fashion upcycling is a process of using excess or waste clothing and textiles to generate new products, as an unconventional and new practices, which can successfully tackle concerns on excessive consumption of resources. The project "From Granny to Trendy" works with fashion upcycling and, in addition to the issue of sustainability, promotes the empowerment of unemployed women over 50 years. The main objective of our paper is to analyze social partnerships, particularly the social impact on the individual level, so a case study was conducted, exploring the benefits and difficulties of the project that belongs to a local nonprofit organization (NPO). The study is based on a qualitative (seven focus groups) and quantitative data analysis - two questionnaires, in two distinct moments: moment one corresponding to the beginning of the training and moment two corresponding to the end of the training, in a total of 100 questionnaires, 50 in each moment. Our study explores the project impact at the micro level, and conclude that participants gain benefits through the acquisition of new instrumental/technical knowledge/capabilities (e.g., new insights about fashion design) and psychological benefits (e.g., improvement of self-confidence).)

Keywords: social partnerships, stakeholders, impact

1. Introduction

The fashion and textile industry are one of the world's highest polluting industries. Textiles production involves a lot of land for crops and uses a lot of water, energy, chemicals and other resources, having a very negative environmental, economic and social footprint (Aus et al., 2021; Oliveira et al., 2021), being that textiles resources, skills or wills for environmental protection have not always been found in textile fashion (Aus et al., 2021).

An effective and transparent impact assessment is a challenge for all organizations (Ebrahim and Rangan, 2014). There is a growing concern with reliability and credibility in any sector of activity, so, in order to promote transparency and increase communication with the various stakeholders, there is a set of indicators that are assumed in a holistic format, in order to respond to an internal and external analysis, being that there is no consensus as to a single form of measuring the social impact (Arvidson and Lyon, 2014).

Vintage for a Cause is a circular economy brand that reuses textile waste/used clothing, creating exclusive designs in collaboration with different designers, with the aim of minimizing the impact of the fashion industry on the environment. At the same integrates senior seamstresses in the production of garments, which identifies and trains in a program to empower women over 50 years, long-term unemployed, through the creation of sewing clubs where upcycling workshops, called "From Granny to Trendy", culminates in a fashion session and parade. In this event, users showcase their creations, a statement against textile waste fashion and cherishing knowledge and age.

2. Theoretical framework

The quality of the relationship between stakeholders and businesses is determined by the degree to which stakeholders benefit from the implementation of corporate social responsibility (CSR) partnerships, as well as by the nature of these benefits, that is the more the benefits, the better the quality of the relationship (Bhattacharya et al., 2009).

Social partnerships can produce benefits at different levels, notably at individual (micro), organizational (meso), sectoral and social (macro) (Austin and Seitanidi, 2012; Googins and Rochlin, 2000; Kolk et al., 2010; Seitanidi and Lindgreen, 2010). Micro, meso and macro are levels or scales that can and may be mobilized in social analysis (Serpa and Ferreira, 2019). Macro level focuses on the divisions between the perspectives on

society and culture, the meso level corresponds to organizations and groups and finally, the micro level corresponds to individual identity, motives and individual cognition (Hartmann, 2017).

With regard to the micro level, social partnerships can have positive effects on the organization as well as its employees since, they can help create favorable perceptions of employees on organizational justice, support, trust and satisfaction at work which might encourage greater motivation and productivity (Kolk et al., 2010), as well as benefiting individuals working on the project as their skills combine effectively with others to produce a successful project and/or to the extent that they learn from it (Selsky and Parker 2010). At this level, the value created for individuals can be double: instrumental and psychological (Austin and Seitanidi, 2012). For example, instrumental benefits may include new or enhanced management skills, leadership opportunities, technical and industry knowledge, expanded perspectives, among others. Regarding psychological value, this can be translated into the emotional benefits that cover the psychological satisfaction of individuals to contribute to social improvement and the development of new friendships with colleagues from the partner organization (Austin and Seitanidi, 2012). Interactions at the micro level may even have broad benefits, as individuals play various roles and micro effects quickly spread to the meso level (organization) and consequently at the macro level (society) (Seitanidi and Lindgreen 2010).

The most common focus in the literature and in practice is on the value accruing to the partners, which are the organizational benefits that enhance the performance of the NPOs or the company (Selsky and Parker 2010). The literature abounds with long and at times confusing arrays of benefits (Selsky and Parker 2010). At the meso level partnerships with NPOs can maximize the objectives of both organizations (NPOs and for-profit organizations) (Googins and Rochlin 2000), i.e. at this meso level, each organization hopes to benefit by meeting its partnership objective (Selsky and Parker 2010).

Beneficiaries of successful social partnerships get benefits such as improving self-confidence, financial capacity or workforce participation (Sharma and Bansal, 2017). The managers of these successful partnerships note that the projects also meet expectations of commercial cost, quantity, quality and punctuality. Organizations that assume cognitive fluidity (information and knowledge) seek to solve problems and accommodate each other's needs (Sharma and Bansal, 2017). The increase in the success of social partnerships is conditioned by the s'aring of the same values between socially responsible companies and NPOs (Méndez et al., 2018), that is, t'e compatibility of intersectoral organizations chosen for the partnership is crucial for the success of any collaborative enterprise. Success is understood as achieving the objectives of the partnership (Hartman and Dhanda 2018).

3. Methodology

Vintage for a Cause is an ethical and sustainable clothing brand, and the "From Granny to Trendy" project aims to fill the gap in occupational activities offered to women over 50 years (long-term unemployed), offering them a sewing workshop where they can meet, talk, create and learn from each other. The project "From Granny to Trendy", was promoted by Vintage for a Cause and by four Municipalities from the North of Portugal, in collaboration with several Institutes of Employment and Professional Training. The creative sewing course consists of 12 technical workshops and has as main objectives: to value sewing as an art; reuse resources (reuse of used clothing and fabrics) giving them a new life, i.e., doing fashion upcycling; to enhance the role of women over 50 and create new opportunities for learning.

The quantitative analysis is made through two questionnaires (see Table 1), in two distinct moments: moment one corresponding to the beginning of the training and moment two corresponding to the end of the training. Our sample consists of 50 individuals, that have participated in the project "From Granny to Trendy". Regarding qualitative analysis, we did seven focus groups, they were based on a previously established script, which was directed and adapted to the sample. Seven focus groups were organized, at moment two, with participants from the four different places where the trainings took place. The groups had between 4 and 6 participants and their duration varied between 15 and 30 minutes (see Table 2). Each interview had 9 questions, with the objective of determining the impact of the trainings.

Table 1: Structure of the two questionnaires

Q1 Start of Training M1| November 2019
Demographic data; Personal characterisation (health, quality of life, leisure time); General knowledge on: • association; • textile waste; • environmental impact of textiles; • sewing; • clothing transformation • fashion design; • circular economy; • communication; • overall environmental impact: Learning needs on: • Sewing • Confidence • Fashion

Q2 End of Training M2| February 2019
Demographic data; Personal characterisation (health, quality of life, leisure time); General knowledge on: • association; • textile waste; • environmental impact of textiles; • sewing; • clothing transformation • fashion design; • circular economy; • communication; • overall environmental impact: Advantages of training; Disadvantages of training.

Table 2: Characterization of Focus Groups (moment 2)

Group	Number of participants	Training location	Interview duration (min)
1	4	Porto	15
2	4	Guimarães	18
3	5	Guimarães	20
4	4	Guimarães	25
5	5	Esposende	26
5	5	Gondomar	22
7	6	Gondomar	30

4. Results

Comparison of questionnaires results in two different moments

The perception that this is a project with an important impact on the community lacks evidence, so the collection of data at two different moments, in the beginning and in the end of training, materializes the interest in identifying possible changes and/or improvements in the perception of participants. The main aspect to be mentioned is the perception of the health status of the participants, in moment one the majority of the respondents classified their health as poor or average, and at the end of the training only about 33% of the participants maintained the same state of health. Thus, there is an improvement in the perception of the health status of the participants, at the beginning of the training few of the respondents classified their health as good or very good and at the end of the training this value changed to about 67%. At the end of the training, most of the participants considered that they felt improvements in their health (see Table 3).

Regarding the quality of life, it is observed that in moment one more than half of the respondents classified their quality of life as very poor, bad or average and in the end only 30.4% of the participants maintained the same level of quality of life. Thus, there was a considerable improvement in the perception of the quality of life of the participants (see Table 3). In the group of questions about general knowledge, we can say that for all items (NPO, textile waste, environmental impact of textile, sewing, clothing transformation, fashion design, circular economy, communication an environmental impact in general) the values have grown, and generally the knowledge of the participants has greatly increased for all dimensions, namely the knowledge about the NPO initiative is now very high, the knowledge about the environmental impact of textile is now high or very high, as well as the knowledge about sewing, the transformation of clothing, fashion design and the circular economy. Regarding communication skills, in moment one only 14% of the participants had high

communication skills, and after the training, it was found that approximately 80% of them had a high or very high communication capacity. Finally, there is a very significant increase in the knowledge of general environmental impacts, now considered as high or very high (see Table 3). Finally, regarding self-confidence, a significant improvement is identified. Initially, 56% of the respondents classified their self-confidence as average and at the end of training, 73% classified self-confidence as high or very high (see Table 3). The main reasons that led the respondents to register for the NPO workshops were the possibility of gaining skills in the area of sewing and the possibility of meeting people. After the training, it is observed that the main advantages identified are precisely the fact that the participants have met people, occupy better their time and have gained skills in the area of sewing. Considering the data, in moment one, about the knowledge of environmental impacts in general, the textile environmental impact and the circular economy, it is possible to identify an important growth of knowledge on these topics. So, it is possible to identify the important work of the association in the context of environmental awareness.

Table 3: Results questionnaires (Moment 1 and Moment 2)

MOMENT 1

		Percent
How you rate your health?	Very bad	0
	Bad	8,7
	Medium	23,9
	Good	30,4
	Very Good	37
How you rate your quality of life?	Very bad	0
	Bad	4,3
	Medium	26,1
	Good	41,3
	Very Good	28,3
Association Vintage for a Cause Knowledge	Very bad	13
	Bad	8,7
	Medium	26,1
	Good	21,7
	Very Good	30,4
Textile Waste Knowledge	Very bad	2,2
	Bad	6,5
	Medium	23,9
	Good	30,4
	Very Good	37
Environmental Impact of Textile Knowledge	Very bad	4,3
	Bad	17,4
	Medium	13
	Good	28,3
	Very Good	37
Sewing Knowledge	Very bad	4,3
	Bad	6,5
	Medium	21,7
	Good	19,6
	Very Good	47,8
Clothing Transformation Knowledge	Very bad	0
	Bad	10,9
	Medium	15,2
	Good	23,9
	Very Good	50
Fashion Design Knowledge	Very bad	6,5
	Bad	15,2
	Medium	19,6
	Good	19,6
	Very Good	39,1
Circular Economy Knowledge	Very bad	2,2
	Bad	17,4
	Medium	13
	Good	32,6
	Very Good	34,8

MOMENT 2

		Percent
How you rate your health?	Very bad	0
	Bad	12
	Medium	52
	Good	30
	Very Good	6
How you rate your quality of life?	Very bad	2
	Bad	4
	Medium	56
	Good	30
	Very Good	8
Association Vintage for a Cause Knowledge	Very bad	54
	Bad	22
	Medium	16
	Good	8
	Very Good	0
Textile Waste Knowledge	Very bad	28
	Bad	18
	Medium	38
	Good	10
	Very Good	6
Environmental Impact of Textile Knowledge	Very bad	26
	Bad	20
	Medium	38
	Good	14
	Very Good	2
Sewing Knowledge	Very bad	18
	Bad	22
	Medium	42
	Good	14
	Very Good	4
Clothing Transformation Knowledge	Very bad	24
	Bad	32
	Medium	34
	Good	8
	Very Good	2
Fashion Design Knowledge	Very bad	60
	Bad	22
	Medium	14
	Good	2
	Very Good	1
Circular Economy Knowledge	Very bad	58
	Bad	26
	Medium	16
	Good	0
	Very Good	0

Communication skills	Very bad	0
	Bad	4,3
	Medium	15,2
	Good	41,3
	Very Good	39,1
Knowledge Environmental Impacts in General	Very bad	4,3
	Bad	4,3
	Medium	13
	Good	43,5
	Very Good	34,8
Self-Confidence	Very bad	0
	Bad	2,2
	Medium	15,2
	Good	52,2
	Very Good	30,4

Communication skills	Very bad	22
	Bad	20
	Medium	44
	Good	14
	Very Good	0
Knowledge Environmental Impacts in General	Very bad	14
	Bad	20
	Medium	48
	Good	14
	Very Good	4
Self-Confidence	Very bad	2
	Bad	12
	Medium	56
	Good	24
	Very Good	6

Focus Groups

Through the analysis of the answers to the question "what type of knowledge did you acquired in the last three months?" participants were unanimous, concluding that they acquired new knowledge, for example "we have acquired more knowledge. (...) At least I had no knowledge of sewing and then I learned a little bit." (FG1). It is observed that the participants benefited from the project, as they acquired knowledge at the level of clothing transformation, fabric conjugation, at the level of sewing where they learned to make manual stitches and still work in the sewing machine. The participants mentioned that they learned to take advantage of everything, it was also mentioned the conviviality as a positive aspect, since the "people are a little closed" (FG5), and the project contributed to create "new friendships" (FG6).

It can be seen that some of the knowledge was acquired through sharing. It was possible to perceive the unity and sharing spirit among the groups, seeing the emergence of friendships arising as a result of the participation in the project. When asked why this intense sharing existed, the participants justified it by the fact that they were all about the same age: "if we were younger, we might not feel as comfortable as we did. I'm honest, all the years I've worked in a company I've come to the point where I don't want to go to work. When I started this training, I started to wake up always in a good mood, I sang, everything. We'd spend the mornings there and we didn't even see time goes by, it was lunch time and we didn't even realize it. We also talked to each other about our problems. I know I have that commitment and I go to that appointment, but I'm going happy, which should happen in the factories, but it doesn't happen" (FG6).

Regarding the question about the existence of new friendships, it is observed that only in one group the participants all knew each other from before, on the other groups, they did not know each other or knew only one person. In this sense, it is observed that for those who already knew, the friendship remained, while for those who did not know each other, new friendships emerged, underlining another positive result of the project.

Regarding the question about whether any transformation was identified, after having participated in this project, it is observed that in all groups, the answer was unanimous in considering the project as very positive, and in mentioning the appearance of some transformation in their lives, "A little light appeared. We were almost all unemployed, so we thought there was going to be nothing left, ending there. After all, we found that there is much to do" (FG3). This testimony reinforces the importance that this project had in the lives of these participants, since, they left their homes, began to work with other people, learned new things, representing an important social change.

When asked what they intended to do professionally with this knowledge, almost all answered that they intend to apply this knowledge, but in a more unpretentious format, "now we look at cloth differently. Deep down we're going back in time, I remember my mom reusing her clothes. This is going back a little bit to what it should be" (FG5), and we identified some references to the desire to return to work, "I wish I had a job now"

(FG6) and to have the opportunity to start a business together with some colleagues "If this lady opens a business, I would work with her" (FG6).

The less positive aspects mentioned are very few, the short time of training and its end, underline their taste for the project and training, reinforcing the idea that they liked it, wishing that it would be longer to have more time to "conviviality and learn more" (FG2), not representing a negative aspect. Nevertheless, some answers mentioned the training location, the consequent transportation expenses and the limited variety of textiles cloth as some negative aspects.

Regarding the question “would you recommend the participation in the project to other people?” all participants in the project would recommend, without any hesitation. In fact, there are even those who said that they already did “I recommend it to two friends” (FG3).

5. Discussion

It is clear that social partnerships go beyond purely economic support, seeking to qualify the human workforce (Chen et al., 2010), providing access to resources that go far beyond cash contributions, including counseling, technological and communications support (Seitanidi et al., 2010). The resources (tangible and intangible) involved in social partnerships can be embodied in financial, operational, reputational, network, trust, relational capital, learning, knowledge and joint problem solving resources, contributing to the co-creation of value and consequently generating benefits for partners, individuals and society, among others (Austin and Seitanidi, 2012; Hartman and Dhanda, 2018).

In addition, NPOs motivations include the growth of public awareness of social problems, as well as greater support for its organizational mission (Gourvilhe and Rangan, 2004). Social partnerships can have positive effects on the organization, which encourages greater motivation and productivity (Kolk et al., 2010), in addition to benefiting the people participating in the project, as their skills effectively combine with others to produce a successful project as they learn from it (Selsky and Parker, 2010)

The scientific literature identifies some benefits at the individual (micro) level as catalysts for benefits at other levels, namely at the level of organization (meso) and society (macro) (Seitanidi and Lindgreen, 2010).

Micro level corresponds to the individual identity (Hartmann, 2017), so, in our case study, the beneficiaries of social partnerships perceptions (women over the age of 50 who participated in the "From Granny to Trendy" project) identify as main advantages the improvement of their health status, a good level of quality of life, a high level of self-confidence as well as changing the way they occupy their free time. Initially, through the analysis of the questionnaire (moment one), it can be seen that the participants of the training occupied their free time essentially watching TV, tidying up the house, reading a book or walking, so it can be inferred that they spent most of their free time at home. Additionally, it is observed that most of them lived alone, with their children or with their spouse, and the majority presented as reasons for their enrollment in the training, the need to meet people and enjoy better their time.

In this sense, it was extremely advantageous to participate in the training, being that in moment two we can see an improvement in the quality of life, higher self-confidence as well as a change in the way of leisure time occupation. In addition, participants also acquired knowledge about clothing transformation, sewing, fashion design and communication skills. The above corroborates the literature that states that at the micro level, the value for individuals can be twofold: instrumental and psychological (Austin and Seitanidi, 2012). Instrumental benefits can include enhanced management skills, leadership opportunities, technical knowledge, expanded perspectives, among others (Austin and Seitanidi, 2012). So, the acquisition of knowledge of clothing transformation, sewing and fashion design through participation in the training represent instrumental benefits. As far as the psychological benefits relate, these can be translated into the emotional benefits that cover the psychological satisfaction of individuals in contributing to social improvement and the development of new friendships (Austin and Seitanidi, 2012). The benefits that can be included here are, the high level of self-confidence, the high level of quality of life, the knowledge of new people, the emergence of new friendships, conviviality, as well as the high communication capacity resulting from participation in the formation. This project benefits the people who participated in it, since they learned from it by effectively combining their skills to produce a successful project (Selsky and Parker, 2010).

However, the main disadvantages of this project were the high occupation of the time of the trainings as well as the high distance from the local of the trainings.

Hypothesis are strengthened by our case study, since it is possible to conclude that the micro benefits have consequences at the meso level and macro level. Many of the aspects that appear at the meso level also appear at the macro level, since they are related, given that positive impacts that occur beyond the domain of the participating organizations and the receiving population in a broader environment, that is, beyond what they learned at the individual level resulting from the organization's action, produces a positive impact on society (Austin and Seitanidi, 2012; Selsky and Parker, 2010). For example, it turns out that there was a transformation in people's lives, denoting the importance that this project had in the lives of these women, since they left their homes, learned new things, and this represent a social change. So, this social partnerships can be seen as a mechanism to solve social problems, which can lead to organizational and social changes (Seitanidi et al., 2010; Sharma & Bansal, 2017). Again, we can evidence that the benefits arising from the micro level can produce a positive impact on society, by improving the quality of life of the participants (Seitanidi and Lindgreen, 2010).

Finally, through the analysis of focus groups, it is concluded that all participants would recommend this project without any hesitation, and there is once again an impact at the macro level.

6. Conclusions

Scaling up fashion upcycling businesses might empower the changeover of the fashion industry towards sustainability (Sung et al., 2020). Based on a global analysis, our case study allowed us to conclude that social partnerships have an important impact at the micro level (Austin and Seitanidi, 2012).

Regarding to the micro level, it is possible to conclude that social partnerships benefit individuals participating in these projects, since they help to create favorable perceptions of organizational justice, trust, satisfaction, greater productivity and motivation, as well as the acquisition of knowledge through these projects. With this analysis, it has also become possible to conclude that the benefits at this level can be divided into two, namely (1) instrumental benefits and (2) psychological benefits. The instrumental benefits of the social partnership studied, were configured in the acquisition of knowledge of clothing transformation, sewing, fashion design, among others. With regard to psychological benefits, these were embodied in the improvement of self-confidence, communication improvement, conviviality, the emergence of new friendships, among others.

Consumers' lack of awareness and negative beliefs and perceptions about upcycling and upcycled products are identified by retailers and consumers (Sung et al., 2020), so this awareness/perception is an important future challenge, in upcycling businesses, that should be addressed in future research.

Acknowledgements

The authors would like to extend their deepest gratitude to Helena Silva (CEO of Vintage for a Cause) for their enthusiasm and availability.

Diana Machado gratefully acknowledges financial support from FCT- Fundação para a Ciência e Tecnologia (Portugal), national funding through project UIDP/04728/2020.

Marisa R. Ferreira, Amélia Carvalho, Alexandra Braga and Vítor Braga gratefully acknowledges financial support from FCT- Fundação para a Ciência e Tecnologia (Portugal), national funding through project UIDB/04728/2020.

References

Arvidson, M. and Lyon, F. (2014), "Social Impact Measurement and Non-profit Organisations: Compliance, Resistance, and Promotion", *Voluntas*, Vol. 25 No. 4, pp. 869–886.

Aus, R., Moora, H., Vihma, M., Unt, R., Kiisa, M. and Kapur, S. (2021), "Designing for circular fashion: integrating upcycling into conventional garment manufacturing processes", *Fashion and Textiles*, Springer Singapore, Vol. 8 No. 1, available at:https://doi.org/10.1186/s40691-021-00262-9.

Austin, J.E. and Seitanidi, M.M. (2012), "Collaborative Value Creation: A Review of Partnering Between Nonprofits and Businesses: Part I. Value Creation Spectrum and Collaboration Stages", *Nonprofit and Voluntary Sector Quarterly*, Vol. 41 No. 5, pp. 726–758.

Bhattacharya, C.B., Korschun, D. and Sen, S. (2009), "Strengthening stakeholder-company relationships through mutually beneficial corporate social responsibility initiatives", *Journal of Business Ethics*, Vol. 85 No. SUPPL. 2, pp. 257–272.

Chen, X., Moore, K.J. and Renaud, L. (2010), "Social Alliances", *Obesity Prevention*, Vol. 47 No. 1, pp. 661–671.

Ebrahim, A. and Rangan, V.K. (2014), "What Impact? A Framework for Measuring the Scale & Scope of Social Performance", *California Management Review*, Vol. 56 No. 3, pp. 118–141.

Googins, B.K. and Rochlin, S.A. (2000), "Creating the Partnership Society: Understanding the Rhetoric and Reality of Cross-Sectoral Partnerships", *Business and Society Review*, Vol. 105 No. 1, pp. 127–144.

Gourvilhe, J.T. and Rangan, V.K. (2004), "Valuing the cause marketing relationship", *California Management Review*, Vol. 47, pp. 38–57.

Hartman, L.P. and Dhanda, K.K. (2018), "Cross-Sector Partnerships: An Examination of Success Factors", *Business and Society Review*, Vol. 123 No. 1, pp. 181–214.

Hartmann, E. (2017), "Violence: constructing an emerging field of sociology", *International Journal of Conflict and Violence*, Vol. 11, pp. 1–9.

Kolk, A., van Dolen, W. and Vock, M. (2010), "Trickle Effects of Cross-Sector Social Partnerships", *Journal of Business Ethics*, Vol. 94 No. SUPPL. 1, pp. 123–137.

Méndez, B., Galera-Casquet, C., Seitanidi, M.M. and Valero-Amaro, V. (2018), "Cross-Sector Social Partnership Success: A Process Perspective on the Role of Relational Factors", *European Management Journal*, Vol. 34 No. 6, pp. 674–685.

Oliveira, V.M. de, Araújo, A.C. da M., Barbosa, A. de P.A. and Correia, S.É.N. (2021), "Ecoinovação, Upcycling e Slow Fashion para Produção e Consumo Sustentável: O Caso da Think Blue", *REUNIR*, Vol. 11 No. 1, pp. 41–55.

Seitanidi, M.M., Koufopoulos, D.N. and Palmer, P. (2010), "Partnership Formation for Change: Indicators for Transformative Potential in Cross Sector Social Partnerships", *Journal of Business Ethics*, Vol. 94 No. SUPPL. 1, pp. 139–161.

Seitanidi, M.M. and Lindgreen, A. (2010), "Editorial: Cross-Sector Social Interactions", *Journal of Business Ethics*, Vol. 94 No. SUPPL. 1, pp. 1–7.

Selsky, J.W. and Parker, B. (2010), "Platforms for Cross-Sector Social Partnerships: Prospective Sensemaking Devices for Social Benefit", *Journal of Business Ethics*, Vol. 94 No. SUPPL. 1, pp. 21–37.

Serpa, S. and Ferreira, C.M. (2019), "Micro, Meso and Macro Levels of Social Analysis", *International Journal of Social Science Studies*, Vol. 7 No. 3, p. 120.

Sharma, G. and Bansal, P. (2017), "Partners for Good: How Business and NGOs Engage the Commercial–Social Paradox", *Organization Studies*, Vol. 38 No. 3–4, pp. 341–364.

Sung, K., Cooper, T., Oehlmann, J., Singh, J. and OksanaMont. (2020), "Multi-Stakeholder Perspectives on Scaling up UKFashion Upcycling Businesses", *Fashion Practice*, Vol. 12 No. 3, pp. 331–350.

Tackling the Critical Hurdles: Revising Technology-Based Ideation Processes

Sarah Manthey, Christin Eckerle and Orestis Terzidis
Karlsruher Institut für Technologie, Germany
sarah.manthey@kit.edu
christin.eckerle@kit.edu
orestis.terzidis@kit.edu

Abstract. Technological innovations are crucial for a country's economic growth as they often have radical innovation potential. Although recognized as a key role in the innovation process, lots of technologies remain unexploited. University spin-offs (USOs) have the potential to transfer technologies into technological innovations. Often though, in universities there is a lack of consideration of potential implementation right from the start. The so-called fuzzyfront end (FFE) stage is crucial for successful innovation, as no commercialization can be achieved without the identification of a suitable application. This represents a critical hurdle, as of to date appropriate approaches for a successful systematic identification and validation of technology applications are missing. Furthermore, most investigating studies rely on data from spin-offs that are already operating successfully on the market and have therefore survived the critical initial stages of development, without highlighting the FFE of their process. This fact makes the pre-development activity of opportunity recognition appear to be a scientifically neglected topic. In this research a mixed-method approach is conducted to investigate the critical hurdles in the technology application selection (TAS) process of technologies, consisting of an extended literature review, completed by interviews with stakeholder involved in the USOs ecosystem. Striving to uncover the black box of the FFE, the study aims to specify and operationalize requirements for application identification of technologies. These findings are of relevance for researchers and practitioners which like to facilitate the exploration of potential technological innovation.

Keywords: technological innovation, technology application selection, entrepreneurship, technology-push

1. Introduction

Technology push (TP) represents an important innovation strategy to exploit new technology and technological knowledge to transform it into value (Maier et al. 2016). While they have the potential to lead to breakthrough innovations (Herstatt and Lettl, 2000), it also involves high uncertainty. Identifying and selecting applications for new technologies is challenging and risky since the appropriate market is often not clear and no guarantee of success can be estimated (Terzidis and Vogel, 2018). Furthermore, systematic and consistent approaches for identifying application fields are sparse (Henkel and Jung, 2009).

Despite the high demand for technological innovations in industry and research, few practical approaches supporting the TAS process are known (Terzidis and Vogel, 2018), while several exist for Market Pull Innovations, like Design Thinking (Leavy, 2012). Furthermore, there is hardly any specific investigation on the process of TAS for new technologies. Literature reviews focusing on the TAS process have been conducted by several authors, investigating different kinds of influential factors in the process (e.g., Abd Rahim et al. 2021), perceived meaning of opportunity and the underlying process (e.g., Ojala and Puhakka, 2013) and the whole TP process (e.g., Gbadegeshi, 2018). Additionally, studies explored the theoretical underpinnings in practical settings, testing the derived factors and contributions in the business environment (Wohlfeil and Terzidis, 2015; Okhli et al. 2019). Associated research topics, like methods to support the identification and selection process of applications for technology, have been covered by e.g., Hartelt et al. (2015) and Veilleux et al. (2018). Few authors address the development and testing of practical approaches to identify and select applications for new technologies, despite the continuous interest in tackling the challenge of TP innovations leading back to Roberson and Weijo (1988), being followed by various studies until today (Moncada-Peternò-Castello et al. 2003; Bianchi et al. 2010; Terzidis and Vogel, 2018).

The current state of research shows that most studies investigate mostly parts in the TAS process with theoretical and practical approaches, while few address the design and testing of practical approaches to support the discovery of new applications for technology. Whereas George et al. (2016) conducted a systematic literature review (SLR) on influential factors in the opportunity recognition process, no aggregated state of the art for application identification and selection in TP exists yet.

The purpose of this study is to explore how systematic approaches to conduct TAS for new technologies need to be designed to serve industry and research as a guiding approach to foster technological innovations. Considering theoretical contributions as well as the practical perspectives of experts in the field of TP by using a mixed-methods approach, this paper follows the main objective of answering the following research questions:

RQ1: Which influential factors exist for the TAS process and which kind of challenges arise within it?
RQ2: Which kind of approaches do already exist and for which target group are they tailored?
RQ3: What is the relevant content of an systematic TAS approach and how is it compiled?

Thereby, the paper contributes to the body of knowledge on the TP field, by exploring the fuzzy field of TAS. Based on the findings, challenges, influential factors, and key concepts are identified, which provides the fundament for designing a systematic approach for TAS. The paper is organized as follows: Section 2 will present the research methodology, and section 3 will present the results of the analysis. The paper concludes with a critical discussion and identification of limitations and future research directions.

2. Methodological approach

Two phases of data collection were executed. In phase one, a SLR on the topic of TAS was conducted. Phase two consisted of semi-structured interviews to investigate the area of ideation and evaluation processes for technologies from a practical perspective.

For the first phase, a SLR has been chosen as the appropriate method to explore the challenges, influential factors, as well as methods and processes of TAS, following the approach of Kitchenham and Charter (2007). Based on the focus of the study, search terms were derived from both aspects, the application identification and selection, and TP.

“opportunity discover*” OR "opportunity seek*" OR "opportunity develop*" OR "opportunity recognition" OR "opportunity identif*" OR "application scenario generation" OR "commercial potential" OR "techno-market insight" OR "business idea generat*" OR "prospecting" OR "application identification" OR "application recognition" OR "application ideation" OR "ideation at the fuzzy front end")

AND

("technology*push" OR "spin*off" OR start*up OR NBTF OR "technology commercial*" OR "New Technology based Firm" OR "academic entrepreneur*" OR "university entrepreneur*" OR "research entrepreneur*" OR "technology transfer")

The search was initiated on the search engines Web of Science, IEEE Xplore, Business Source Premier, EconLit, and Google scholar, which resulted in 1024 results. To complete the list of relevant literature, a backward and forward search was conducted. Not accessible or relevant literature for TAS was excluded, as well as too broad literature. Afterwards, 20 studies were considered in the citation analysis. After a forward and backward search, 54 publications remained to be considered for further analysis. In the final stage of SLR process, a hand search was used to identify more frameworks and methods regarding the ideation process in TP innovation, which resulted in 66 publications at last.

No limitation on a specific date range in the search was set to avoid too narrow results in the initial search and given the fact that one of the most important publications in this field was already in 1989 by Souder. Study selection criteria, based on the research questions and refined during the search process (Kitchenham and Charters, 2007) were defined as follows: Language: English; Full-text open access; Period: 1989 – 2021; Covering the relevant parts in the TAS process. Exclusion criteria precluded the results, which were only focusing on TP processes, just touching the surface of TAS, or fulfilling none of the inclusion criteria. The complete list of references can be obtained per request to the authors.

For extending and validating the gathered insights of the SLR, interviews were chosen as a suitable complementary data collection method. Using the advantages of flexibility while giving guidance and structure at the same time, semi-structured interviews were chosen to explore the area (Kallio et al. 2016). The interviews were conducted with 20 representatives in the field of technology transfer around the USO’ ecosystem, including

entrepreneurs, professors, and executives in research institutions. During the interviews, the respective function of the interviewees, as well as their individual experiences with the technology application identification and selection process were discussed. A qualitative content analysis was conducted (Mayring, 2014), following a deductive approach based on the SLR. Still, additional categories were added during the analysis if necessary.

The findings from the SLR and the interviews were used to enable an in-depth understanding of the topic of TAS as well as the derivation of influential factors, emerging challenges in the process and commonly known processes and methods, to answer the outlined research questions.
Results

2.1 Influential factors and challenges in the TAS process

To answer the first research question, influential factors in the TAS process, as well as accompanying challenges were analysed. A total of 13 influencing factors were identified, seven of which were frequently mentioned, but six only mentioned by individual sources. All influencing factors were also mentioned in the expert interviews - conversely, no new factors were added.

Prior Knowledge describes information people already have and can be separated into three major dimensions in the technology context: prior knowledge of markets, prior knowledge of ways to serve markets, and prior knowledge of customer problems (Shane, 2000). Siegel and Renko (2012) extended this by the dimension of technology knowledge, as the ideation is influenced by the relationship between technology and market knowledge. The importance of the balance of domain-specific and general knowledge for identifying new applications for technology was stated by Frishammar et al. (2012).

A widely accepted key driver of opportunity recognition is *Experience*, which is closely related to *Prior Knowledge* and illustrates a more practical perspective (Shane, 2000; Park, 2005; Rahim et al. 2015). Especially technical experience assists in the application identification process by assessing the potential and trends of a new technology (Rahim et al. 2015). The amount of identified applications for a technology increases by the amount of experience of the involved actors (Gruber et al. 2008).

Professional and Social Environment of entrepreneurs have a strong impact on their ability of opportunity recognition (Cooper and Park, 2008), as it acts as a mediator between the personal characteristics and the opportunity recognition – a change in the environment can thereby lead to the identification of an application (George et al. 2016).

Particularly the *Social Network* can act as a suitable platform to exchange knowledge, increasing possibilities to identify opportunities (Lim and Lee, 2019). Hereby, the balance of weak and strong ties plays an important role (Elfring and Hulsink, 2003). Active utilization of the social network also fosters the selection of the most promising application by assessing its potential (Franzoni, 2007).

Empirical evidence exists for *Personality Traits* in the TAS process, as some are significantly correlated with entrepreneurial behaviour (Rauch and Frese, 2007). In the context of ideation, activeness (Veilleux et al. 2018), creativity, optimism, and self-efficacy (Ardichvili et al. 2003), self-regulated learning (Abd Rahim et al. 2021), and openness to experience (Dew, 2009), risk propensity (Neill et al. 2017), self-confidence (Abd Rahim et al. 2015) are of special importance. In addition, curiosity, imagination, and open-mindedness are crucial for the identification of applications for technology (George et al. 2016).

First introduced by Kirzner (1997), the term of *Entrepreneurial Alertness* gathered popularity in terms of application identification, enabling the entrepreneur to perceive opportunities without actively searching (Baron, 2006). It can be strengthened by personality traits like creativity and optimism (Ardichvili et al. 2003) and is seen as a key determinant of the ideation process (Garcia-Cabrera and Garcia-Soto, 2009; Lim and Lee, 2019).

Besides the number of applications found by spontaneous recognition (Shane, 2000), *Systematic Search* to discover opportunities is of much importance in the field of technological innovation (Baron, 2006). By creating a linkage between changes and trends with the market, customer, and technology, entrepreneurs are even able to achieve serendipity (Dew, 2009). Furthermore, active search strengthens the opportunity development

competence and deepens alertness, knowledge and experience, which in turn contribute to application identification (Garcia-Cabrera and Garcia-Soto, 2009).

Further influential factors involve *Customer Inclusion* (Holzleitner, 2015), *Clear Advantage of Technology* and *Carefully Examined Alternatives* (Bishop, 2004), *Contact with Industry and Scientific Community* (Rasmussen and Wright, 2015), and *Information Transformation* (Corbett, 2007).

The interviews confirm the influencing factors identified, although it is noticeable that these are not mentioned in equal measure - the focus in the interviews is on *Experience* and *Alertness*.

Besides the influencing factors, challenges in the TAS process are also evident, which is identified by 14 articles and extended by the interviews by six. Due to thematic overlaps, a list of eleven challenges in total was drawn up.

Grégoire and Shepherd (2012) detected a *Cognitive Challenge,* to make the connection between technology and potential target market because of superficial dissimilarities, which was also identified by Terzidis and Vogel (2018). Hence, a *Lack of related Market Knowledge* (Shane, 2000; Vohora et al. 2004) is often recognized in the ideation process. Although this challenge can be solved by combining experts with different knowledge (Shane, 2000), a *Lack of Resources*, due to missing time, energy, or financial capital impedes the process (Gruber et al. 2008; Strøm, 2018). A *Lack of Human Capital* (Vohora et al. 2004) is another challenge in the ideation process, as it is vital to discover and create entrepreneurial opportunities (Alvarez and Barney, 2007; Marvel, 2013).

Strong investigation of *Underlying Technologies* is suggested by experts, as some unexploited opportunities could be avoided due to a deeper comprehension of the technology. Furthermore, besides the fact that involving customers in TP processes is difficult, the *customer needs to be considered* when thinking about possible applications, also suggested by Henkel and Jung (2009) in their lead-user integration approach. Overall, *missing technological and entrepreneurial Alertness* hinders a promising opportunity recognition while obtaining S*ufficient Alertness* itself is also a challenge, as it is based on personality traits, knowledge, experience, environment, search process, and social network (García-Cabrera and García-Soto, 2009).

Although successful ideation is sometimes based on spontaneous recognition, enabled by alertness and prior experiences (Kuo, 2011) *Systematic Approaches* aiding at matching a technology and a market are still missing (Felkl, 2013). Furthermore, especially in the case of research-emerged technologies or technology knowledge, systematic search processes are needed to estimate potential applications of the technology. In most cases, technologies are bought from existing companies that already have concrete use cases of the technology in mind, which makes inventors quick to dismiss the possibility of their own spin-off or further development. On the one hand, there is a high demand for systematic processes that can facilitate application identification, while on the other hand, the potential impact of systematic exploration is not well understood.

The *Selection of the Appropriate Application* is also a difficult process that is rarely addressed, especially in a practical context, and is usually approached with rather random methods, such as gut feeling or decisions by hierarchical levels. Furthermore, in ideation processes that are carried out, few *Alternative or Multiple Applications* are identified, which is sometimes related to other challenges, such as *cognitive challenges* (Strøm, 2018). Although identifying different applications can mitigate risk in TP processes (Bianchi et al. 2010), as the likelihood of developing valid applications is higher, the challenge is still very significant, and supporting methods are poorly known.

2.2 Building blocks of a TAS process

Although a high need for systematic TAS processes was identified (Kuo et al. 2011; Platzek et al. 2012), isolated or no systematic approaches are known in practice. Especially actors in the USO's area expressed high interest in a structured approach to transform the technology developed in research institutions into a consumable product or service (Djokovic and Souitaris, 2008; Rothaermel et al. 2008), while the interviewed entrepreneurs that had already gone through the process showed less interest but were still open to such a process. The SLR resulted in 17 TAS approaches (Table 1), published between 1986 and 2018, and represent the existing approaches for TAS processes.

Table 1: TAS approaches in literature

Authors	Publication year	Titles
Conway and McGuinness	1986	Idea Generation in Technology-Based Firms
Roberson and Weijo	1988	Using Market Research To Convert Federal Technology Into Marketable Products
Souder	1989	Improving productivity through technology push
Lynn and Heintz	1992	From experience: where does your new technology fit into the marketplace?
Moncada-Paternò-Castello et al.	2003	Early identification and marketing of innovative technologies: a case study of RTD result valorisation at the European Commission's Joint Research Centre
Bishop	2004	A Comprehensive Model for Technology Push Product Development
Nelson	2005	A Detailed Approach for Concept Generation and Evaluation in a Technology Push Product Development Environment
Danneels	2007	The process of technological competence leveraging.
Henkel and Jung	2009	The Technology-Push Lead User Concept: A New Tool for Application Identification
Bianchi et al.	2010	Enabling open innovation in small and medium-sized enterprises: how to find alternative applications for your technologies
Evans et al.	2010	Seeding and Harvesting the Innovation Gap: Linking Technology to Social and Market Needs
Kuo et al.	2011	Reconsidering the role of brainstorming in the marketing of technology-driven innovation
Maarse and Bogers	2012	An Integrative Model for Technology-Driven Innovation and External Technology Commercialization
Felkl	2013	Advanced Technology Innovation Mapping Tool to Support Technology Commercialization
Holzleitner	2015	A comprehensive framework for successful commercialization of technology push innovations
Strøm	2018	Identification of Applications to Technology in the CERN Knowledge Transfer Group
Terzidis and Vogel	2018	A Unified Model of the Technology Push Process and Its Application in a Workshop Setting

The publication by Terzidis and Vogel (2018) was also known to some of the interviewees through their own use. Other approaches to systematic ideation were not mentioned except for *"keeping and constantly expanding and evaluating an excel list"*. The startup founders tended to develop their ideas based on identified market opportunities, to which they then identified the appropriate technology. Consequently, a strict TP process did not take place here.

The target groups of the identified approaches varied from "technology managers" (Terzidis and Vogel, 2018) to "various large companies" (Bianchi et al. 2010) to "everyone interested in technology-based product innovation" (Henkel and Jung, 2009). In summary, the approaches were designed for actors who want to turn a technology into value by identifying and selecting a suitable application to build on to trigger further development.

However, 17 concrete approaches could be identified, while all of them were found in the literature and tailored for technology manager, different-sized companies, and individuals, which answers the second research question. To tackle the third research question, the relevant content of a TAS process was examined by investigating the 17 identified approaches in more detail. Thereby six clusters were identified: *Technology characterization* (Examining the basic functional and situational characteristics), *trend assessment* (Exploration of related trends and changes), *market assessment* (Exploring related market and industry), *customer integration* (Exploring needs of customer), *value analysis* (Value assessment of market and customer) and *evaluation* (Evaluating the application with defined criteria). A clear differentiation was not possible for each approach; moreover, the approaches go into varying degrees of detail in the execution of their process.

The identified approaches contain on average about 3-5 of the clusters, while none of the approaches contain all. *Technology characterization* was mentioned in more detail in five approaches, where partly detailed information for a suitable method were given, however, all the processes started with the technology. Terzidis and Vogel (2018) suggested a Technology Canvas, which is inspired by the description of a patent. Technology Description was mentioned by Linton and Walsh (2008) and Moncada-Paterno-Castello et al. (2003). Felkl (2013) and Bianchi et al. (2010) put their focus on the functionalities of the technology.

Trend and market assessment were mentioned each four times in the processes (e.g., by Henkel and Jung, 2009), but the underlying methods were not specified, yet it was stated that it shall be close to the functions of the technology. The customer integration was just mentioned in two approaches, one focusing on the lead user (Henkel and Jung, 2009) and one analysing the customer buy decision (Felkl, 2013). Mostly, the value analysis

was based on the assessment of customer benefit and technology functions (Felkl, 2013; Terzidis and Vogel, 2018). The evaluation was mentioned in three processes and based on given criteria, which support the selection of the final application (Bianchi et al. 2010; Maarse et al. 2012, Terzidis and Vogel, 2018).

2.3 Requirements for a systematic TAS process

The research has shown that processes developed so far contain the most important building blocks of a TAS process. However, the influencing factors and challenges that can affect and arise in such a process should also be considered here. Although there is already some overlap, blocks to be added are the use and expansion of human capital, the consideration of limited resources, the identification of alternative and multiple application fields, and the structured evaluation of identified applications, as the literature shows, that those can highly influence the process and are not found or specified in the existing processes yet.

The outline of identified challenges, influencing factors, and clusters of existing processes provide a comprehensive picture of the requirements that a process should address to support a systematic TAS process. To make these findings tangible, they are transformed into concrete requirements. These should be considered in future processes to ensure that the TAS process becomes more impactful. The requirements for a systematic and effective TAS process are listed below.

1. The process needs to enhance the user's knowledge of markets, trends, and technology
2. The process must enable users to understand the underlying function of the technology and to connect this to potential markets and industries
3. The process must support users to make use of and extend their human capital
4. The process must provide guidance on how to explore multiple and alternative applications
5. The process must enhance users to consider potential customer and their needs
6. The process must enable users to do the technology application selection within limited resources
7. The process must enable users to evaluate their ideas in a structured manner

The requirements presented function as guiding recommendations for designing TAS processes more systematically in the future, as previously developed processes didn't specify, how they were developed nor presented a detailed evaluation approach. Hence, they combine the current theoretical and practical findings in this field, which in turn may lead to encouragement to seek to transform more frequent technologies into value.

3. Discussion

Technology push and market pull innovation strategies have an important function in the management of innovative ideas, technologies, and trends (Maier et al. 2016). The coexistence of these two approaches has led to numerous debates over the last decades, and the focus has been shifted several times from paying more attention to technology push approaches to promoting market pull approaches (Guo et al. 2020). As market pull is a rapid and simple methodology that is expected to be successful in the short term, it has increasingly become the focus of entrepreneurial activities in recent years (Maier et al. 2016). In this context, the human-centred methodology "Design Thinking" has become progressively prominent and has become an integral part of almost every organisation Thinking (Leavy, 2012). However, the major difficulty in this case is that disruptive or radical innovations rarely emerge. This contrasts with technology push innovations - however, here the high risk due to high uncertainty and high costs is a deterrent (Herstatt and Lettl, 2000).

Studies show that authors have been working on the topic of TAS and the corresponding processes for more than 20 years to make technology push innovations more acceptable. Despite the comparatively long period of investigation, research is still in the early stages of finding the answer to the question of how to design a systematic process to make a systematic TAS process more tangible and thus reduce the barrier to entry.

The last few years have been characterized primarily by market-pull approaches and have brought corresponding innovations to the market (El Abjani and Ghafs, 2020). Still, the need for systematic approaches to transform technology into value is present, especially among technology-driven companies, but also among research institutions which come up with new technologies or new technological knowledge, seeking for applications (Geum et al. 2015). While further research has been undertaken in this area, due to the prominence of the design thinking methodology and the according shaping of entrepreneurial activities in the sense of the

market pull approach, the focus on technology push innovations has faded into the background (El Abjani and Ghafs, 2020).

To transform this status, a detailed examination of technology push innovations, in particular the fuzzy front end, is necessary to make them tangible and thus relevant for entrepreneurs and researchers (Stevens, 2014). The approaches identified during the systematic literature research show a solid basis for the discussion of technology application selection processes, which can be seen as drivers for technology push innovations.

However, none of the approaches has yet been able to establish itself or achieve popularity, such as it is the case for the design thinking approach whereby here no declaration is known. Although many approaches are already trying to close this deficit, at least the practical perspective suggests that there is still room for improvement. In addition, the development of an applicable TAS approach can lower the inhibition to technology-push innovation, which could result in more technology-based ideas and companies, as well as the aggregation of existing knowledge through increased awareness of the topic to further develop the processes.

4. Conclusion, limitations, and further research

This research enables a wider understanding of the underlying factors and challenges, occurring in the TAS process. A total of 13 influencing factors were identified, out of which six were only included through individual references. The results of the interviews confirmed the most frequently mentioned factors in this context, but in particular experience and alertness. Furthermore, a total of eleven challenges in the TAS process were identified, of which fourteen were identified through paper and six through interviews - with the elimination of thematic duplication yielding the final eleven.

Altogether, 17 approaches towards a TAS process were identified in the systematic literature review. The results of the interviews demonstrated that the only systematic approach known was the TAS approach by Terzidis and Vogel (2018), which were used by the interviewees themselves.

Furthermore, by reviewing the identified approaches, the research provides the building blocks of existing systematic approaches, transforming them into requirements for a systematic TAS process. By reviewing the status quo and summarizing the previous research in this field, a clear picture of the TAS process is provided, which can be used as a basis for further investigations.

Nevertheless, this study faces its limitations. Although the small number of experts provides an initial estimate of the overall situation, it is not indicative of the population. Besides that, the fuzzy nature of the TAS environment might exclude experts, which are more experienced in this field, but not identified as those yet. Another limitation is the wording of the Technology Application Selection process, as some stakeholders are more familiar with other terms.

Moreover, the search string and the quality criteria narrow the search radius accordingly, which could have excluded potential promising and relevant research. Furthermore, the identified processes are equally analysed, besides their narrow and unspecific target groups, which may lead to inconsistencies in the association.

In further research, a specific target group could thus be identified, and interviews tailored accordingly, with a wider field of experts and stakeholders. Additionally, cases could be investigated where technologies have already been transformed into value. In these settings, similarities to identified processes and building steps in the processes could be identified and influencing factors and challenges could be aligned. Furthermore, the requirements that have been worked out should be reflected on to check the projectability of these requirements for various scenarios as well as test them with the given approaches.

References

Abd Rahim, N., Mohamed, Z., Amrin, A., and Masrom, M. (2021). Impact of Self-Regulated Learning on Entrepreneurial Opportunity Recognition and Academic Entrepreneurship Performance. *International Journal of Innovation and Technology Management (IJITM)*, 18(04), 1-30.

Alvarez, S.A. and Barney, J.B. (2007). Discovery and creation: Alternative theories of entrepreneurial action.

Ardichvili, A., Cardozo, R., and Ray, S. (2003). A theory of entrepreneurial opportunity identification and development. *Journal of Business venturing*, 18(1), 105-123.

Bianchi, M., Campodall'Orto, S., Frattini, F., and Vercesi, P. (2010). Enabling open innovation in small-and medium-sized enterprises: how to find alternative applications for your technologies. *R&d Management*, 40(4), 414-431.
Bishop, G. L. (2004). A comprehensive model for technology push product development. Brigham Young University.
Byers, T. H., Dorf, R. C., and Nelson, A. J. (2011). Technology Ventures: From Idea to Enterprise. McGraw-Hill. New York.
Caetano, M., and Amaral, D. C. (2011). Roadmapping for technology push and partnership: A contribution for open innovation environments. *Technovation*, 31(7), 320-335.
Corbett, A. C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. *Journal of business venturing*, 22(1), 97-118.
Cooper, S. Y., and Park, J. S. (2008). The impact of incubator' organizations on opportunity recognition and technology innovation in new, entrepreneurial high-technology ventures. *International Small Business Journal*, 26(1), pp 27-56.
Danneels, E. (2007): "The process of technological competence leveraging." *Strategic management journal* 28.5: 511-533.
Dew, N. (2009). Serendipity in entrepreneurship. *Organization studies*, 30(7), 735-753.
Djokovic, D., and Souitaris, V. (2008). Spinouts from academic institutions: a literature review with suggestions for further research. *The journal of technology transfer*, 33(3), 225-247.
El Abjani, A., & Ghafs, Z. (2020). Entrepreneurship and innovation logics: Fundamental dilemma of market pull and technology push. A case study of leading Moroccan cluster. *International Journal of Accounting, Finance, Auditing, Management and Economics*, 1(2), 528-547.
Elfring, T., & Hulsink, W. (2003). Networks in entrepreneurship: The case of high-technology firms. *Small business economics,* 21(4), pp 409-422.
Felkl, J. (2013). "Advanced technology innovation mapping tool to support technology commercialization."
Franzoni, C. (2007). Opportunity recognition in technology transfer organizations. *International Entrepreneurship and Management Journal*, 3(1), 51-67.
Frishammar, J., Lichtenthaler, U., and Rundquist, J. (2012). Identifying technology commercialization opportunities: the importance of integrating product development knowledge. *Journal of Product Innovation Management,* 29(4), 573-589.
García-Cabrera, A. M., & García-Soto, M. G. (2009). A dynamic model of technology-based opportunity recognition. *The Journal of entrepreneurship*, 18(2), 167-190.
Gbadegeshin, S. A. (2018). Lean commercialization: A new framework for commercializing high technologies. *Technology Innovation Management Review*, 8(9).
Geum, Y., Jeon, H., & Lee, H. (2016). Developing new smart services using integrated morphological analysis: integration of the market-pull and technology-push approach. *Service Business*, 10(3), 531-555.
George, N. et al. (2016). "A systematic literature review of entrepreneurial opportunity recognition: insights on influencing factors." *International Entrepreneurship and Management Journal* 12.2: 309-350.
Grégoire, D. A., and Shepherd, D. A. (2012). Technology-market combinations and the identification of entrepreneurial opportunities: An investigation of the opportunity-individual nexus. *Academy of Management journal*, 55(4), 753-785.
Gruber, M., MacMillan, I. C., and Thompson, J. D. (2008). Look before you leap: Market opportunity identification in emerging technology firms. *Management science*, 54(9), 1652-1665.
Guo, H., Wang, C., Su, Z., & Wang, D. (2020). Technology push or market pull? Strategic orientation in business model design and digital start-up performance. *Journal of Product Innovation Management*, 37(4), 352-372.
Hartelt, R., Wohlfeil, F., & Terzidis, O. (2015). Process model for technology-push utilizing the task-technology-fit approach. In 19th Interdisciplinary Entrepreneurship Conference.
Henkel, J., and Jung, S.: "The technology-push lead user concept: a new tool for application identification."
Herstatt, C., and Lettl, C.: "Marktorientierte Erfolgsfaktoren technologiegetriebener Entwicklungsprojekte."
Holzleitner, R. (2015). A comprehensive framework for successful commercialization of technology push innovations. *Management von Innovation und Risiko*. Springer, Berlin, Heidelberg, 2006. 145-169.
Kallio, H., et al. (2016). "Systematic methodological review: developing a framework for a qualitative semi-structured interview guide." *Journal of advanced nursing* 72.12: 2954-2965.
Keinz, P., and Prügl, R. (2010). "A user community-based approach to leveraging technological competences: An exploratory case study of a technology start-up from MIT." *Creativity and Innovation Management* 19.3: 269-289.
Kirzner, I. M. (1997). Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach. *Journal of Economic Literature*, 35(1), 60–85.
Kitchenham, B. (2012). "Systematic review in software engineering: where we are and where we should be going." Proceedings of the 2nd international workshop on Evidential assessment of software technologies.
Kuo, D. C. L., Lin, C. C., and Yang, J. L. (2011). Reconsidering the role of brainstorming in the marketing of technology-driven innovation. *International Journal of Technology Marketing*, 6(1), 4-16.
Leavy, B. (2012). Collaborative innovation as the new imperative–design thinking, value co-creation and the power of "pull". *Strategy and Leadership*.
Lim, W., and Lee, Y. (2019). The impact of social networks on technology entrepreneurs' opportunity recognition process. In 2019 7th International Conference on Information and Communication Technology (ICoICT). IEEE.
Linton, J. D., and Walsh, S. T. (2008). Acceleration and extension of opportunity recognition for nanotechnologies and other emerging technologies. *International Small Business Journal*, 26(1), 83-99.
Maarse, J. H., and Bogers, M. (2012). An integrative model for technology-driven innovation and external technology commercialization. In *Open Innovation in Firms and Public Administrations*: Technologies for Value Creation. IGI global.

Maier, M., Hofmann, M. and Brem, A. (2016). "Technology and trend management at the interface of technology push and market pull." *International journal of technology management* 72.4: 310-332.

Marvel, M.R. (2013). Human capital and search-based discovery: A study of high-tech entrepreneurship. *Entrepreneurship Theory and Practice*, 37(2), 403–419.

Mayring, P. (2014). Qualitative content analysis: theoretical foundation, basic procedures and software solution. *Strategic Entrepreneurship Journal*, 1(1), 11–26.

Moncada-Paternò-Castello, P., Rojo, J., Bellido, F., Fiore, F., and Tübke, A. (2003). Early identification and marketing of innovative technologies: a case study of RTD result valorisation at the European Commission's Joint Research Centre. *Technovation*, 23(8), 655-667.

Okhli, M., Didehkhani, H., Sharifzadeh, M. S., and Hosseini, S. M. R. (2019). Determinants of Opportunity Recognition in the Pattern of Agricultural Tech Startups in Northern Provinces of Iran. International *Journal of Agricultural Science, Research and Technology in Extension and Education Systems*, 9(2), 65-75.

Ojala, A., and Puhakka, V. (2013). Opportunity discovery and creation in cloud computing. In 2013 46th Hawaii *International Conference on System Sciences.* IEEE.

Park, J. S. (2005). Opportunity recognition and product innovation in entrepreneurial hi-tech start-ups: a new perspective and supporting case study. *Technovation*, 25(7), 739-752.

Platzek BP, Pretorius L, Winzker DH (2012). Sustainability in technology driven business environments: a company-level approach. In: Proceeding of the 2012 PICMET'12: technology management for emerging technologies, IEEE, Vancouver, 1195–1208.

Rasmussen, E., and Wright, M. (2015). How can universities facilitate academic spin-offs? An entrepreneurial competency perspective. *The Journal of Technology Transfer*, 40(5), 782-799.

Rauch, A., and Frese, M. (2007). Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success. *European Journal of work and organizational psychology*, 16(4), 353-385.

Roberson, B. F., and Weijo, R. O. (1988). Using market research to convert federal technology into marketable products. *The Journal of Technology Transfer*, 13(1), 27-33.

Rothaermel, F. T., and Boeker, W. (2008). Old technology meets new technology: Complementarities, similarities, and alliance formation. *Strategic management journal*, 29(1), 47-77.

Sarasvathy, S. D., Dew, N., Velamuri, S. R., and Venkataraman, S. (2003). Three views of entrepreneurial opportunity. In Handbook of entrepreneurship research (141-160). Springer, Boston, MA.

Shane, S. (2000). "Prior knowledge and the discovery of entrepreneurial opportunities." Organization science 11.4: 448-469.

Siegel, D. S., and Renko, M. (2012). The role of market and technological knowledge in recognizing entrepreneurial opportunities. *Management Decision*.

Stevens, E. (2014). Fuzzy front-end learning strategies: Exploration of a high-tech company. *Technovation*, 34(8), 431-440.

Strøm, R. (2018). Identification of Applications to Technology in the CERN Knowledge Transfer Group (Master's thesis, NTNU).

Terzidis, O., and Vogel, L. (2018). "A unified model of the technology push process and its application in a workshop setting." Technology entrepreneurship. Springer, Cham. 111-135.

Veilleux, S., Haskell, N., and Béliveau, D. (2018). Opportunity recognition by international high-technology start-up and growth photonics firms. *International journal of entrepreneurship and innovation management*, 22(1-2), 126-151.

Vohora, A., Wright, M., and Lockett, A. (2004). Critical junctures in the development of university high-tech spinout companies. Research policy, 33(1), 147-175

Wohlfeil, F., and Terzidis, O. (2015). A critical success factors model for radical technological innovations. In ISPIM Conference Proceedings (p. 1). The International Society for Professional Innovation Management (ISPIM).

Entrepreneurship: Analysis by Country Through Machine Learning Techniques

Antonieta Martínez-Velasco[11], and Antonia Terán-Bustamante[2]
[1]Facultad de Ingeniería, Universidad Panamericana, México
[2]Facultad de Ciencias Económicas y Empresariales, Universidad Panamericana, México
amartinezv@up.edu.mx
ateran@up.edu.mx

Abstract: This research aims to analyze entrepreneurship worldwide through the dimensions and pillars of the entrepreneurship ecosystem of each country, identifying the contribution and patterns of behavior and correlation within the entrepreneurship ecosystem. This analysis intends to show the main actions that countries have carried out in support of entrepreneurship and entrepreneurs. The tool used to analyze is machine learning, where various algorithms are applied. The evidence shows that the most relevant pillars in the entrepreneurial ecosystem are I. Opportunity Startup, II. Technology Absorption, III. Risk Acceptance, IV. Risk Capital and V. Process Innovation. The pillars that best correlate are I. Competition and Opportunity Startup, II. Opportunity Startup, and Risk Acceptance, III. Opportunity Startup and Technology Absorption, IV. Cultural Support and Opportunity Startup, and V. Opportunity Startup and Risk Capital. The present work aims to provide knowledge to decision-makers in both the public and private sectors to channel public policies that support entrepreneurs in this time of crisis and promote the generation and strengthening of entrepreneurial activity. Although there are still no reliable GEI data for the years 2020 to 2022, the economic crisis generated by the stagnation in the development of the countries has reduced support for entrepreneurs, which in many cases can be a key factor for the rescue of the most disadvantaged countries.

Keywords: entrepreneurship ecosystem, machine learning, patterns detection, innovation process, country clusters, technology absorption

1. Introduction

The crisis caused by the Covid-19 pandemic has generated global uncertainty in all countries and all sectors. The virus spread so fast that it provoked great pressure, leading each country to take extreme measures to prevent its spread through programs of confinement, social distancing, and closure of businesses and borders, among others. Which caused crises at a global level affecting all economic sectors and all economies.

Currently, COVID-19 has caused a global recession and its economic impact is multiple. Although global economic activity is growing again, business is not likely to normalize as usual in the immediate future. This economic slowdown has affected many companies generating that many micro, small, and medium enterprises have closed permanently (OECD, 2020, 2021).

Saavedra et al., (2021) mention that entrepreneurial activity is crucial in all countries, as it drives the growth and development of the economy. The creation of companies as the first step of business activity is based on the favorable conditions that entrepreneurs identify not only in the field of the market but also in the social one (Saavedra et al. 2021 and Santamaría et al 2021).

Entrepreneurship is relevant because it serves as a mechanism that helps process economic crises, by relocating resources in such a way that it promotes new activities (Parra Miranda, 2014). Entrepreneurship favors the creation of new job opportunities, the introduction of new products in the market, and generates competition. The creation of a new company allows access to new job opportunities and even offers the opportunity to receive salary gains higher than those of work as an employee (Constant & Zimmermann, 2006, Nicolás and Rubio 2020).

For Schmiemann, (2012) entrepreneurship is the mindset and process for creating and developing an economic activity in which risk-taking and creativity, and/or innovation are combined, within a new or existing organization. Entrepreneurship is a key factor in the innovation, growth, and development of companies and countries. For this reason, the development of entrepreneurs must be supported in the various modalities that are manifested.

[1] Corresponding author

Entrepreneurship has long been studied from various approaches. The first to provide knowledge about them was Cantillon who mentioned that employees are those who obtain fixed income, while entrepreneurs establish themselves with capital to run their company, or own their work without capital, and can be considered actors who live on uncertainty (Cantillon, 1931). Later Say (1803) affirms that the entrepreneur is the person who starts a small business, and makes the change of resources from an area of low performance to one of high productivity and higher performance (Terán-Bustamante and Torres, 2020).

Schumpeter (1934) assigns the entrepreneur a creative role and promoter of innovation, where he appears like the individual who breaks patterns of routines and introduces the new. Penrose (1959) sees entrepreneurship as a function focused on innovation as a source of profit (Szirmai et al., 2011). Also noteworthy are the contributions of Knight (1942) who argues that for the entrepreneur to obtain a positive benefit, he must carry out three tasks: 1. Start changes or useful innovations; 2. Adapt to changes in the economic environment; and 3. Assume the consequences of uncertainty and risk related to the company.

Entrepreneurship involves an innovation process that facilitates new production combinations, giving rise to new products, production methods, industrial organizations, business models, and even the creation of new markets. Innovative activities include not only strictly technological innovations but also new goods, new production methods, new markets, new sources of supply, and new forms of industrial organization.

According to the above, entrepreneurship is a complex concept that has long been studied by various disciplines. Schumpeter (1934) assigns the entrepreneur a creative role and driver of innovation, where he appears like the individual who breaks routine patterns and introduces the new.

The economic growth of nations has been associated with their innovative capacity. This depends on multiple variables and how they are combined. One of these variables is entrepreneurship, which is related to innovation and business generation. This results in a better quality of life for a country.

The training of entrepreneurs and new companies is a key factor to promote the economic and social development of countries, especially in times of crisis such as the current one, therefore, it is necessary to determine which are the most important factors that influence and contribute to this objective (ODCE, 2021).

Based on this, several proposals have emerged to determine entrepreneurship capacity at the country level. The objective of this research is to analyze, through machine learning (ML) techniques, the variables that make up the entrepreneurship Index (GEI) to identify those that have the greatest contribution. The results can be used to guide entrepreneurship policies that promote their effectiveness.

Based on the above, the questions that guide this research are, what are the most relevant pillars at the country level that decision-makers and public policymakers should support in an entrepreneurship ecosystem? What are the best correlations between the various pillars of the entrepreneurship ecosystem that decision-makers should consider in public policies?

In this research, ML techniques are used to make predictions. This allows us to identify patterns of behavior for countries concerning entrepreneurship.

The entrepreneur and Entrepreneurship: conceptualization

For Lederman et al. (2014), the entrepreneur is an individual who transforms ideas into profitable initiatives. In addition, that transformation requires a special talent such as the ability to innovate, introduce new products and explore other markets. At the same time directing other people, prioritizing tasks to increase production efficiency, and giving available resources the best possible use.

An entrepreneur is a person with the vision to see innovation and the ability to bring it to market. The opportunity to undertake is positively correlated with economic growth. Entrepreneurs envision scalable, high-growth businesses. They also possess the ability to realize those visions. They get things done. They go over, below, and around obstacles. Entrepreneurs are the bridge between invention and commercialization. Invention without entrepreneurship stays in the university laboratory or R&D facilities (Zoltán, et al., 2018). According to

the above, there is no entrepreneurship without an entrepreneur and an entrepreneur to remain through time needs an ecosystem well strengthened by all the institutions and actors that participate in the

For Schmiemann, (2012) entrepreneurship is the mindset and process for creating and developing economic activity by combining risk, creativity, and/or innovation within a new or existing organization (Schmiemann, 2012, GIZ, 2018).

In each of these scenarios, entrepreneurship is usually seen as an individual-driven process (or by key people within companies), involving some sort of innovative behavior and/or taking risks that result in change. Most scholars agree that entrepreneurship is also driven by a desire to accrue earnings or other types of rewards, whether they are related to monetary gains, personal satisfaction, career-related status, a change in lifestyle, recognition, or other benefits. As such, entrepreneurship is a process that has the potential to lead to the creation and expansion of businesses.

Entrepreneurship and innovation

Innovation is a fundamental factor for entrepreneurship and economic growth. Innovation is the process that turns ideas into inventions (the practical applications of new knowledge and ideas resulting from experience, scientific research, technological research, and development) into products, services, and processes with value in terms of their commercial impact and social benefit (UNCTAD, 2017).

The entrepreneur innovates by introducing ideas or improving products and services, by incorporating new technologies, production processes, work practices, or ways of doing business. According to the Oslo Manual (OECD, 2018) innovation, as the implementation of a new and useful idea. It is the effective realization that achieves a change in the system, to improve and perfect some aspect of its structure, content, or operation. Consequently, innovation turns ideas into useful, practicable, and commercial products or services. (Adair, 2007).

The definition of an entrepreneur and the act he carries out adopted different approaches throughout the periods of analysis. Innovation emerged as a novelty in the definition of entrepreneurship. These approaches also include that of Say (1803), who believes that the entrepreneur is an intermediary between the scientific producer/producer of knowledge and the worker who applies this knowledge in the industry (Say, 1803). Later, Marshall put the innovative role of the entrepreneur at the forefront, highlighting that the actor within the company is the one who constantly looks for opportunities to reduce costs (Marshall, 1875).

Entrepreneurs are the bridge between invention and commercialization. Invention without entrepreneurship stays in the university laboratory, or only in R&D facilities.

The Entrepreneurial Ecosystem

The environment of an entrepreneur is dynamic and very complex and requires support along the way. Moore (1993) affirms that companies do not evolve in a vacuum and highlights the links and relationships these when interacting with various actors such as suppliers, customers, financial agents, the government, research centers, and universities among others.

According to the above, business ecosystems are complex socio-economic structures that come to life first through action at the individual level (GEI, 2018), and then through collaborative action where various actors participate. However, some of the knowledge relevant to business action is embedded in the various structures and actors of the ecosystem and requires collaborative actions to extract it.

An entrepreneurial ecosystem is an environment that facilitates the emergence of new businesses and where social, political, economic, and cultural elements are combined to create an adequate environment in which its different actors interact to strengthen the different types of entrepreneurship.

For Mason and Ross (2014) an entrepreneurial ecosystem is a set of interconnected entrepreneurial actors (both potential and existing), business organizations (e.g., companies, venture capitalists, private investors, banks), institutions (universities, public sector agencies, financial institutions), and business processes (e.g., the birth

rate of companies, the number of high-growth companies, the levels of 'highly successful entrepreneurship', the number of serial entrepreneurs, the degree of total selling) mindset within companies and levels of entrepreneurial ambition) that come together formally and informally to connect, mediate and govern performance within the local business environment.

In addition to entrepreneurs and new businesses, the entrepreneurial ecosystem brings together the following: Accelerators and incubators of startups, investments, private groups, public institutions or consolidated entrepreneurs, educational institutions, universities, business schools, and research centers.

The concept of ecosystem illustrates how different individuals, organizations, and resources necessary for the successful generation of new companies in each territory.

For Isenberg (2011a) having an entrepreneurship ecosystem is an indispensable factor to stimulate the economy and successfully detonate strategies de hubs, innovation systems, knowledge economy, and national competitiveness policies. To achieve the above, it identifies six dimensions within the business system: I. Favorable culture, II. Politics, III. Availability of adequate funding, IV. Talent, V. Favorable markets for products, and VI. A range of institutional supports. These dimensions in turn comprise various elements that interact in very complex ways. In addition to these dimensions, it also gives importance to the context, arguing that each ecosystem arises under a unique set of conditions and circumstances (Isenberg, 2011, a,b).

Measuring entrepreneurship at the country level.

There are several models at the country level to measure the performance and quality of support for entrepreneurship. Among them are the Global Entrepreneurship Index (GEI) and the Global Entrepreneurship Monitor (GEM). The GEM evaluates nine conditions of Entrepreneurial Activity, which in turn are subdivided into [1] financing; [2] government policies, tax payments, and bureaucracy; [3] government programs; [4] Education and training in entrepreneurship at the school and graduate-level; [5] transfer of research and development; [6] access to commercial and professional infrastructure; [7] internal market dynamics; [8] access to physical infrastructure and services, and [9] social and cultural norms of Entrepreneurship (Isenberg, 2011). The GEI is based on three dimensions [1] Attitude, [2] Ability, and [3] Aspiration (see table 1).

Table 1: Dimensions, pillars, and variables in GEI

Dimension	Pillars	Concept	Variables
Attitude (5 pillars, 10 variables)	Opportunity perception	Refers to the entrepreneurial opportunity perception potential of the population and weights this against the freedom of the country and property rights	Opportunity recognition
			Freedom (economic freedom property rights)
	Start-up skills	Captures the perception of start-up skills in the population and weights this aspect with the quality of education	Skill perception
			Education (tertiary education quality of education)
	Risk acceptance	Captures the inhibiting effect of fear of failure of the population on entrepreneurial action combined with a measure of the country's risk.	Risk perception
			Country risk
	Networking	This pillar combines two aspects of Networking: (1) a proxy of the ability of potential and active entrepreneurs to access and mobilize opportunities and resources and (2) the ease of access to reach each other.	Know entrepreneurs
			Agglomeration (urbanization infrastructure)
	Cultural support	The Cultural Support pillar combines how positively a given country's inhabitants view entrepreneurs in terms of status and career choice and how the level of corruption in that country affects this view	Career status
			Corruption
Ability (4 pillars, 8 variables)	Opportunity start-up	The Opportunity Startup pillar captures the prevalence of individuals who pursue	Opportunity motivation

Dimension	Pillars	Concept	Variables
		potentially better-quality opportunity-driven start-ups (as opposed to necessity-driven start-ups) weighted with the combined effect of taxation and government quality of services.	Governance (taxation good governance)
	Technology absorption	The Technology Absorption pillar reflects the technology intensity of a country's start-up activity combined with a country's capacity for firm-level technology absorption.	Technology level
			Technology absorption
	Human capital	The Human Capital pillar captures the quality of entrepreneurs by weighing the percentage of start-ups founded by individuals with higher than secondary education with a qualitative measure of the propensity of firms in a given country to train their staff combined with the freedom of the labor market.	Educational level
			Labor market (staff training labor freedom)
	Competition	The Competition pillar measures the level of the product or market uniqueness of start-ups combined with the market power of existing businesses and business groups as well as with the effectiveness of competitive regulation.	Competitors
			Competitiveness (market dominance regulation)
Aspiration (5 pillars, 10 variables)	Product innovation	The Product Innovation pillar captures the tendency of entrepreneurial firms to create new products weighted by the technology transfer capacity of a country.	New product
			Tech transfer
	Process innovation	The Process Innovation pillar captures the use of new technologies by start-ups combined with the Gross Domestic Expenditure on Research and Development (GERD) and the potential of a country to conduct applied research.	New technology
			Science (GERD ((average quality of scientifical institutions +availability of scientists and engineers))
	High growth	The High Growth pillar is a combined measure of (1) the percentage of high-growth businesses that intend to employ at least ten people and plan to grow more than 50 percent in five years (2) the availability of venture capital and (3) business strategy sophistication	Gazelle
			Finance and strategy (venture capital*business sophistication
	Internationalization	The Internationalization pillar captures the degree to which a country's entrepreneurs are internationalized, as measured by businesses' exporting potential weighted by the level of economic complexity of the country	Export
			Economic complexity
	Risk capital	The Risk Capital pillar combines two measures of finance: informal investment in start-ups and a measure of the depth of the capital market. The availability of risk capital is to fulfill growth aspirations.	Informal investment
			Depth of capital market

Source: Own elaboration based on Szerb and Acs Zoltan (2011); J Ács, et.al (2018a, b); Global Entrepreneurship Index methodology in detail (2019) and Bonyadi (2021).

For Isenberg (2011a) having an entrepreneurship ecosystem is an indispensable factor to stimulate the economy and successfully detonate strategies de hubs, innovation systems, knowledge economy, and national competitiveness policies. To achieve the above, it identifies six dimensions within the business system: I.

favorable culture, II. Politics, III. Availability of adequate funding, IV. Talent, V. Favorable markets for products, and VI. A range of institutional supports. These dimensions in turn comprise various elements that interact in very complex ways. In addition to these dimensions, it also gives importance to the context, arguing that each ecosystem arises under a unique set of conditions and circumstances (Isenberg, 2011, a,b).

In this work, the GEI was chosen for including the pillars that the authors have considered most explicit for the adequate impulse for entrepreneurship (table1).

Methodological Strategy

This research is quantitative. The analysis of the information was carried out through Machine Learning techniques. The three dimensions and the 14 pillars of support that make up the Global Entrepreneurship Index (GEI) are analyzed, to identify those that have the greatest contribution to the performance of the entrepreneurship ecosystem of each country, that is, quality and depth of support for entrepreneurship. The questions that this research aims to answer are: What are the most important dimensions within the entrepreneurship ecosystem?

Based on the information available, it is possible to consider a hypothesis that successful entrepreneurship requires training and support from various sectors that cause the necessary synergy for it to flourish. Support alone will not give entrepreneurs the necessary boost. The combination of them is what will make entrepreneurship successful.

The key elements for the realization of this study are 1) The Global Entrepreneurship Index database containing the 14 variables for the year 2019 was used. 2) 137 countries were considered. 3) Python software version 3.6.1 was used to create models based on machine learning techniques (Table 1).

Tasnim et al., (2018). Faghih and Bonyadi (2020); Junior et al. (2021) have developed models to analyze entrepreneurship at the country level and agree on considering systemic efficiency more thoroughly and the limitation of resources.

The methodology followed for the analysis of the data is integrated into three steps.

- 1. The pillars that have the greatest influence on the GEI were identified, based on the importance of each of the 14 variables for the classification. The GEI published for the year 2019 was taken as a class. This was done employing univariate regression for the GEI variable, to approximate the dependency relationship between the GEI variable and the variables that make up the database under study.
- 2. Correlations between the variables were established, based on Pearson's correlation coefficient. This coefficient is efficient for measuring correlations between continuous variables. It measures the statistical relationship between continuous variables. This coefficient takes values in the range of +1 to -1. Where a value less than zero indicates a negative correlation, that is, the variables will be associated in the opposite direction. A value greater than zero indicates a positive correlation. The Pearson correlation coefficient is calculated by random dates (X, Y) through the covariance between the variables divided by the standard deviations of both variables (Eq.1).

$$\rho_{X,Y} = \sigma_{XY} / \sigma_X \sigma_Y \quad \ldots\ldots\ldots\ldots \textit{Eq.1}$$

- 3. Unsupervised learning was applied through the machine learning clustering tool by applying the K-means algorithm. This is a grouping method, which aims to partition a set of n observations into k groups in which each observation belongs to the group whose mean value is closest. Given a set of observations (x_1, x_2, ..., x_n), where each observation is a real vector of d dimensions, k-means construct a partition of the observations into k sets ($k \leq n$) to minimize the sum of the squares within each group.

We utilized K=4; random initialization, where clusters are assigned randomly at first and then updated with further iterations; and 99 iterations as maximum, as the maximum number of iterations within each algorithm run.

2. Results and discussion

To elucidate the factors that most influence entrepreneurship, first, the index is reviewed in 137 countries, and the countries with the highest GEI in 2019 are located (Table 2).

Table 2: Countries best evaluated through GEI

Country	GEI	Country	GEI
United States	86.800	Ireland	71.300
Switzerland	82.200	Sweden	70.200
Canada	80.400	Finland	70.200
Denmark	79.300	Hong Kong	67.900
United Kingdom	77.500	Israel	67.900
Australia	73.100	France	67.100
Iceland	73.000	Germany	66.700
Netherlands	72.300		

Source: Own elaboration

Features relevance

According to the analysis of the data, the variables that are most relevant for the classification considering that GEI has been chosen as the target variable have been determined employing univariate regression. In this way, each of them was rated according to their correlation with the GEI (Table 3) to consider only the most influential variables.

Table 3: Feature Selection for GEI

Feature	Univar. Regression
Opportunity Startup	667.5
Technology Absorption	440.4
Risk Acceptance	365.3
Risk Capital	355.0
Competition	344.0
Process Innovation	281.7
Internationalization	268.7
Cultural Support	256.0
Human Capital	184.3
Product Innovation	183.3
High Growth	164.6
Startup Skills	115.3
Networking	106.3

Source: Own elaboration

The pillars that best correlate are Competition, Opportunity Startup, Risk Acceptance, Technology Absorption, and Cultural Support (Table 4). So, these variables provide information in the same proportion.

Table 4: Pearson correlations

Correlation	Feature 1	Feature 2
0.820	Competition	Opportunity Startup
0.817	Opportunity Startup	Risk Acceptance
0.802	Opportunity Startup	Technology Absorption
0.788	Cultural Support	Opportunity Startup
0.777	Opportunity Startup	Risk Capital
0.772	Internationalization	Technology Absorption
0.771	High Growth	Risk Capital
0.757	Risk Capital	Technology Absorption
0.751	High Growth	Human Capital
0.751	Competition	Cultural Support
0.747	Internationalization	Opportunity Startup
0.746	Competition	Risk Acceptance
0.746	Process Innovation	Technology Absorption
0.740	Opportunity Startup	Process Innovation
0.734	Human Capital	Risk Capital
0.732	Risk Acceptance	Technology Absorption
0.729	Competition	Process Innovation
0.724	Competition	Technology Absorption

Source: Own elaboration

To understand the behavior of the countries under study in terms of entrepreneurship performance, clustering of the countries was carried out using the k-means algorithm. In this way, the clusters to which each country belongs to the group whose average value is closest were obtained (Fig.1).

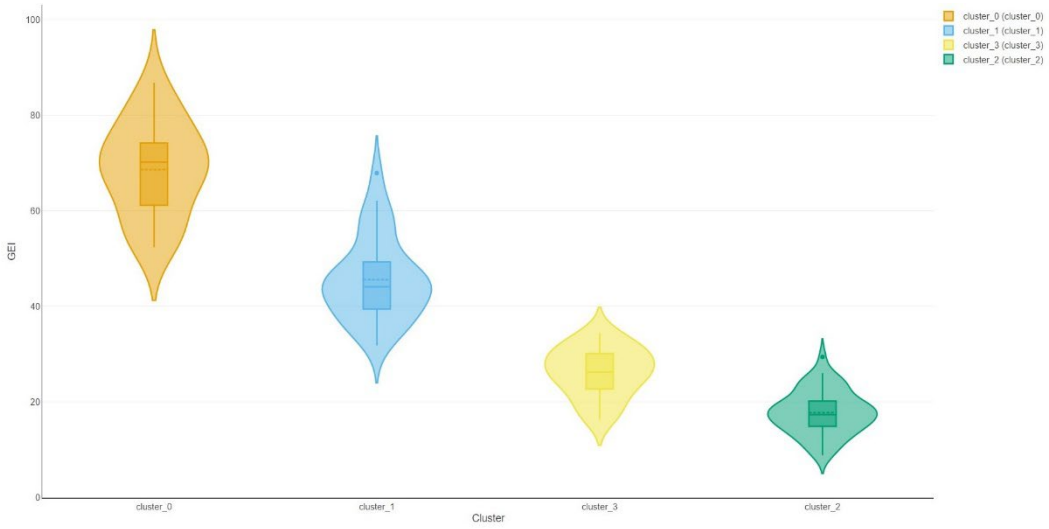


Figure 1: Violin chart by cluster

Countries are grouped by their similarities in the values corresponding to the pillars. This means that it is necessary to consider that the grouping does not depend on the overall value obtained from GEI, but on the quality and depth of the support to the venture. Thus, the countries were grouped into four groups with similar entrepreneurship ecosystems according to the 14 pillars of the GEI. Then, the countries that make up cluster zero are characterized by having the highest values for the most relevant variables. These values decrease as the cluster identifier number increases. The smallest cluster is cluster 0, which also includes the countries with the highest GEI (Table 5).

Table 5: Clusters composition

Cluster	Number of countries by cluster
Cluster 0	9
Cluster 1	20
Cluster 2	3
Cluster 3	10

Source: Own elaboration

Most relevant features by cluster

The values found for the most relevant variables for the countries of cluster 0 and cluster 3 are listed to compare them (Table 6). Where the United States stands out with the highest values and Botswana with the lowest values of all countries. Mexico occupies 16th place in cluster 3 (lowest values).

3. Conclusions

The crisis caused by this great confinement and this recession worldwide shows, as in other previous crises, the fundamental role that entrepreneurs have to face this situation and generate economic recovery. It is a fact that it is possible to perceive innovative opportunities in periods of crisis, however, it should not be thought that everything that entails an economic crisis makes entrepreneurship easier.

Consequently, entrepreneurs need to have the support of their institutions in each country to be able to create or continue with their activity in the face of this crisis caused by COVID-19, since they have to face important challenges. Among which stand out digitalization – which has become a priority -, lack of financing, lack of human talent with digital skills, and administrative facilities among others. Entrepreneurship is dynamic and generates a high impact to the extent that new entrants to the economy generate changes in productivity and sustainability

in economic sectors. In the analysis presented, the countries have been grouped based on the values of the 14 pillars that characterize them.

Table 6: Most relevant features of Cluster 0 and Cluster 3

Country	*Opportunity Startup*	*Technology Absorption*	*Risk Acceptance*
Cluster 0			
United States	**1**	**0.95**	**0.93**
Switzerland	0.71	0.82	0.9
Canada	0.91	0.9	0.66
Denmark	1	1	0.76
United Kingdom	0.75	1	0.88
Australia	0.8	1	0.74
Iceland	0.68	1	0.92
Netherlands	0.81	0.99	0.95
Ireland	0.77	0.89	0.82
Sweden	0.95	1	0.69
Finland	0.6	0.82	0.78
Israel	0.73	1	0.48
France	0.36	0.84	0.81
Germany	0.49	0.82	0.72
Austria	0.64	0.92	0.65
Belgium	0.52	0.83	0.56
Luxembourg	0.55	0.97	0.54
Slovenia	0.42	1	0.92
Norway	0.79	0.73	1
Japan	0.18	0.74	0.69
Singapore	0.5	0.73	0.81

Country	*Opportunity Startup*	*Technology Absorption*	*Risk Acceptance*
Cluster 3			
Botswana	0.58	0.22	0.76
Colombia	0.63	0.36	0.31
Thailand	0.37	0.2	0.16
Barbados	0.44	0.28	0.2
Azerbaijan	0.44	0.28	0.14
South Africa	0.46	0.24	0.24
Kazakhstan	0.62	0.14	0.09
Uruguay	0.43	0.56	0.36
Bulgaria	0.28	0.31	0.29
Namibia	0.83	0.13	0.26
Jordan	0.33	0.44	0.12
Costa Rica	0.34	0.07	0.34
Lebanon	0.33	0.17	0.02
Serbia	0.3	0.14	0.17
Morocco	0.27	0.35	0.27
Mexico	**0.4**	**0.21**	**0.44**
Belize	0.38	0.26	0.02
Georgia	0.46	0.31	0.07
Vietnam	0.43	0.15	0.08
Indonesia	0.35	0.41	0.24
Panama	0.37	0.11	0.5
India	0.33	0.05	0.38
Jamaica	0.71	0.22	0.08
Egypt	0.27	0.26	0.07
Philippines	0.39	0.01	0.34
Peru	0.55	0.25	0.42
Trinidad & Tobago	0.64	0.11	0.54
Ghana	0.53	0.13	0.09
Senegal	0.37	0.12	0.24
Bosnia & Herzegovina	0.15	0.4	0.02
Suriname	0.41	0.02	0.1
Ethiopia	0.33	0.08	0.02
Zambia	0.45	0.03	0.1
Guyana	**0.37**	**0**	**0.11**

Source: Own elaboration

Therefore, it is convenient to analyze the level of entrepreneurship by separating it from the GEI to indicate the key factors to improve in each case since each country will have its unique characteristics and by region as well. It should be noted the difference between the values for the most relevant variables between the countries that make up the ends of cluster 0 and cluster 3. At the highest point of cluster 0 is the United States with values of 1, 0.95, and 0.93 for the variables Opportunity Startup, Technology Absorption, and Risk

Acceptance, respectively. At the lower end of cluster 3 is Guyana with values of 0.37, 0, and 0.11 for the same variables. This allows us to contrast the great differences in the support that entrepreneurs receive in these countries. In the case of Mexico, located in cluster 3, the values obtained in the same pillars are 0.4, 0.21, and 0.44. While they are not at the lower end of cluster 3, they also show that action is needed in favor of entrepreneurs.

The countries that have a high performance in the variables detected as the most relevant are only 9, these makeup cluster 0. While those that do not reach an optimal performance are the 33 countries belonging to clusters 1, 2, and 3.

The country clusters clearly show that it is necessary to improve the values in the pillars of Opportunity Startup, Technology Absorption, Risk Acceptance, Risk Capital, Competition, Process Innovation, Internationalization, and Cultural Support. This indicates that it is essential to support entrepreneurs from countries belonging to clusters other than cluster 0 in the aforementioned areas since these can be triggers for the economies of those regions. These differences have been marked with greater force after two years of the covid19 pandemic has begun. Although there is still no reliable data on GEI for the years 2020 to 2022, the economic crisis generated by the stagnation in the development of countries has decreased support for entrepreneurs, which in many cases can be a key factor for the rescue of countries with less favored economies.

Future work on the entrepreneurial ecosystem should focus on going from the general to particular, that is, from the best practices in the world, the best practices and correlations in the entrepreneurial ecosystem of each country within the cluster of similarities, to the individual analysis of each case individually country by country. This exercise will allow the generation of unique models for each country that will allow them to make better public policies and actively involve all the actors. Remember that the way of absorbing knowledge is different for each country and its implemented strategies. In other words, what can be successful for a country is not necessarily so for its different resources.

References

Adair, J. E. (2007). Leadership for innovation: How to organize team creativity and harvest ideas. Kogan Page Publishers.

Ács, Z., Szerb, L., Lafuente, E., Lloyd, A. (2018a). Global Entrepreneurship and Development Index 2018. Springer International Publishing. DOI: 10.1007/978-3-030-03279-1.

Ács, Z. J., Szerb, L., & Lloyd, Z. (2018b). Global Entrepreneurship Index, Global Entrepreneurship and Development Institute. Url: https://thegedi. org/wpcontent/uploads/dlm_uploads/2017/11/GEI-2018-1. pdf (16.07. 2019).

Banco Mundial (2014) El emprendimiento en América Latina: muchas empresas y poca innovación, de próxima aparición.

Bonyadi, E., Sarreshtehdari, L. The Global Entrepreneurship Index (GEI): a critical review. J Glob Entrepr Res (2021). https://doi.org/10.1007/s40497-021-00302-0

Cantillon, R. (1931). Essai Sur la Nature du Commerce en General. Londres: MacMillan and Co.

Colin Mason and Ross Brawn (2014). Entrepreneurial Ecosystems and Growth-Oriented Entrepreneurship. Final Report to OECD, Paris, 30(1), 77-102.

Constant, A., & Zimmermann, K. F. (2006). The Making of Entrepreneurs in Germany: Are Native Men and Immigrants Alike? Small Business Economics, 26(3), 279–300. https://doi.org/10.1007/s11187-005-3004-6

Faghih, N., Bonyadi, E., & Sarreshtehdari, L. (2020). Entrepreneurship Viability Index. A New Model Based on the Global Entrepreneurship Monitor (GEM) Dataset. Springer

GIZ, Deutsche Gesellschaft für Internationale Zusammenarbeit (2018). Guide for Mapping the Entrepreneurial Ecosystem Observe – Analyse – Visualise. https://www.giz.de/en/downloads/giz2018-en-guide-mapping-entrepreneurial-ecosystem.pdf

Isenberg, D. (2011). The entrepreneurship ecosystem strategy as a new paradigm for economic policy: Principles for cultivating entrepreneurship. Presentation at the Institute of International and European Affairs, 1(781), 1-13.

Isenberg, D. (2011). How to foment an entrepreneurial revolution. The Babson Entrepreneurship Ecosystem Project, 781(7).

Junior, I., E., Dionisio, E.A., Fischer, B.B., Li, Y. and Meissner, D. (2021), "The global entrepreneurship index as a benchmarking tool? Criticisms from an efficiency perspective", Journal of Intellectual Capital, Vol. 22 No. 1, pp. 190-212. https://doi.org/10.1108/JIC-09-2019-0218

Knight, F. (1942). Profit and entrepreneurial functions. . The Journal of Economic History 2 (supplement), 126–132.

Nicolás, C. & Rubio, A. (2020): Emprendimiento en épocas de crisis: Un análisis exploratorio de los efectos de la COVID-19, Small Business International Review (SBIR), ISSN 2531-0046, Spanish Accounting and Business Administration Association (AECA) and Universidad Politécnica de Cartagena (UPCT), Madrid and Cartagena, Vol. 4, Iss. 2, pp. 53-66, http://dx.doi.org/10.26784/sbir.v4i2.279

Mason, C., & Brown, R. (2014). Entrepreneurial ecosystems and growth-oriented entrepreneurship. Final report to OECD, Paris, 30(1), 77-102.

Moore, J.F., 1993. Predators and prey: a new ecology of competition. Harvard Business Review, 71(3), pp.75–86.

OECD Economic Outlook. (2021). Volume 2021 Issue 2: Preliminary version, No. 110, OECD Publishing, Paris, https://doi.org/10.1787/66c5ac2c-en

OECD/Eurostat (2018). Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg, https://doi.org/10.1787/9789264304604-en.

Parra Miranda, M. S. (2014). Emprender en tiempos de crisis. Observatorio Económico, 80, 2–3. https://doi.org/10.11565/oe.vi80.130

Penrose, E. (1959). The Theory of the Growth of the Firm. Blackwell, Oxford

Romero, X. A. V., & Restrepo, S. O. (2016). Emprendimiento e innovación: Una aproximación teórica. Dominio de las Ciencias, 2(4), 346-369.

Saavedra, R., Morones, A. y Martínez, G. (2021). «El robo como obstáculo para el emprendimiento en México, 2005-2018». Análisis Económico, 36 (9), 145-163.

Santamaria (2021). Emprendimiento en México: el antes y el después de la covid-19. Revista Internacional de Organizaciones, nº 27, octubre 2021, 35–57 35. ISSN: 2013-570X; EISSN: 1886-4171. http://www.revista-rio.org

Say, J. B. (1803). A Treatise on Political Economy or the Production, Distribution and Consumption. New York.

Szerb, Laszlo and Acs, Zoltan J. (2011) The Global Entrepreneurship and Development Index Methodology (June 4, 2011). Available at SSRN: https://ssrn.com/abstract=1857985 or http://dx.doi.org/10.2139/ssrn.1857985

Schumpeter, J. (1934). The Theory of Economic Development, HUP (Spanish version, Schumpeter, J. Teoría del desenvolvimiento económico). México: Cambridge, Mass.

Schmiemann, Manfred. (2012). Entrepreneurship determinants: culture and capabilities. Luxembourg: Publications Office of the European Union, Eurostat. Industry, trade and services Collection: Statistical books

Terán-Bustamante, A., & Torres, A. V. (2020). Capacidades de emprendimiento e innovación: El caso de una empresa biofarmacéutica en México. Revista Espacios, 41, 230-47.

Tasnim, N., Afzal, M.N.I. An empirical investigation of country level efficiency and national systems of entrepreneurship using Data Envelopment Analysis (DEA) and the TOBIT model. J Glob Entrepr Res 8, 37 (2018). https://doi.org/10.1186/s40497-018-0138-y

UNCTAD (2017). Manual del Participante del Módulo 1 Innovación, Política y Desarrollo del Curso de Formación en Políticas de CTI de la UNCTAD.

Zoltán J. Ács, László Szerb Esteban Lafuente Ainsley Lloyd (2018). Global Entrepreneurshipand Development Index 2018. Springer Nature Switzerland AG. https://doi.org/10.1007/978-3-030-03279-1

Towards a Theory of Motivations and Roles in Business Ecosystems

Margaret Mastropetrou [1], George Bithas[1,2] and Konstadinos Kutsikos[1,3]
[1]Growth Transformation and Value Engineering (W.A.V.E.) Lab, Business School, University of the Aegean, Greece
[2]PlanBe Management Consulting, Greece
[3]School of Social Sciences, Hellenic Open University, Greece
mastropetrou@aegean.gr
g.bithas@ba.aegean.gr
kutsikos@aegean.gr

Abstract: Focusing on the role of networking organizational structure, the literature on innovation management has turned towards value co-creation. The need for value co-creation has emerged from the fact that, in order for firms to cater for their customers' needs, they cannot deliver on their own as single entities, but rather participate in business ecosystems. Ecosystems are a fundamental occurrence of the academic literature, as well as the managerial world. In order to gain insight to the operations of ecosystems, a systematic literature was carried out. The research question concerned the motivations that drive participants to join a business ecosystem. Several frameworks were explored with a focus on the roles that participants might fill and their specific attributes. The findings suggest linking the stakeholders' motivations to specific roles' attributes, thus leading to the filling of a certain role. The outcomes are then reflected in the luxury goods industry, which is one of the richest and unmanageable sectors and bears the characteristics of an ecosystem. The contribution of this research is fundamental for the ecosystems operations, as the exploration of stakeholders' motivations is essential for the sustainability of the ecosystem from a managerial perspective.

Keywords: business ecosystems, ecosystem stakeholders, motivations, roles, value co-creation, innovation

1. Introduction

The increasing dynamism in customer engagement which derives from the complexity of current business environments, has created the need for continuous innovation by organizations, aiming for value creation and competitiveness (Valkokari et al. 2017). Focusing on the role of networking organizational structure, the literature on innovation management has turned towards a collaborative nature of value creation, also known as value co-creation. The need for value co-creation has emerged from the fact that, in order for firms to cater for their current customers' needs, they cannot deliver on their own as single entities, but rather participate in networks, namely business ecosystems, consisting of multiple interdependent and interactive actors (Iansiti and Levien, 2004).

The emergence of business ecosystems is a fundamental occurrence of the academic literature, as well as the managerial world, as value co-creation is performed among several stakeholders with conflicting needs and goals, who contribute unique resources and capabilities, serving the generally agreed necessity for innovation and unique value propositions. Although the concept of business ecosystems is a common topic of interest in the academic literature (Song, 2019), there is a distinct lack of practical frameworks concerning ecosystem operations.

One framework that offers valuable insight into the operations of ecosystems is that by Bithas et al (2018). The contribution of this framework lies to the analysis of the roles that ecosystem participants might fill and their specific attributes. In the context of this model, the issue of what motivates participants to join a business ecosystem arises, as well as which role does each stakeholder engages in, led by its motivations. This is the research question of the current study, which is analyzed in the context of stakeholder management and explored through a systematic literature review.

More specifically the research question addressed is: *What is the relationship between a business ecosystem role and a new participant's motivation?* The findings suggest linking the stakeholders' motivations to specific roles' attributes and by making such combinations, each motive of joining an ecosystem leads to the filling of a certain role. The contribution of this outcome is fundamental for the

ecosystems operations, as the exploration of stakeholders' motivations clarifies the way each participant engages in a specific role. Furthermore, the exploration of stakeholders' motivations is essential for the sustainability of the ecosystem from a managerial perspective.

The rest of the paper includes the literature review, which provides a background for the concepts of ecosystems, value co-creation, and the conceptual model, the methodology followed, and its findings, the discussion and the conclusion, which includes future research potential.

2. Literature review

2.1 Business ecosystems and value co-creation

Value is co-created more and more in complicated networks, rather than in a single organization (Adner, 2017). Firms partner in so-called business ecosystems, where they each make a contribution, while one single entity does not have to develop all resources and capabilities itself (Cusumano et al. 2020). This is basically the concept of business ecosystems: "an economic community supported by a foundation of interacting organizations and individuals that produces goods and services of value to customers, who are themselves members of the ecosystem." The participants "work co-operatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations" (Moore, 1996).

Recently, interest in business ecosystems has increased, due to some big structural economic changes, concerning mostly regulatory and digital shifts. These changes blur the lines between products and services and enable the collaboration of firms and the development of product-service bundles (Jacobides et al. 2018). Given these changes, organizations are less likely to cater customer needs on their own. And so ecosystems are on the rise.

As technological and several other changes occurred, the organizational operations evolved. The supply chain turned into a value chain and ultimately a value network. The conceptualization of the ecosystem as a new type of value co-creation system, implies that the structure and interdependencies between different business actors has sprung to the forefront of analysis in understanding strategic activities in ecosystem contexts.

As a core part of the ecosystem concept, value co-creation links different kinds of ecosystem participants. It is defined as "the joint, collaborative, concurrent, peer like process of producing new value, both materially and symbolically" (Galvagno and Dalli, 2014). In reality, the value co-creation process initiates once the ecosystem participants agree in mutual terms, sharing their goals for innovation (Ketonen-Oksi and Valkokari, 2019). According to Frow et al (2014), exchange happens because no single entity possesses all the resources needed to operate efficiently on their own, and in order to co-create value, has to join the resource integration process. This is possible even when the stakeholders have conflicting priorities, values and goals.

There are two schools that analyze the concept of value co-creation. The traditional view is referred to as goods-dominant (G-D) logic and is based on the value-in-exchange meaning of value. The service-dominant (S-D) logic, is tied to the value-in-use meaning of value (Vargo and Lusch, 2008). In S-D logic, the roles of producers and consumers are not distinct, meaning that value is always co-created, cooperatively and collectively, in interactions among suppliers and beneficiaries through the integration of resources and application of competences.

2.2 Ecosystem stakeholders' roles and motivations

A key concern in business ecosystems is operations, with a distinct lack of practical frameworks. Actors interact continuously with each other and thus their relationships require certain management, in order to ensure the undistracted value co-creation process. One such conceptual framework is proposed by Bithas et al (2018).

The most important member of an ecosystem is the "keystone", which is essential (Iansiti and Levien, 2004). The keystone is backed by "niche players", which represent the majority of the ecosystem and

produce the most innovations and value. The role of niche players makes them "complementors" who assist the platform leader to expand the boundaries of its operation.

Based on the basic roles, Bithas et al (2018) have proposed a model where roles are described in terms of three sets of attributes; service innovation, collaboration and resilience. The four broader roles are defined according to the axes of this model, which include resource capitalization and value co-creation intensity. According to Bithas et al (2018), these four main roles include:

Role 1 can be performed by a stakeholder aiming at resource acquisition, but without any customization. Due to low co-creation intensity, this stakeholder can engage in value co-creation with other ecosystems as well. This loose collaboration within each ecosystem, makes the participant replaceable. The main goal of Role 2 is acquisition and integration of resources with its own. Although it engages in basic collaboration processes, it is more dependent on other stakeholders, due to its purpose for resource integration. Role 3 refers to a stakeholder that joins an ecosystem for acquiring resources, but without resource integration. Value co-creation intensity is high, meaning that the stakeholder collaborates closely with others. Thus, customization and generated value propositions are high. Role 4 is filled by a stakeholder that aims for resource acquisition and integration. Also, value co-creation intensity is high, meaning that in combination with the resource integration, collaboration with other stakeholders is high.

In order to sustain ecosystem development and understand the engagement with certain roles, it is essential to explore the motivations that drive existing and new stakeholders to join an ecosystem and fill a specific role. The existing literature has analyzed the reasons for stakeholder engagement, but from the strategy and organization aspect. These include an increasing interest for public matters, the possible cost of stakeholders to an organization, and achieving a better performance (Homburg et al. 2013). The identification of stakeholders' motives is essential for the central organization in taking up efficient resource integration processes, which can lead to worthwhile value co-creation. Thus, establishing the connections between stakeholder motivations and resources is fundamental to triggering innovative possibilities. Based on the conceptual model, we connect the stakeholders' motivations to the assigned roles.

3. Methodology

The above depict a summary of developing a systematic literature review in the context of ecosystems research. We deployed this methodology, because, apart from being the most transparent, inclusive and explanatory type of study, several systematic mapping studies have been already conducted, which are considered the ideal bases for a systematic literature review.

Initially the research concerned the broader topic of business ecosystems, their development and several ecosystem types. Then, the study explored the stakeholders' interactions in a business ecosystem and the conflict management among stakeholders during a reconfiguration. On the other end, there is the chosen conceptual framework that analyzes the ecosystem roles (Bithas et al. 2018). Starting from the ecosystem concept, we combine the fields of ecosystem management, as well as stakeholder management in ecosystem networks in order make a key contribution.

3.1 Scoping

- Previous studies: the concepts of business ecosystems, value and stakeholder management in general have been analyzed in previous studies (Galvagno and Dalli, 2014; Rachinger et al. 2019).
- Purpose of the review: the analysis of these concepts from a different perspective and in combination with other ideas and the updating of previous outdated research. This information will be analyzed and combined, in order to overcome the knowledge frontier and lead to the exploration of new ideas.

3.2 Planning

Research questions: Following a systematic mapping study, where the research questions were broader, we now establish a more specific question, so that the contribution to the literature is novel, important and interesting. In order to conclude to the final research question, the CIMO- logic was followed (Denyer and Tranfield 2009). For the ecosystem's sustainable development, the motivations of stakeholders have

to be explored, in the context of the roles that they fill. That said, and in agreement with the CIMO logic, the emerging research question is: *RQ: What is the relationship between a business ecosystem role and a new participant's motivation?*

Formulation of inclusion and exclusion criteria:

Inclusion criteria:

- Books or book chapters on ecosystem stakeholders and value creation or stakeholder management or ecosystem stakeholders' roles.
- Reports describing empirical studies on the research topic.
- Empirical studies with results based on observed and measured phenomena and derived knowledge from actual experience rather than from theory or belief.
- Papers that provide scientific research findings on the research question.
- Time- frame: 2008-2021. The topic of business ecosystem is mostly described after 2008 (Vargo and Lusch, 2008).

Exclusion criteria:

- Studies not available in full text
- Duplicates
- MSc theses
- Studies in languages other than English
- Studies that cover the topic of business ecosystems, definition and governance, but do not concern stakeholders.

3.3 Conducting the search

Search databases: The systematic literature review presupposes a systematic search of literature. In this particular review, the search strategy is sensitive rather than specific, meaning that all relevant papers are included (Nigtingale, 2009).

Steps:

- In order to create the search terms, the research questions are broken down into individual facets (Kitchenham *et al*., 2009).
- A list of synonyms is created.
- Search terms are identified.
- The database GoogleScholar is used.
- A backward and forward searching is performed.
- While performing the search, the publication year is selected as a filter.

Study selection:

- The title and abstract of the identified studies are reviewed and irrelevant papers are rejected.
- Full copies of the papers not previously rejected are obtained. These papers pass again the inclusion-exclusion criteria review. The included articles from this step were 20.
- At this point some modification and additions were made to the search terms, to find more results. 95 more studies were retrieved from this stage.
- The same process was followed and the final number of included studies is 53.

Quality assessment: For the quality assessment, the full texts of studies are carefully examined against the quality criteria, providing an opportunity for a final check on inclusion-exclusion (Xiao and Watson, 2019). All of the studies met the quality criteria. The quality assessment process includes several quality criteria,

which provide a measure of the extent to which a publication would make a valuable contribution to the review (Mikalef *et al*., 2018). The quality criteria are defined as questions:

- Is there a clear statement of research aims?
- Is the research methodology described in the study?
- Is the data collection method described in the study?

In addition to the more general categorization of studies, a quality appraisal tool is also used, according to the type of each study. This additional tool is JBI. JBI is recommended for quality assessment by many authors as an appropriate frequently used tool (Bucheri and Sharifi, 2017; Xiao and Watson, 2019) and because, in comparison to most other appraisal tools, JBI provides a big selection of checklists, depending on the type of study-to-be-assessed, as well as a justification for each question and guidance for the assessment.

Each of the selected studies is categorized according to its type (SLR, report, qualitative study etc.), appraised according to the JBI checklists and finally being categorized again according to the number of positively answered questions.

Data extraction: Extracting data represents a crucial step in the systematic review procedure. In this step, after obtaining the list of papers from the literature search, information is taken from each paper to serve as the raw material for the synthesis step (Okoli, 2015).

The data extracted from each study are: (Kitchenham *et al.,* 2009)

- The source and full reference.
- Classification of the study Type (SLR, Meta-Analysis MA).
- Main topic area.
- The author(s).
- Quality evaluation.

The following data are presented in a table along with the evaluation from the previous step.

4. Findings

The attraction of new organizations by an ecosystem is because of the benefits new participants perceive in collaborating on resource capitalization with other members of the ecosystem. These new members raise novel expectations and offer tools that have not been used in the network before, they are part of the management scheme of the ecosystem, and they must coordinate with the other projects. The ecosystem must be able to scale along multiple dimensions in order to meet these changing requirements and stay successful over time (Amorim et al. 2014).

Here, we analyze each stakeholder's motivation to join a business ecosystem and find the common ground between the motives and the roles' key attributes, by mapping the common points. From the conceptual model, we have picked some key attributes along with the intensity that characterize each role (Bithas et al. 2018) and presented them on table1. Some attributes make a better match, meaning that if the stakeholder is triggered by the certain motivation, it is more likely to engage with a role with the common attributes as the motivation. For simplification and length purposes, we pick the two most contrasting roles, role1 and role4 to analyze against the motivators. However, the same method can be applied to whichever role once chooses to explore.

Table 1: Attribute intensity and roles

Attribute intensity/ Roles	Role 1	Role 4
Collaboration	Low	High
Value co-creation	Low	High
Resource integration	Low	High
Collaboration with other ecosystems	High	Low
Customization	Low	High

First of all, value co-creation and resource capitalization are considered the two primary motivators, as they represent the two axes of the conceptual model, and indeed are key motivations for stakeholders. The rest motivations are considered secondary, but are equally important. The rest of the attributes remain as role characteristics and are not considered motivators.

Primary motivators:

1. Value co-creation: Value co-creation is a primary motivator for a stakeholder to join an ecosystem as through it, the stakeholder expects to gain insights about the marketplace (Bithas, 2020), meet better customer needs, develop new value propositions (Ramaswamy, 2011), build customer commitment and consequently customer contribution to the final product (Dong et al. 2008) and build customer loyalty and trust (Jaworski and Kohli, 2006). Furthermore, value co-creation emits a generally positive feeling to the stakeholders' employees, as well as the customers (Schneider and Bowen, 1995).

2. Resource acquisition: Resource acquisition is another primary motivation with some expected outcomes. First of all, the stakeholder expects material return on invested resources. Another expectation is the involvement in decision making. Furthermore, a stakeholder might want to join an ecosystem in order to make a resource contribution, so as to build innovative value propositions, or to gain access to other stakeholders' resources, in order to gain competitive advantage and of course to ensure its sustainability. Last but not least, when joining an ecosystem, the stakeholder might expect a lower cost for the resource acquisition, as well as shorter time to develop the resources (Bithas, 2020).

Secondary motivators:

1. Reputation enhancement: The ecosystem's positive image is expected to promote the individual identity and personal recognition of each stakeholder, making reputation a motivator for close collaboration (Pera et al. 2016). The findings indicate that the promotion of personal identity might encourage the individual transformation, which in turn requires resource acquisition and integration. Because the stakeholders' image depends on and derives from the ecosystem's positive image, the collaboration with other ecosystems might be low. Since a stakeholder is motivated to collaborate closely with others and co-create value, and since a stakeholder is vulnerable to resource acquisition and integration aiming for individual transformation, while collaborating on a low level with other ecosystems, we conclude that it is more likely to engage with role4, which entails these attributes.

2. Experimentation: Multi-stakeholder co-creation is driven by experimentation motives to develop new products/services within the shared ecosystem, and beyond it. Actors expect to hybridize solutions and tools from other actors and transfer them into their specific ecosystem (Pera et al. 2016). One aspect of this motive is the resource acquisition, where stakeholders acquire new resources as part of the experimentation. In the context of experimentation, collaboration with other ecosystems is open and individual transformation might be a deeper motive. Since a stakeholder is motivated to collaborate with multiple ecosystems, while acquiring new resources, we assume that the most potential role to pursue is role1, which entails these attributes, although individual transformation is not enabled, but as stated it might be a deeper and long-term motivation of the stakeholder.

3. Relationship: Multi-stakeholder co-creation is driven by relationship motives to develop new partnerships and collaborations. The co-creation allows stakeholders to connect to others (Pera et al. 2016). Relationship development might be accompanied by the opportunity of new partnerships, alliances and access into other ecosystems. The more intense the relations, the more likely they are to exchange information, share expectations, and form coalitions. For the same reason, a stakeholder might want to collaborate with other ecosystems as well. Since a stakeholder is motivated to develop a close interaction with others and engage in value co-creation, while at the same time collaborating with other ecosystems, it is possible that it will adopt role4 which entails these attributes.

4. Communication: A multi-centered flow communication enables actors to co-create a shared storytelling and build a shared identity of the ecosystem (Pera et al. 2016), meaning that the collaboration and interaction among stakeholders is high. Shared identity provides a platform for "shared cognition, consensus, and coordination" (Postmes, 2003). In order to build these values, a behavior adjustment and

individual transformation is crucial. In turn, this enables value co-creation, resource acquisition and integration and customization. Since a stakeholder is motivated to engage in close collaboration and value co-creation with others, to acquire and integrate new resources and individually transform, while providing high customization, it is more likely to adopt role4, which entails these attributes.

5. Mapping practices: Multi-stakeholder co-creation is performed through encounter mapping practices, which identify and organize micro-specialized capabilities into complex resource integration (Pera et al. 2016). In this case, resource integration might be faced as a motivation, as well as the individual transformation. The variety of stakeholders, in terms of identities, conflicting values and purposes naturally leads to conflicts. These conflicts may often produce unexpected outcomes. In order to exploit this diversity, value co-creation is enabled so that new value propositions come up. Since a stakeholder is motivated to engage in intense value co-creation and to individually transform, through the resource acquisition and resource integration process, it is more likely to adopt role4 which entails these attributes.

6. Formalized processes: Multi-stakeholder co-creation is enabled by formalized shared processes, managed by dedicated teams, where decision-making is smoothed by a decisions maker. Implementation processes consist of recurrent and formalized touch-points among stakeholders whilst promoting more informal interactions. This could lead to resource integration and individual transformation and discourage collaboration with other ecosystems (Pera et al. 2016). Since a stakeholder is motivated to interact closely with others and proceed to resource integration, but without engaging with other ecosystems and without having a close investment to the said ecosystem, it is likely to adopt role4 which entails these attributes.

7. Individual characteristics: Multi-stakeholder co-creation depends on individual characteristics to build shared value: creativity, flexibility and negotiation. Creativity means finding authentic, efficient solutions and making them real. Flexibility means that co-creation enhances individuals' capacity to confront change and adapt, thus enabling customization. Negotiation occurrs between actors making a joint decision about an issue where there are initial discrepancies in preference (Pera et al. 2016). This in turn implies some kind of close interaction and enables value co-creation. All these values have as a result the stakeholders' individual transformation. Since a stakeholder is motivated to collaborate closely with others and co-create value, while being vulnerable to transformation, as well as providing customization, it is more likely that it engages in role4 which entails these attributes.

8. Standardization: Ecosystem players have their own proprietary solutions. For a broader acceptability, they try to aspire their solution to evolve as de facto standards. Their aspiration toward standardization could go in their favor to capture bigger market share (Kar et al. 2018). Standardization is enabled by access to information which is an aspect of value co-creation (Bithas, 2020). Since a stakeholder is motivated to engage in intense value co-creation with others, it is more possible to engage in role4, which entails this attribute.

9. Social: Stakeholders aim to get products to market with a larger goal of bringing better quality of life to the society (Kar et al. 2018). In order to make a bigger impact, stakeholders have the motive to collaborate closely with each other, to co-create value and to invest more in the ecosystem. Since a stakeholder is motivated to have a high interaction and value co-creation with other stakeholders, it is likely to engage in role4, which entails these attributes.

10. Diversification: Stakeholders pursue diversification, meaning that a business goal is to exploit market potential by developing vertical solutions in various industrial sectors (Kar et al. 2018). In order to expand in other sectors, collaboration with other ecosystems is enabled. Since the stakeholder is motivated to collaborate with other ecosystems, it could engage in any role, but more likely to engage in role1 which entails this attribute.

5. Discussion

This paper begins by highlighting the increasing necessity for organizations to join business ecosystems, due to the current structural changes in the economy. In order for firms to be competitive and survive the rapidly changing market, they need to participate in networks, to offer their clientele unique value

propositions that they would not be able to deliver on their own. A core part of ecosystem operations is value co-creation, where participants exchange diverse resources and capabilities. For the sustainability of this operational model, the exploration of stakeholders' roles and motivations is fundamental. There lies the contribution of this paper to the current operational field of multi-stakeholder ecosystems by outlining the motivations of stakeholders to join the ecosystem and by identifying the links between each motivation and the roles that stakeholders fill when joining such a network.

The findings suggest that resource capitalization and value co-creation are the main motives that drive stakeholders into joining a business ecosystem. Furthermore, each of the rest motivators drive stakeholders into filling a certain role, depending on the intensity of value co-creation, collaboration, customization, collaboration with other ecosystems and resource integration processes. All of these parameters are combined on the purposes of the participant or the motivator.

If we would like to set this framework in a real ecosystem, a market that offers great potential is the personal luxury goods industry. This market is particularly interesting as it is a traditional sector, with a huge economic power and some luxury conglomerates that rule the majority of the industry. A case in point is Farfetch, a multi-brand online store, which in essence represents an ecosystem, as it includes players from different fields, each offering different capabilities and resources. Farfetch deploys a range of players such as the Restory, many luxury brands, Snapchat and influencers. These players represent certain roles, as depicted in table 2: the Restory, which repairs damaged goods, could have joined Farfetch triggered by its motivation for experimentation in new garments, as Farfetch offers a wide range of products concerning not only the type but the range category as well, including clothing and accessories and at the same time sports brands and high luxury. Another motive is diversification, as the Restory has the opportunity to expand in another field. Led by its motives for experimentation and diversification, the Restory proceeds to resource acquisition and is enabled to collaborate with other ecosystems, in order to achieve its goals and as a result, it could fill role1. Luxury brands on the other hand represent role4, driven by their potential motive for reputation enhancement as they join the most well-known luxury online shop, or by their urgent need for the digital competencies of the most tech-savvy app. This way, they develop new capabilities and individual characteristics. In order to achieve the positive image and the integration of new competencies, luxury brands participate in intense value co-creation with Farfetch, to gain the full potential of the ecosystem's benefits. Snapchat deploys a range of AR (Augmented Reality) tools, which Farfetch takes advantage on. Snapchat on the other end exploits the benefit of Farfetch, by adding shopping features. Led by its motivations for standardization for its AR tools, diversification to the field of luxury shopping and experimentation regarding its introduction of high technology features to a new audience, Snapchat joins the Farfetch ecosystem filling role1. Influencers, including Instagram and YouTube stars, join the Farfetch ecosystem seeking reputation enhancement by the best-selling platform, as well as relationship building, which might lead to new partnerships and collaborations. Thus influencers fill role4 which aligns with their leading motivations. All of the mentioned Farfetch ecosystem participants are primarily motivated by value co-creation and resource acquisition, in order to build customer commitment, build new value propositions, gain insights to a different market and ensure sustainability

Table 2: The Farfetch example

Farfetch ecosystem	Motivations	Roles	Role filling
The Restory	Experimentation	Role 1	ROLE1
	Diversification	Role 1	
Luxury brands	Reputation	Role 4	ROLE4
	Individual characteristics	Role 4	
Snapchat	Standardization	Role 4	ROLE1
	Diversification	Role 1	
	Experimentation	Role 1	
Influencers	Reputation enhancement	Role 4	ROLE4
	Relationships	Role 4	

6. Conclusions and further research

The contribution of this analysis aims at the optimization of the operation, as well as providing an assistance on the sustainability of the ecosystem by using the ecosystem roles, as motivations for attracting new stakeholders.

Until today the roles that actors engage in were explored, without considering the reasons for the engagement with certain roles. This paper fills this step and provides potential for future research. An extension of the current study could explore the stakeholders' relationships after they have adopted specific roles and driven by specific motivations. More specifically, the potential reconfiguration of ecosystems or the reconfiguration of motivations could be explored. From this emerges another key issue: what if the motivations change at the same time or in combination with a change in configurations.

The exploration of stakeholders' motivations and roles in such an organization provide some interesting insight on how a certain industry works, like the luxury industry, and would probably raise more questions to be answered on the concept of business ecosystems.

References

Adner, R. (2017) "Ecosystem as Structure: An Actionable Construct for Strategy", *Journal of Management,* Vol 4.

Amorim, S., Almeida, E.S. and McGregor, J. (2014) "Scalability of Ecosystem Architectures", *IEEE/IFIP Conference on Software Architecture.*

Bithas, G. (2020) A new business transformation model for service ecosystems. *Phd thesis,* Business school, University of the Aegean.

Bithas, G., Kutsikos, K., Warr, A. and Sakas, D. (2018) "Managing Transformation within Service Systems Networks: A System Viability Approach", *Systems Research and Behavioral Science Systems Research,* Vol 35, pp 469–484.

Buccheri, R.K. and Sharifi, C. (2017) "Critical Appraisal Tools and Reporting, Guidelines for Evidence-Based Practice", *Worldviews on Evidence-Based Nursing*, Vol 14, No.6, pp 463-472.

Cusumano, M. A., Yoffie, D. B., and Gawer, A. (2020) *The Future of Platforms*, MIT Sloan Management Review.

Denyer, D. and Tranfield, D. (2009) "Producing a systematic review". In Buchanan, D. and Bryman, A. (Eds), *The Sage Handbook of Organizational Research Methods* (pp.671-689). Sage Publications, London.

Dong, B., Evans, K. and Zou, S. (2008) "The effects of customer participation in co-created service recovery", *Journal of the Academy of marketing science,* Vol 36, No.1, pp 123-137.

Frow, P., McColl-Kennedy, J. R., Hilton, T., Davidson, A., Payne, A., and Brozovic, D. (2014) "Value propositions: A service ecosystems perspective", *Marketing Theory,* Vol 14, No.3, pp 327–351.

Galvagno, M. and Dalli, D. (2014) "Theory of Value Co-Creation: A Systematic Literature Review", *Managing Service Quality,* Vol 24, pp 643-683.

Homburg, C., Stierl, M., and Bornemann, T. (2013) "Corporate social responsibility in business-to-business markets: How organizational customers account for supplier corporate social responsibility engagement", *Journal of Marketing,* Vol 77, pp 54–72.

Iansiti, M. and Levien, R. (2004) "Strategy as ecology", *Harvard Business Review,* Vol 82, No.3, pp 68-78.

Jacobides, M. G., Cennamo, C., and Gawer, A. (2018) "Towards a theory of ecosystems", *Strategic Management Journal,* Vol 39, No.8, pp 2255–2276.

Järvi, K., and Kortelainen, S. (2017) "Taking Stock of Empirical Research on Business Ecosystems: A Literature Review", *International Journal of Business and Systems Research,* Vol 11, No.3, pp 215–228.

Jaworski, B. and Kohli, A.K. (2006) "Co-creating the voice of the customer". In Lusch, R.F. and Vargo, S.L. (Eds.), *The service- dominant logic of marketing: Dialog, debate and directions* (pp.109-117). Prentice Hall, Delhi.

Kar, S., Chakravorty, B., Sinha, S. and Gupta, M.P. (2018) "Analysis of Stakeholders within IoT ecosystem". In Kar, A. et al. (eds.), *Digital India, Advances in Theory and Practice of Emerging Markets*. Springer International Publishing AG, part of Springer Nature.

Ketonen-Oksi, S. and Valkokari, A. (2019) "Innovation Ecosystems as Structures for Value Co-Creation", *Technology Innovation Management Review,* Vol 9, No.2.

Kitchenham, B., Brereton, O.P., Budgen, D., Turner, M., Bailey, J. and Linkman, S. (2009) "Systematic literature reviews in Software engineering- A systematic literature review", *Information and software technology,* Vol 51, pp 7-15.

Ma, L.L., Wang, Y.Y., Yang, Z.H., Huang, D., Weng, H. and Zeng, X.T. (2020) "Methodological quality (risk of bias) assessment tools for primary and secondary medical studies: what are they and which is better?", *Military Medical research,* Vol 7, No.7.

Mikalef, P., Pappas, I.O., Krogstie, J. and Giannakos, M. (2018) "Big data analytics capabilities: a systematic literature review and research agenda*", Information Systems E-Business Management*, Vol 16, pp 547-578.

Moore, J. (1996) "The Death of Competition. Leadership & Strategy in the Age of Business Ecosystems", *HarperCollins.*

Nightingale, A. (2009) "A guide to systematic literature reviews", *Surgery*, Vol 27 No.9.

Pera, R., Occhiocupo, N. and Clarke, J. (2016) "Motives and resources for value co-creation in a multi-stakeholder ecosystem: A managerial perspective", *Journal of business research,* Vol 69, pp 4033-4041.

Postmes, T. (2003) "A social identity approach to communication in organizations". In Haslam S.A., Knippenberg D., M., Platow, J. and Ellemers N. (Eds.), *Social identity at work: Developing theory for organizational practice* (pp. 81-97) .Psychology Press, Philadelphia, PA.

Rachinger, M., Rauter, R., Muller, C., Vorraber, W. and Schirgi, E. (2019) "Digitalization and its influence on business model innovation", *Journal of Manufacturing Technology Management,* Vol 30, No.8, pp 1143-1160.

Ramaswamy, V. (2011) "It's about human experiences…and beyond, to co-creation", *Industrial marketing management,* Vol 40, pp 195-196.

Schneider, B. and Bowen, D.E. (1995) *Winning the service game*, Harvard business press.

Song, A. (2019) "The digital entrepreneurial ecosystem- a critique and reconfiguration" *Small business economies,* Vol 53, pp 569-590.

Valkokari, K., Seppänen, M., Mäntylä, M., and Jylhä-Ollila, S. (2017) "Orchestrating Innovation Ecosystems: A Qualitative Analysis of Ecosystem Positioning Strategies", *Technology Innovation Management Review,* Vol 7, No.3, pp 12–24.

Vargo, S. L. and Lusch, R. F. (2008) "Service-dominant logic: Continuing the evolution", *Journal of the Academy of Marketing Science,* Vol 36, No.1, pp 1-10.

Xiao, Y. and Watson, M. (2019) "Guidance on conducting a systematic literature review", *Journal of planning education and research,* Vol 39, No.1, pp 93-112.

Strategic Alliances, Innovation Capability, Cost Reduction, Customer Loyalty and Competitive Advantage in B2B Alliances

Soebowo Musa
Swiss German University, Graduate School of Business, Tangerang, Indonesia
soebowomusa@gmail.com

Abstract: Disruptive business environment such as the Covid-19 pandemic and the recent high volatility in commodity prices has changed the way businesses were conducted. The heavy equipment industry is one of many industries affected by such an environment, especially those who are related to the mining industry where the volatility of the commodity prices has a significant impact on their business performance. Alliances are commonly formed by heavy equipment distributors and their customers to create a mutual benefit to sustain their performance. Strategic alliances have attracted substantial attention from industry as well as academia as a way to stay competitive. They mostly focus on the partner-to-partner alliances in serving their customers. Consumer behaviour has changed due to changes in the environment that make firms' strategic focus more on human-centric business approaches. This study looks at the roles of the partner-to-customer alliances, innovation capability, and cost reduction toward customer loyalty and competitive advantage. Data was collected from 335 respondents from the firms that have entered into alliances. This study finds strategic alliances have the highest association with cost reduction, followed by their association with innovation capability. They enhance customer loyalty through innovation capability. Cost reduction is not a lever to develop customer loyalty in the partner-to-customer relationship. The study also confirms that operational efficiencies are necessarily the source of competitive advantage, but strategic alliances are.

Keywords: strategic alliances, innovation capability, cost reduction, customer loyalty, competitive advantage

1. Introduction

The strategic business environment has changed rapidly due to the digital transformation and disruptive innovation in many industrial sectors resulting in the saturation of existing markets and the emergence of new markets in various business sectors (Foroohar, 2018). Digital transformation and the Covid-19 pandemic have changed the landscape of the competitive dynamics for many firms. One of the challenges in digital transformation is that firms need to enhance their collaboration to tap into the digital ecosystem, access resources and skills, and have an effective customer retention strategy. Strategic alliances have become a strategy that attracts scholars as well as business practitioners as a way to sustain competitiveness. Strategic alliances help firms to be competitive through various means, such as enhancing market shares, increasing operational efficiencies, and tapping into new resources or capabilities (Rothaermel & Boeker, 2008).

Green & McCann (2020) indicated strategic alliances bring benefits to firms through sharing resources and expertise, strengthening new market penetration, expanding production capabilities, and building innovation. Strategic alliances are also believed to have a positive effect on the operational efficiencies of firms. Scholars have identified the benefits of strategic alliances in developing a sustainable competitive advantage through better operational efficiencies and enhancing organizational capabilities such as innovation capability (Mowla, 2012; Schweitzer, 2014). Gomes et al., (2016) stated one of the motives for firms entering strategic alliances is access to and transfer of knowledge in building innovation capability. The drivers for entering into strategic alliances are efficiency motives, and competitive motives by securing market power such as sustaining customer loyalty. However, there were also research findings that stated that strategic alliances harm the development of innovation capability due to difficulties in managing unstable characteristics of strategic alliances (Spekman et al., 1996; Wittman, 2007). Strategic alliances are known to enhance such efficiencies (cost reduction) through collaborated efforts in technologies and information exchange between firms. However, other research findings showed that strategic alliances create an unpredictable new cost to the firms putting downward pressure on the operational efficiencies (Das & Rahman, 2010). Kottas & Madas (2018) indicated no evidence of a positive impact of strategic alliances on operational efficiencies. These studies on strategic alliances show that the impact of strategic alliances on organizational outcomes and competitive advantage remains unclear. Under the current condition of digital disruption and transformation, where competitive advantage is becoming rare or shorter, the effectiveness of strategic alliances in creating competitive advantage remains yet to be examined. He et al., (2020) indicated there is a lack of studies focusing on the possible shift in the role of strategic alliances towards firms' outcomes due to the rapid change in the environment and the digital transformation.

Many studies have examined strategic alliances from the perspective of partner-to-partner alliances, but less from the perspective of partner-to-customer alliances (McSweeney-Feld et al., 2010). The study of strategic alliances on partner-to-customer is important because there are differences in the objectives, governance, and structure. Further examination of the relationship between strategic alliances and customer loyalty in the context of partner-to-customer alliances merits consideration. It is also important to examine the impacts of strategic alliances on the organizational outcomes from the perspective of efficiencies and competitive motives concerning customer loyalty as a lever for firm performance, and innovation capability. This study will examine the roles of strategic alliances, innovation capability, and cost reduction toward customer loyalty and competitive advantage in the partner-to-customer alliances. The heavy equipment industry will be the context of this research. The customers were represented by the 35 mining contractors/ companies; while partners were represented by the top 5 heavy equipment distributors whom they have a partnership with. Considering the high volatility and turbulent conditions in the heavy equipment industry, this study expects to provide insight into whether or not the role of strategic alliances has shifted.

2. Theoretical framework and hypotheses

Strategic alliances (SA) are defined as a purposive relationship among firms that stay legally independent to achieve specific common targets, sharing benefits between partners that involve cooperation, resources sharing, knowledge transfer, and improvement of competencies and capabilities (Talebi et al., 2017). Jiang et al. (2016) stated that SA offers an interesting opportunity for learning and knowledge sharing from partners; whereas, Vaidya (2011) indicated that SA potentially gives a cost advantage and reduces potential uncertain risk through cost reduction methods between partners, such as creating a new product, operating new management technique, and implementing new technology to sustain competitive advantage. SA would improve collective capabilities and produce various new ideas and knowledge as the foundation of innovation. On the behavioural aspects of SA, Lin (2013) argues that long-term relationships based on understanding between partners in SA would be based on mutual trust and commitment. Strategic alliance plays an important role in enhancing a partner's loyalty due to coordination, deal, commitment, trust, and interdependency between partners.

Innovation Capability (IC) is defined as the capability to potentially produce or adopt innovations by using internal abilities to allow an organization to have a continuous transformation to have value creation (Weber & Heidenreich, 2018). A firm's activities may involve a process of building innovation capabilities like internal and external R&D, usage of new equipment, technology, improvement process, maximizing external advisory, innovation training, and other activities related to the development of process improvement. IC is one of the firm's capabilities that can generate new knowledge and methods that enhance the firm's competitive advantage. IC was also believed to create better service quality given to customers through products and services evidenced by higher customer retention, and also to yield greater growth and profit for a firm through the operational efficiencies from such IC (Raghuvanshi et al., 2019; Sudolska & Lapinska, 2020). Lam et al., (2021) highlighted strong IC provides firms with the ability to enable employees to convert knowledge into new intellectual assets that could be used to improve existing products, services, processes, technology, and administrative systems, which could provide a secure long-term survival and sustainable development of the firms. Knowledge transfer has a significant relationship with developing the organizational IC. Sun et al., (2021) found SA enhances knowledge sharing between partners, thereby improving IC. Hence, the following hypothesis was made:

> ***Hypothesis 1:*** *There is a positive relationship between strategic alliances and innovation capability.*

Cost Reduction (CR) is defined as the process to find out and eliminate waste in a business process to increase profit without negatively impacting the quality of products or services (Yadav et al., 2013). CR can be achieved through running current activities more cheaply by optimizing internal resources or restructuring the business process. Transaction cost theory explains why some firms may be more efficient in governing their economic activities. Such transaction costs arise from the process of a transaction between two parties in the market, and these transaction costs can be reduced through activity outside the market (Williamson, 1975). It is not only concerned with how a firm manages its transaction costs in its business activities, but also how such transaction costs depend on the types of exchange activities between two parties in alliances. Chen & Chen (2003) highlighted the objective of SA is to have a better resource alignment and sharing between partners in leveraging their ability to appropriate the benefits out of the alliances. SA is expected to provide a cost

advantage and mitigate uncertain risk by developing new products, operating new management processes, and applying new technology. Based on such synthesis, the following hypothesis was developed:

Hypothesis 2: *There is a positive relationship between strategic alliances and cost reduction.*

Customer Loyalty (CL) is defined as a deeply held commitment to re-purchase a selected product continuously in the future and produce repetition on the same brand, despite situational influence or marketing efforts that potentially may cause switching behaviour (Oliver, 1999). CL leads to commitment to doing business with the same partner for a long period and becomes a state of mind, a set of attitudes, trust, and appetite. Loyalty can be defined from two dimensions which are attitudinal and behavioural loyalty (Dick & Basu, 1994). Attitudinal loyalty defines customer connection to products, services, brands, or firms, tolerance of price, and intention to purchase. Strong positive attitudinal loyalty results in a protective process toward CL irrespective of the competition, where customers would stick to the existing product and services and deny competitive offers although the competitor's product and services are fairly better. Behavioural loyalty requires repetitive purchases that came from buying orientation involving readiness to accept benefits from a specific entity. Shoemaker & Lewis (1999) indicated an organization needs to pay attention to three functions for building CL - process, communication, and value creation functions. The process function takes into account all activities from both the customer and the service provider's perspectives to have a better business process for both partners. The communication function focuses on how the service provider communicates with its customers to keep track of the customers' favour, needs and preferences resulting in better customer satisfaction that creates CL. It facilitates knowledge transfer between the partners fostering IC. Finally, the value creation function addresses value-added strategies focusing on the long-term relationship between the partners; and value-recovery strategies focusing on the delivery of the services for the relationship between the partners. The objective of value creation is to enhance the perceptions of the customers on the rewards and costs associated with the service transactions provided by the service provider. It infers that value creation enhances operational efficiencies on the part of the customers, which in turn it creates CL. SA facilitates the connectivity across complementary abilities for both partners in the alliances to create new market values without hampering each partner out of its existing competencies. Such connectivity strengthens the partners' relationship resulting in better collaboration where one firm compensates for the other firm's weaknesses. Such collaboration strengthens the loyalty among the partners. Based on the above synthesis, this study advances the following hypotheses:

Hypothesis 3: *There is a positive relationship between strategic alliances and customer loyalty.*

Hypothesis 4: *There is a positive relationship between cost reduction and customer loyalty.*

Hypothesis 5: *There is a positive relationship between innovation capability and customer loyalty.*

Competitive Advantage (CA) is defined by Barney (1991, p. 102) as a "value-creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy". CA involves the selection of organization resources like organization processes, information, knowledge, and capabilities and the utilization of such resources to create the 'value-creating strategy'. Firms enter SA to obtain the resources needed to enhance and sustain CA. The choice of these resources among other organizational capabilities would determine the sustainability of an organization's CA, where such CA could be fostered through IC (Freije et al., 2021). Hussein et al., (2018) found CL plays a key strategic business in creating sustainable performance. Zhang et al., (2018) indicated CR creates financial efficiency that could be the source of CA. Based on such synthesis, this study advances the following hypotheses:

Hypothesis 6: *There is a positive relationship between strategic alliances and competitive advantage.*

Hypothesis 7: *There is a positive relationship between cost reduction and competitive advantage.*

Hypothesis 8: *There is a positive relationship between innovation capability and competitive advantage.*

Hypothesis 9: *There is a positive relationship between customer loyalty and competitive advantage.*

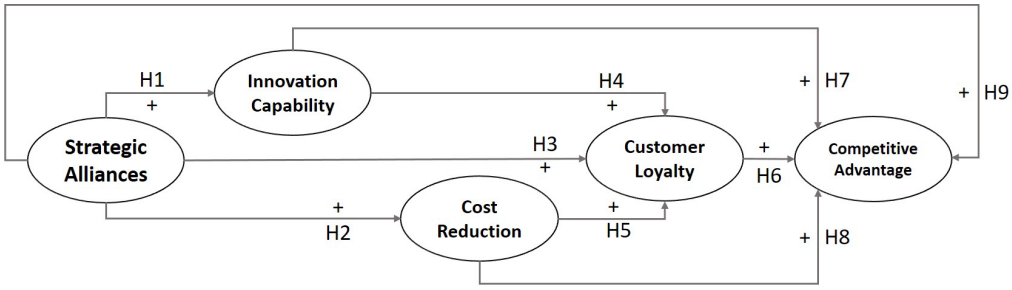


Figure 1: illustrates the proposed research model in this study

3. Data and methods

3.1 Sample and data collection

This study collected data from a sample based on the two attributes of the firms in the heavy equipment industry - (i) the firms' main business is in the contracting business for the mining industry; and (ii) the firms have engaged in the SA. The data collection was done from December 2021-February 2022 through online self-administered questionnaires distributed to respondents at middle-to-top level positions. The final data comprised 335 usable answers (a response rate of 73%) from employees at the middle level up from 35 firms who have full knowledge of the partnership and day-to-day interaction with their partner's employees. Data analysis was performed using SEM Lisrel 8.8 to test construct validity, reliability, and the goodness of fit indices and the SPSS program was used for the descriptive statistics.

3.2 Measures

All measurements in this study were adapted from the validated and existing measurements used in previous studies and were measured on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree) for SA, IC, CL, CA, and CR. We conducted Brislin's back-translation into the Indonesian language to ensure the face validity of the survey in Indonesian. A pilot test was conducted based on 25 respondents from targeted firms to assess the face validity of Brislin's back-translation. We performed an outlier test on the data collected. A focus group discussion was then conducted to further refine the wording of the outlier items to make them easy to understand by the respondents. The final questionnaires were then distributed to the targeted respondents.

3.2.1 Independent variables

Strategic alliances are measured with 14 items across the five dimensions of SA, namely trust (SAA) with 2 items, commitment (SAB) with 4 items, communication (SAC) with 3 items, cooperation (SAD) with 3 items, and joint problem-solving (SAE) with 2 items. The SA measurement was adapted from Kwok & Hampson (1996). Sample items for SAA include: "We share commercial and technical information related to projects without the need to protect ourselves"; for SAB: "We actively build trust"; for SAC: "We communicate regularly to compare current performance against expectations"; for SAD: "We co-operate to share risks"; and for SAE: "We feel free to admit and discuss difficulties eve they relate to uncomfortable issues" *Innovation capability* is measured with 6 items. The IC measurement was adapted from Lin (2007). Sample items for IC include: "Our firm looks for new ways of doing things". *Cost reduction* is measured with 5 items. The CR measurement was adapted from Essuman et al. (2020). Sample items for CR include: "Overhead costs incurred by our firm have been very efficient" *Customer loyalty* is measured with 5 items across the two dimensions of CL, namely attitudinal loyalty (CLA) with 2 items, and behavioural loyalty (CLB) with 3 items. The CL measurement was adapted from Lenninkumar (2017). Sample items for CLA include: "We consider our strategic alliance partner as the first choice to buy heavy equipment units and services.", and for CLA: "We say positive things about our strategic alliance partner to other people".

3.2.2 Dependent variables

Competitive advantage – CA is measured with 7 items. The CA measurement was adapted from Fainshmidt et al., (2019). Sample items for CA include: "The firm has better managerial capability than the competitors".

3.2.3 Control variables

This study employs the 4 firm attributes such as size, firm age, the respondent's position and length in strategic alliance with their partner as control variables that might affect the independent variables and the dependent variable.

3.3 Data analysis

The descriptive statistics shown in Table 4.1 were done through SPSS version 25, while the hypotheses testing was done using Lisrel 8.8 SEM with the maximum likelihood estimation method. The measurement model analysis was done to assess the composite reliability (CPR) and validity of the constructs and the average variance extracted (AVE) of each construct. For constructs that have dimensions, we used a higher-order model as prescribed by Crede & Harms (2015).

4. Results

4.1 Descriptive statistics and correlations

All correlations among the constructs in this study are less than 0.60. Therefore, multicollinearity does not pose a threat to the analysis. The variance inflation factor (VIF) analysis (all VIFs ≤ 2.5, Tolerance ≥ 0.20) on the independent variables also suggests the absence of multicollinearity. Table 1 shows the descriptive statistics and correlations among the constructs used in the study.

Table 1: The descriptive statistics and correlations among the constructs used in the study

Descriptive Statistics & Correlations										
No	Variable	Mean	S.D.	Min	Max	1	2	3	4	5
1	SA	6.842	0.285	6.666	6.875	1.000				
2	IC	6.816	0.321	6.669	6.827	0.529**	1.000			
3	CR	6.766	0.380	6.709	6.773	0.419**	0.555**	1.000		
4	CL	6.861	0.283	6.803	6.890	0.478**	0.410**	0.454**	1.000	
5	CA	6.851	0.245	6.699	6.940	0.149**	0.043	0.141**	0.113*	1.000
*** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed); N=335*										

4.2 Measurement model analysis

All standardized loadings were above 0.30 except for the CA construct, and AVEs for the single-factor model were below the recommended threshold of 0.50. Discriminant validity analysis showed that the SQRT (AVE) of the respective constructs were greater than the inter-correlation coefficients suggesting a good validity. All CPRs and Cronbach's alphas were well above the cut-off point of 0.70 (Fornell & Lacker, 1981) indicating good reliability measures, except for the marginally acceptable CA. The model fit indices showed χ2/dfs below the cut-off point of 5.0, RMSEAs below the cut-off point of 0.06, and SRMRs below the cut-off point of ≤ 0.08. GFIs, NNFIs, CFIs, and IFIs are all above the cut-off point of 0.90 (Hu & Bentler, 1999). The results of model fit indices suggest a good fit of the measures. Table 2 shows the results of the measurement model analysis.

Table 2: The results of the measurement model analysis.

Measurement Model Analysis							
	Single Factor Model			**Higher-Order Model**			
Construct/Variable	**Standardized Loadings**	**CPR**	**AVE**	**Standardized Loadings**	**CPR**	**AVE**	**Cronbach's Alpha**
SA	0.36-0.65	0.85	0.30	0.65-1.00	0.93	0.76	0.85
	Ave: 0.54			Ave: 0.87			
IC	0.50-0.69	0.78	0.37	-	-	-	0.79
	Ave: 0.61			-			
CR	0.57-0.71	0.80	0.44	-	-	-	0.80
	Ave: 0.66			-			
CL	0.52-0.68	0.73	0.35	0.99-1.00	0.99	0.99	0.73
	Ave: 0.59			Ave: 0.99			
CA	0.20-0.59	0.62	0.20	-	-	-	0.60
	Ave: 0.43			-			

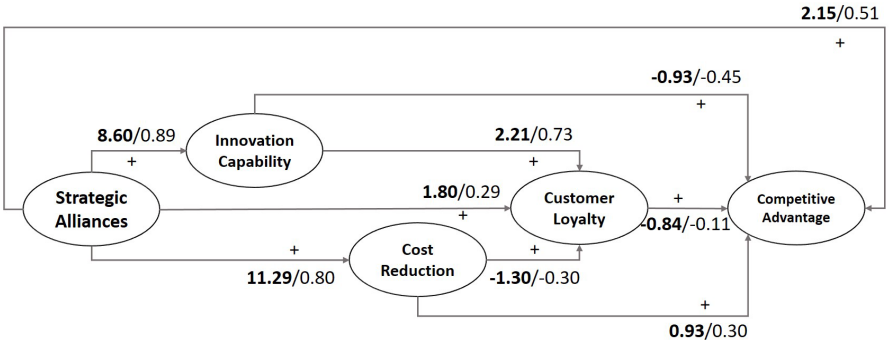
Measurement Model Analysis										
	Single Factor Model				Higher-Order Model					
Model Fit Indices										
	Single Factor Model					Higher-Order Model				
Construct/Variable	**SA**	**IC**	**CR**	**CL**	**CA**	**SA**	**IC**	**CR**	**CL**	**CA**
χ^2	107.99	8.60	0.00	0.40	17.14	2.94	-	-	0.00	-
df	62.00	7.00	0.00	2.00	13.00	2.00	-	-	0.00	-
χ^2/df	1.74	1.23	0.00	0.20	1.32	0.47	-	-	0.00	-
ρ-value	0.0003	0.283	1.00	0.820	0.193	0.231	-	-	1.00	-
RMSEA	0.047	0.026	0.000	0.000	0.031	0.037	-	-	0.000	-
SRMR	0.04	0.021	0.000	0.006	0.035	0.006	-	-	0.000	-
GFI	0.96	0.99	1.00	1.00	0.99	1.00	-	-	1.00	-
NNFI/TLI	0.97	1.00	1.00	1.00	0.98	1.00	-	-	1.00	-
CFI	0.98	1.00	1.00	1.00	0.98	1.00	-	-	1.00	-
IFI	0.98	1.00	1.00	1.00	0.99	1.00	-	-	1.00	-

4.3 Structural model analysis

The results of the hypotheses testing are presented in Table 3. The supported hypotheses have t-values ranging from 2.15 to 11.29. The overall model has χ2/df=1.23, ρ-value = 0.0158, RMSEA=0.026, SRMR=0.034, GFI=0.94, NNFI=0.99, CFI=1.00, and IFI=1.00 suggesting that the structural model of the study and the data is statistically good fit. Figure 2 illustrates the hypotheses testing results.

Table 3: Illustrates the hypotheses testing result

Hypotheses Testing Results				
No	**Hypotheses**	**t-value**	**S. Coeff.**	**Results**
1	**H1:** There is a positive relationship between strategic alliances and innovation capability.	8.60	0.89	Supported
2	**H2:** There is a positive relationship between strategic alliances and cost reduction.	11.29	0.80	Supported
3	**H3:** There is a positive relationship between strategic alliances and customer loyalty.	1.80	0.29	Not Supported
4	**H4:** There is a positive relationship between cost reduction and customer loyalty.	-1.30	-0.30	Not Supported
5	**H5:** There is a positive relationship between innovation capability and customer loyalty.	2.21	0.73	Supported
6	**H6:** There is a positive relationship between strategic alliances and competitive advantage.	2.15	0.51	Supported
7	**H7:** There is a positive relationship between cost reduction and competitive advantage.	0.93	0.30	Not Supported
8	**H8:** There is a positive relationship between innovation capability and competitive advantage.	-0.93	-0.45	Not Supported
9	**H9:** There is a positive relationship between customer loyalty and competitive advantage.	-0.84	-0.11	Not Supported



t-value/structural coefficient: Chi-Square=246.46, df=201, ρ-value=0.01584, RMSEA=0.026

Figure 2: Hypotheses testing results

5. Discussion

This study examines the roles of SA, IC, and CR towards CL and CA in the partner-to-customer alliances. The study found associations between SA and IC, CR, and CA, where SA has the greatest association with a t-value of 11.29 with CR compared to IC with a t-value of 8.60, and CA with a t-value of 2.15. The study showed IC has an association with CL with a t-value of 2.21. Such finding infers for partner-to-customer alliances, the key driver in developing CL comes from IC. The study confirms partners' commitment to SA would be perceived as highly substantial when the existence of non-financial contributions present like human resources and technical know-how that could enhance their capabilities. Such commitment is the key driver in establishing CL. No direct associations between SA to CL, and CR to CL because the relationships are fully mediated through IC. During a disruptive environment, customers value more the partner's ability to enhance their capabilities in dealing with challenges rather than merely on cost reduction to create CL. The high association between SA and CR can be explained by the transaction costs theory whereby firms enter into alliances to have resource exchange or sharing that improves their operational efficiencies (Gorovaia & Windsperger, 2018). From the perspective of resource-based view theory, the study confirms SA capitalizes on the strategic implications through the development of organizational capabilities evidenced by a positive relationship with CA. The study found no associations between CR to CA, and IC to CA because of the direct relationship between SA and CA. Furthermore, the study confirms Porter's (1996) view stating that operational efficiency is not a sufficient condition to create CA, particularly in a rapid change of business environment.

Our study enriches the literature on several issues. First, the study clarifies the role of SA in the partner-to-customer relationship showing high association in creating operational efficiencies for the customers. The study also shows operational efficiencies created in partner-to-customer alliances are not necessarily creating CL. From the resource-based view perspective, SA has an indirect relationship with CL mediated by IC. The study also shows that operational efficiencies are not the source of CA, while SA can directly foster CA. Furthermore, our study provides some important implications for partner-to-customer alliances. First, the key success factor in creating CL through SA is by fostering IC. Second, CR is an important outcome for SA, to achieve operational efficiencies. However, CR will not create loyalty or CA. The high t-value between SA and CR indicates the creation of operational efficiencies could be the short-term objective in SA while developing organizational capabilities could be the long-term objective of SA. Finally, the study indicates that developing CA in the partner-to-customer alliances is more driven directly by how SA is structured to enhance CA.

6. Conclusion

This study provides insights on the importance of the strategic alliance between partner-to-customers to enhance innovation capability and competitive advantage for the customers to create customer loyalty. Moreover, the study indicates that operational efficiency in the form of cost reduction is not a sufficient condition to create customer loyalty and competitive advantage, particularly in a rapid change in a business environment. This study has several limitations. First, the data was based on cross-sectional data. Hence, the results of the study may not be able to highlight the causality among the constructs before, during and/or after the Covid-19 pandemic. Future research could explore the research using the same research model longitudinal research. Second, the study only covered the firms in heavy equipment that have entered into partner-to-customer alliances with a distributor of heavy equipment. Therefore, the data collected from these firms may not represent other SA in different industries. Future research merits consideration to examine more diverse industries. Last, this study was conducted in Indonesia, the findings of the study may be affected by the country's demographic. Hence, future research could explore multi countries' studies.

References

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99-120.

Chen, H., & Chen, T-J, (2003). Governance structure in strategic alliances: transaction cost versus resource-based perspectives. *Journal of World Business,* Volume 38, pp. 1-14.

Crede, M., & Harms, P. D. (2015). 25years of higher-order confirmatory factor analysis in the organizational sciences: A critical review and development of reporting recommendations. *Journal of Organizational Behavior*, 36, 845-872.

Das, T., & Rahman, N. (2010). Determinants of Partner Opportunism in Strategic Alliances: A Conceptual Framework. *Journal of Business & Psychology*, 25, 55-74.

Dick, A. S., & Basu, K. (1994). Customer Loyalty: Toward an Integrated Conceptual Framework. *Journal of the Academy of Marketing Science, 22(3), 99-13*3.

Essuman, D., Boso, N., & Annan, J. (2020). Operational Resilience, Disruption, and Efficiency: Conceptual and Empirical Analysis Dominic. *International Journal of Production Economics*.

Fainshmidt, S., Wenger, L., Pezeshkan, A., & Mallon, M. R. (2019). When do Dynamic Capabilities Lead to Competitive Advantage? The Importance of Strategic Fit. *Journal of Management Studies*, 758-787.

Foroohar, R., (2018). Corporate elites are overlooking deglobalization. *Financial Times*, 15 October.

Freije, I., de la Calle, A., & Ugarte, J. V., (2021). Role of supply chain integration in the product innovation capability of servitized manufacturing company. *Technovation*, pp. 1-14.

Gomes, E., Barnes, B.R., & Mahmood, T., (2016). A 22-year review of strategic alliance research in the leading management journal. *International Business Review*, pp. 1-13.

Gorovaia, N., & Windsperger, J., (2018). The choice of contract duration in franchising networks: A transaction cost and resource-based view. *Industrial Marketing Management*, pp. 1-9.

Green, D. D. & McCann, J. (2020). The Coronavirus Effect: Building Strategic Alliances in Today's Universities and Colleges. *Management and Economics Research Journal*.

He, Q., Meadows, M., Angwin, D., Gomes, E. and Child, J, (2020). Strategic alliance research in the era of digital transformation: Perspectives on future research. *British Journal of Management*, Volume 31, pp. 589-617.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling*, 6, 1-55.

Hussein, A., Hapsari, R., & Yulianti, I. (2018). Experience quality and hotel boutique customer loyalty: Mediating role of hotel image and perceived value. *Journal of Quality Assurance in Hospitality and Tourism*, 19(4), pp. 442-459.

Jiang, X., Bao, Y. C., Xie, Y., & Gao, S. (2016). Partner trustworthiness, knowledge flow in strategic alliances, and firm competitiveness: A contingency perspective. *Journal of Business Research*, 69(2), 804-814.

Kottas, A.T., & Madas, M.A. (2018). Comparative efficiency analysis of major international airlines using Data Envelopment Analysis: Exploring effects of alliance membership and other operational efficiency determinants. *Journal of Air Transport Management*, 70, 1-17.

Kwok, T. L., & Hampson, K. D. (14-15 July 1996). Strategic Alliances Between contractors and Subcontractors: A Tender Evaluation Criterion for The Public Works Sector. *Proceedings of the International Conference on Construction process Re-engineering*. Gold Coast, Australia: Construction Process Re-engineering.

Lam, L., Nguyen, P., Le, N., & Tran, K., (2021). The Relation among Organizational Culture, Knowledge Management, and Innovation Capability: Its Implication for Open Innovation. *Journal of Open Innovation*, 7(66), pp. 1-16.

Lenninkumar, V. (2017). The Relationship between Customer Satisfaction and Customer Trust on Customer Loyalty. *International Journal of Academic Research in Business and Social Sciences*, 7(4), 450-465.

Lin, H. F. (2007). Knowledge Sharing and Firm Innovation Capability: An Empirical Study. *International Journal of Manpower*, 28(3-4), 315-332. DOI: 10.1108/01437720710755272.

Lin, H. F. (2013). The Effects of Knowledge Management Capabilities and Partnership Attributes on The Stage Based E-business Diffusion. *Internet Research*, 23(4), 439-464.

McSweeney-Feld, H. M., Discenza, S., & De Feis, G. L., (2010). Strategic Alliance & Customer Impact: A Case Study of Community Hospitals. *Journal of Business & Economics Research*, 8(9), pp. 13-22.

Mowla, M. M., (2012). Strategic Alliances and Interfirm Knowledge Transfer. *Strategic Management Journal*, Volume 17, pp. 77-91.

Oliver, R. L. (1999). Whence Customer Loyalty? *Journal of Marketing*, 63, 33-44.

Porter, M. 91996). What is Strategy? *Harvard Business Review,* pp. 1-22.

Raghuvanshi, J., Ghos, P. K., & Agrawal, R. (2019). Taxonomy of Innovation Capability Framework With Future Directions. *International Journal Business Excellent*, 17, 265-289.

Rothaermel, F., & Boeker, W. (2008). Old technology meets new technology: Complementaries, similarities and alliance formation. *Strategic Management Journal*, 29(1), 47-77.

Schweitzer, J. (2014). Leadership and Innovation Capability Development in Strategic Alliances. *Leadership and Organization Development Journal*, 35(5), 442-469. DOI: 10.1108/LODJ-01-12-0001.

Shoemaker, S., & Lewis, R. C., (1999). Customer Loyalty: The future of hospitality marketing. International *Journal of Hospitality Management*, Volume 18, pp. 345-370.

Singhal, J., (2015). Cost Reduction Through Strategic Sourcing: A Case Study of Walmart. *NBR E-Journal*, 1(1).

Spekman, R. E, Isabella, L. A., MacAvoy, T. C., & Forbes III, T. (1996). Creating Strategic Alliances that Endure. *Long Range Planning*, 29(3), 346-357.

Sudolska, A. and Lapinska, J. (2020) 'Exploring Determinants of Innovation Capability in Manufacturing Companies Operating in Poland', *Sustainability* (Switzerland), 12(17), pp. 1–20. DOI: 10.3390/su12177101.

Sun, Y., Sun, Y., & Liu, J., (2021). Does Strategic Alliance Knowledge Heterogeneity Truly Promote Innovation Performance? *Sustainability*, 14(3443), pp. 1-15.

Talebi, K., Farsi, Y. J., & Miriasl, H. (2017). Identifying the Impact of Strategic Alliances on the Performance of SMEs (Case Study: The Industry of Automotive Parts Manufacturers in Iran). *International Business Research*, 10(6), 227. DOI: 10.5539/ibr.v10n6p227.

Vaidya, S., 2011. Understanding Strategic Alliances: An Integrated Framework. *Journal of Management Policy & Practice*, 12(6), pp. 90-100.

Weber, B. & Heidenreich, S, (2018). When and with whom to cooperate? Investigating effects of cooperation stage and type on innovation capabilities and success. *Long Range Planning*, 51(2), pp. 334-350.

Williamson, O. E., (1975). Markets and Hierarchies: Analysis and Antitrust Implications. New York: Free Press.

Wittman, C. (2007). Strategic Alliances: What Can We Learn When They Fail? *Journal of Business to Business Marketing*, 14(3), 1-19.

Yadav, G. H., Jain, R. K., Kapoor, M., & Nateriya, R. (2013). Cost Reduction In Different Disciplines. *International Journal of Current Research*, 5(10), 2821-2825.

Zhang, Y., Ma, E. J., & Qu, H., (2018). Transaction Cost and Resources Based Views on Hotels' Outsourcing Mechanism: An Empirical Study in China. *Journal of Hospitality and Marketing Management*, 27(5), pp. 583-600.

The Role of Trust in Forming a Social Innovation Service System

Thao Nguyen and Vy Pham
University of Economics Ho Chi Minh City, Ho Chi Minh City, Vietnam
thao.nk@ueh.edu.vn
thuyvypham@ueh.edu.vn

Abstract: The promotion of social innovation requires the interaction of multiple actors in a network who exchange resources to create value for customers. Adopting the Service-Dominant logic perspective, this paper explores how trust influences the emergence and evolvement of a social innovation service system. Data from a case study of One4One reveals that trust guides the activities of the social impact business and other actors in the service system to search for collaborators in a network, to lead the exchange of resources in the system for co-value creation, and to deal with other actors through the evolvement of the system. The study's findings could inform practitioners' practices conducive to creating a social innovation service system that aims to improve the quality of life for people in developing countries like Vietnam.

Keywords: social innovation, service innovation, service ecosystem, service system, service-dominant logic

1. Introduction

Social innovation refers to system-changing new ideas that could impact the perception and behavior of people to address cultural, social, economic, and environmental challenges (Pol and Ville, 2009). The promotion of new ideas would not be implemented by an organization alone because resources necessary to develop and expand the adoption of innovation would be scattered in the market instead of accumulated in one firm. Therefore, innovation requires the collaboration of various connected parties (Leite, 2022; Pol and Ville, 2009; Siaw and Sarpong, 2021). To promote social innovation, support for the emergence and development of such a network is necessary.

Existing research on the formation and dynamics of the system for social innovation (Babu et al, 2020; Chen and Lin, 2018; Polese et al, 2018) have highlighted key activities by network actors such as searching for collaborators, searching for opportunities for the innovation, implementing bilateral and multilateral resource integration in the network, and convincing others of the benefits of the social innovation. These activities strongly involve the interaction of humans. While trust has been considered a critical factor for human exchange and innovation adoption (Mitcheltree, 2021), research on how trust influences those activities remains understudied. Therefore, this paper addresses this gap in the literature by investigating how trust impacts stakeholders to form their social innovation service system (SISS). Adopting the Service-dominant logic, this study analyses the case of One4One and found that trust considerably guides the network actors to search for their collaborators, establish their relationships, and manage the resource exchanges with other stakeholders in the system.

The paper is structured in four sections. A brief review of existing literature on forming a SISS is discussed, followed by the methodological approach. Consequently, the finding presents critical ideas of stakeholders in the system. The paper ends with a discussion on how the research fits into existing knowledge and avenues for further investigation.

2. Theoretical background

2.1 Service-dominant logic

The service-dominant logic (SDL) highlights the use of resources in value creation. Vargo and Lusch (2004) define service as the application of resources to benefit other actors. They argue that the value created by service is embedded in the use of resources rather than during the delivery of that service to customers. This perspective of value creation in service has shifted the focus from treating services as goods to emphasizing the exploitation of resources from various actors involved in service provision. The key to the value-creation process is the exchange process upon which actors integrate resources to benefit the beneficiary. The actors cannot deliver value without collaboration to use critical resources for value creation. As the actors use their resources and work with others to access theirs, they are considered resource integrators rather than resource owners. Because service is designed to create benefits for the beneficiary, the value created in the service is always determined by the beneficiary.

In the contemporary service era, markets are considered systems of actors connected through network-based relationships to exchange resources and create customer value (Prahalad and Ramaswamy, 2000). The application of SDL has gained much attention in understanding how network actors co-create value for customers. The interaction among actors in a system is necessary as resources are not distributed evenly in the market (Siaw and Sarpong, 2021). Therefore, the value created for customers is created during the exchange between them and the service provider and through the collaboration of various stakeholders and actors in the system who need to jointly combine their resources to benefit the customers (Gueler and Schneider, 2021). This service system approach has been applied both in the commercial and social innovation setting to understand the value co-creation process for customers (Weiss et al, 2020)

2.2 Social innovation service system

According to Pol and Ville (2009), social innovation is system-changing new ideas that resolve social, cultural, economic, and environmental challenges and consequently impact the perceptions and behaviors of people in certain areas. Applying new ideas that change practices and behaviors system-wide innovation requires collaboration among various actors in the system, be they commercial firms, non-profit, or governmental organizations (Saji and Ellingstad, 2016). While social innovation has been considered from different views, such as public goods, service orientation, institutional change, its core attribute remains the improvement of the quality of lifestyle of people involved in the process of social innovation (Babu et al, 2020; Pol and Ville, 2009; Polese et al, 2018; Saji and Ellingstad, 2016). This study defines a social innovation service system as a relationship-based network where multiple actors exchange resources to promote new ideas or products for a better quality of life.

Windasari et al (2017) extend the premises of SDL to the context of social innovation and argue that the main activity of a social enterprise is to provide services that are consistent with its social goals. The social enterprise will function as a service offeror who coordinates various resources of different parties in their service system to achieve their social goals. The beneficiary of a service system may be customers, and those who experience service offerings can determine the value through interaction with the social enterprise.

2.3 Formation of a social innovation service system (SSIS)

Across studies (Babu et al, 2020; Chen and Lin, 2018; Leite, 2022; Polese et al, 2018), the searching for various actors who would share an interest in addressing social issues, the exchange of resources, and the evolvement of the system to promote social innovation are found to be critical elements of a SISS which embraces social innovation. Actors joining a social innovation service system come from various backgrounds, such as public organizations, social enterprises, business organizations, universities, and customers. They usually have different goals and, in many cases, not necessarily to achieve social purposes. However, when combined, their joint efforts would address social issues related to enhancing the quality of life.

The emergence of a SISS usually starts with the initial actor's search for collaborators with complementary resources to achieve their goals. While social purposes drive the formation of SSIS, the motivations of different actors could stem from their economic desire, such as marketing purposes and market position (Leite, 2022). For for-profit organizations, the primary goal is to maximize their resource use or build brand awareness. However, they are all aware that the economic benefits they would receive are expected to couple with solving a social problem (Babu et al, 2020). A critical note of this emergence phase is that parties would explore each other's capabilities and assess their benefits from the collaboration. Trust is essential for building relationships and interactions among actors (Babu et al, 2020; Chen and Lin, 2018). The establishment of the network provides the foundation for activities of resource exchanges where value is created for stakeholders involved. Chen and Lin (2018) show that identifying a party where information passes through helps connect actors in the network. The activities of resource exchange often start after the revelation of the party who plays that central role in the network.

Most often, the integration of resources involves both operant resources (knowledge or skills) and operand resources (physical resources such as technology or equipment) shared by different network actors. During resource exchanges, value is co-created by the stakeholders involved, and the new idea is systematized from an individual level to a collective level during this process (Chen and Lin, 2018; Polese et al, 2018). Actors often need to communicate, collaborate and adjust their resources to promote social innovation. Various actors can quickly access knowledge and skills from other partners for their activities. During the value creation process to

implement social innovation, the social innovator shares the new idea and promotes its adoption on a larger scale. This phase is critical in changing the mindset and behavior of the stakeholders in the system. Windasari et al (2017) show that having a good relationship among actors to build trust, friendliness, and respect creates a fundamental foundation for collaborative actions. Polese et al (2018) argue that stakeholders create value and share across the system during the exchange resources process to benefit all involved actors. The creation of benefits for stakeholders encourages the adoption of social innovation on a larger scale.

The relational factor is critical in the formation and evolvement of a SISS. Research exploring the impact of social factors in enhancing innovation adoption has revealed that a low level of trust would inhibit the acceptance of technology for social change (Julsrud and Krogstad, 2020) because it would hinder the communication of benefits the beneficiaries would receive from the innovation. Similarly, Mitcheltree (2021) points out that trust would promote people's adoption of innovation by reducing their defensive tendencies to hold on to previous routines. In the innovation area, trust is defined as "an expectancy of reasonable and positive reactions by others in response to individual innovation attempts" (Clegg et al, 2002). At the same time, trust has been investigated to impact the adoption of social innovation (Julsrud and Krogstad, 2020; Mitcheltree, 2021; Windasari et al, 2017). However, its influence on stakeholders to collaborate and share their resources during the formation of SISS remains silent. Our research explores trust, a key element in guiding stakeholders' activities in building their SISS.

3. Methodology

We adopted the case study method approach as it is suitable for exploratory purposes (Eisenhardt, 1989; Yin, 2009, Myers, 2013), appropriate for a nascent study. Data were collected through multi-time in-depth interviews with the founder of a social enterprise. There were four semi-structured interviews. The two first interviews explored the firm's background and its development path. In the 3rd interview, learn about this social enterprise's business models and social impacts. Based on the captured data, the 4th interview focused on the resource mobilization and the collaboration aspect of the co-creation process. Both authors attended the interviews and subsequently discussed the findings from the information provided by the interviewees. The analyses were conducted in Vietnamese transcribed text, while all selected quotes have been translated into English in the final report. The translation might not cover all the subtle meaning of language (Marshall & Rossman, 2014). The analyses focused only on the narrative story; then, themes were validated via triangulation by discussing findings within the two researchers. We captured 43 codes and subcodes, aggregating them into four main themes: (1) searching partners, (2) collaboration activities, (3) resources exchanges, and (4) system evolvement.

3.1 The case of One4One

One4One is a social enterprise with the mission to re-establish a fair-commercial and eco-balance lifestyle. One4One's philosophy focuses on humans' connection with humans, the environment, and the products they use. They believe that centralization practices and the pursuit of economic rent have caused numerous problems in the quality of life. The crux of those problems is the commercial business mindset that emphasizes the value creation of the end-product to the customers and disregards the connections among actors whose interaction creates value during production and distribution activities. One4One operates multiple projects, three of which are chosen for the analysis because they reflect the formation of a SISS that One4One has successfully built.

- Coconut project - Ben Tre province (CO_BT): since coconut is a specialty of Ben Tre, One4One builds small factories, helps farmers reconnect with the coconut tree, and improve their living quality through planting, making, and using coconut products. One4One's coconut oil is distributed to urban consumers who share common beliefs and values with One4One.
- Peanut cooking Oil - Ha Tinh province (PO_HT): this project started when One4One met local change agents. At that time, One4One was searching for a cooking oil solution, while a Ha Tinh teacher was engaging himself with a mission to help his dwellers in the community improve their lives based on the local resources. They made peanut cooking oil at Ha Tinh, then sell to both consumers and restaurants in cities.
- Enzyme cleaning product - Da Nang city (Enz_DN): a product made by farmers, One4One helps build a brand and sell to their existing customer base. The product received positive feedback, so One4One plans to open a hundred zero-waste re-fill stations in Vietnam.

4. Findings

This paper studies the impact of trust on the formation of a SISS created by One4One. Figure 1 presents the network relationship of stakeholders and their main activities in the SISS.



Figure 1: The network of One4One

4.1 The value captured by stakeholders

We recognized different values captured by various stakeholders in the system. Value to the customers is in the form of green and organic products, which removes their worries about unhealthy products or ensures them of their contribution to protecting the environment. The stability of outcomes and sustainable production practices to the local farmers, workers, and the local change agents. One4One's employees feel assured of their employment and enjoy a stress-free working conditions, whereas logistics providers are satisfied with their economic rent. To One4One, we are happy with making green products and creating a sustainable system where all stakeholders collectively generate value, the benefit from which they all could enjoy.

4.2 Impact of Trust in the formation of SISS

Trust in the innovation area means the belief that the other party would adopt and commit to the innovation (Mitcheltree, 2021). Results of our analysis reveal the impact of trust in all the three critical phases of developing SISS of One4One in all three projects (see Table 1)

As a social entrepreneur, the desire to build a sustainable system to sell organic/ green products has always been the critical focus of One4One. However, the idea for a green product does not always come from One4One, but in many cases, it is initiated through discussion with local change agents. Notably, the idea is guided by the local knowledge's trust. The arguments for products of the two projects of this study come from the local change agent, and One4One trusts the local people to make an excellent green product that would contribute to the consumers' quality of life.

When building their SISS, the extension of their network is always influenced by trust as they would look for people they believe would share the same value. Their experience taught them not to waste time with people who would not understand and share their purpose. In the absence of trust, they would not proceed with the party, as seen in their experience of the PO_HT project. In the Enz_DN project, when they trusted the local change agent that she would try her best to produce a good quality product, One4One was persistent in supporting her for a long time before her product would be qualified to be sold to their customers. With trust, One4One is willing to start with a small number of farmers to ensure the latter follow their instructions for product quality.

Table 1: Summary of interviews with terms related to trust and collaboration

Dimension/ Actors	Social Innovation Ideation	Search for collaboration Partners	Resource exchange	Evolvement of SISS
One4One	"I am maintaining the traditional production approach. And I want to help the worker who made this product use the products they made. At least, they can involve more in the stories of the products for their body and natural environment" (One4One)	"I am lucky because I have found people who share our common value system" (One4One) "There are many people who have different value systems with me. I don't think I had wasted my time with them. Because I must try (to know), then I let them go" (One4One) "No, they (local change agents) don't have a salary. They contribute their labour" (PO-HT) "We search and find a person who has common value in each local community" (One4One)	"At that time, we didn't know what product testing is. We had to learn so many times. We met some university professors in industrial tech, went to coffee chats, then they instructed us." (CO-BT)	"One4One made products by us. So even though we are not strong in production, we are also self-taught/ self-learn. During the production procedure, there would be problems which we can take. So that we can enhance and complete our models, then imply to manage other projects." (CO-BT)
Employees		"And people who come to join One4One have a common value system with us. A few members had a different value, but they left. So, if they stay with us, they are strongly engaged because they know here is their place. Nowhere is similar this place that has this value, so they are engaged" (One4One)	"The staff left in a very humane way. They knew I can no longer afford to pay their salary on time. So they left but still worked hard for me. Just left to release me from paying for them." (One4One)	"Each manager will work with them, then the program and operation plan changes all the time that I sometimes can't get it either. […] Staffs on my side are good at it. As long as my guys can do it, it's fine (with me)" (One4One)
Consumers	"Because we can tell our consumers that currently, our products are only 70% of good quality. We are not satisfied with this 70%, so can you accept this product? However, we are sure that this 70% is so much better than the product which told a lie about the "good 100%" (One4One)		"Because we can tell our consumers that currently, our products are only 70% of good quality. We are not satisfied with this 70%, so can you accept this product? However, we are sure that this 70% is so much better than the product which told a lie about the "good 100%" (One4One)	

Dimension/ Actors	Social Innovation Ideation	Search for collaboration Partners	Resource exchange	Evolvement of SISS
Local Change agent	"It is not difficult to find a product idea. We just need to ask local dwellers. The residents who have been living there for decades know. Their parents' grandparents know. It's so convenient; we ask around that we capture a ton of ideas." (On4One)	"It was many times when we went to the farm, even the organic farm. But it is impossible to communicate because ours and theirs are two different approaches. Even if we wanted, we couldn't do it due to this difference. In contrast, if people have the same value system, we can *plant the tree on any stone* (local idiom)" (CO-BT) "We visited many places, but until when we came to Ha Tinh province that we found a teacher who has the same concern about his hometown." (PO-HT) "They have been lived there for some decades, so they know who (farmers, dweller) is good, who is not" (PO-HT)	"They are very reputable. They are teachers in the village in a remote area […] When the teacher said one thing, it is to be done immediately" (PO-HT) (during the Covid-19 pandemic) "We still buy their peanut. In the future, we plan to hold some agriculture professionals training. But now, our work is still based on the prestige of the change agents (teacher)" (PO-HT)	"They are so talented. They are more talented than us. (when we ask them to fix this factory) they know much better than us" (PO-HT)
Local farmers and workers		"I was convinced by her stories that I accompany her (in this business)" (Enz-DN) "We began with only 2-3 farmers. They are his (the local change agent) relatives – aunts, uncles and so on." (PO-HT) "It is not difficult to find another farmer. At that time, we found an experienced farmer who had been living with a peanut tree for a long time. And he was also a leader of a local farmer association. So we just need to sell (their products), then they will join. We do not lack of farmers there" (PO-HT)	"Human is the most important resource. It (the same value system) is so that we can communicate and they understand immediately" (One4One)	*(when farmers break the rule, sell peanut to another seller)* "… we said we were said. We confide with them. But we empathize them… so they come back, with a new mindset and attitude" (PO-HT) "I have learned to appreciate the people who, no matter what problem comes, still stay with me. They always share difficult times with me. So no matter what difficulties or conflicts in work, I also learn how to empathize with overcoming" (One4One)

Similarly, the local change agent's act of recruiting farmers into the system is also guided by trust. They would also look for farmers who would commit to a proper production process. To One4One employees, they also trust

their employer for providing a desirable working conditions. It can be seen that trust influences the network stakeholders to search for and recruit other network partners. Besides looking for complementary resources possessed by the partners, the beliefs that the other party would embrace and promote the innovation are critical to the decision whether to include or not to include them in the network. During the collaboration process, the trust in others would encourage their exchange of resources. One4One trusts the experts for sharing their technical knowledge, so they reach out to university professors for their advice in the manufacturing process. Employees trust that One4One is creating a good value for society, so they are willing to work for One4One during the tough time of the pandemic. The local farmers believe that the instructions of the local agents are appropriate, so they would just quickly follow them. One4One also trusts the farmers to adopt their innovation, so they feel at ease when sharing their knowledge. Finally, the customers trust the reliability of One4One's message and social value, so they would support the firm even if the product would not fully meet the desired standards.

The evolvement of One4One's SISS is not linear and would experience some changes or disruptions. Positive change is seen when social innovation is promoted and adopted widely by other stakeholders. In contrast, negative change occurs when an existing member contributing to the co-creation process wants to leave the system for better benefits. The existence of trust in either way would facilitate the evolvement of the SISS into a more concrete form. For example, at One4One, the trust in the employees that they would commit to the firm's core value would help the social entrepreneur decentralize the decision-making process to her staff. Thanks to this decentralization, the idea of innovation is quickly spread to other people and adopted to the next level. Not only is decentralization observed within the firm but also across the actors in the system. Thanks to trust in the local change agent, One4One encourages them to decide what is best for a manufacturing system at the local worker's site. This decentralization helps to expand the practices for social innovation on a larger scale that spread throughout the system. When looking at the adverse incidents where local farmers left the system for better value, the trust and empathy with the farmers led One4One to have a peaceful resolution instead of engaging in any conflicting behavior. The caring behavior adopted by One4One later encourages the farmers to rejoin the system when they realize the benefits received at One4One out-weight what they would earn in other options. From this evidence, we see that trust speed up the evolvement of SISS to expand the adoption of social innovation.

5. Discussion

This paper attempts to understand how trust influences the formation and development of a social innovation service system. The analysis shows that adopting social innovation from the individual to the system level is strongly influenced by trust. It is a critical factor that guides social entrepreneurs to search for their collaborators. Previous research has shown that the essential purpose of partner selection is to locate complementary resources (Hardyman et al, 2021). This study provides an additional perspective on the need for trust. In addition to looking for complementary resources, social innovators would pay more attention to the willingness of potential partners to promote the new idea. While Julsrud and Krogstad (2020) point out that the adoption of social innovation at the system level depends on customers' trust in the value of the innovation, this research examines the trust from the other side, which is of the social innovator. This research also corroborates existing studies showing that relational factors (Windasari et al, 2017) are essential in speeding up the adoption of social innovation on a larger scale. This research suggests that social enterprises should invest in getting to know their partners to develop a service system effectively. In addition, they need to signal their value proposition to all stakeholders to reach collective goals.

Although the findings are encouraging and helpful, it has specific limitation. We only interviewed one social enterprise to investigate the phenomenon. Further studies can consider the impact of trust on the efficient use of resources in the system. Additional studies on how power, another relational factor, influence a SISS's development would be fruitful to promote social innovation on a larger scale.

6. Conclusion

The adoption of social innovation relies on a network of various stakeholders who interact and collaborate to share resources to promote the new idea. While human interaction is essential in promoting social innovation, there is a lack of study on how trust – a critical component in human interaction – influences network actors to exchange resources to adopt social innovation. This research investigates the case of One4One, a social enterprise who have built multiple systems for social innovation, and found that trust plays a vital role in guiding

network stakeholders to identify their partners, maintain their relationships and encourage their resource exchange activities for the adoption of social innovation. These findings highlight the role of trust in promoting social innovation at the system level, which extends current knowledge on how trust influences activities to build value-cocreation competence for stakeholders in the system.

References

Babu, M. M., Dey, B. L., Rahman, M., Roy, S. K., Alwi, S. F. S., and Kamal, M. M. (2020) "Value co-creation through social innovation: A study of sustainable strategic alliance in telecommunication and financial services sectors in Bangladesh," *Industrial Marketing Management,* Vol 89, pp 13-27.

Chen, H. W., and Lin, F. R. (2018*) "*Evolving obligatory passage points to sustain service systems: The case of traditional market revitalization in Hsinchu City, Taiwan", *Sustainability,* Vol 10, No. 7, 2540.

Clegg, C., Unsworth, K., Epitropaki, O., and Parker, G. (2002) "Implicating trust in the innovation process", *Journal of Occupational and Organizational Psychology*, Vol 75, No. 4, pp 409–422.

Eisenhardt, Kathleen M. (1989) "Building theories from case study research." *Academy of Management Review,* 532-550.

Gueler, M. S., and Schneider, S. (2021) "The resource-based view in business ecosystems: A perspective on the determinants of a valuable resource and capability", *Journal of Business Research,* Vol 133, pp. 158-169.

Hardyman W., Garner S., Lewis J., Callaghan R., Williams E., Dalton A., & Turner, A. (2021): Enhancing public service innovation through value co-creation: Capacity building and the 'innovative imagination', *Public Money & Management*, pp 1-9, 120314

Julsrud, D. T. E., and Krogstad, D. J. R. (2020) "Is there enough trust for the smart city? Exploring acceptance for use of mobile phone data in Oslo and Tallinn", *Technological Forecasting and Social Change,* Vol 161.

Leite, E. (2022) "Innovation networks for social impact: An empirical study on multi-actor collaboration in projects for smart cities", *Journal of Business Research*, Vol 139, pp 325-337.

Marshall, C., and Rossman, G. B. (2014) *Designing qualitative research*, Sage publications.

Mitcheltree, C. M. (2021) "Enhancing innovation speed through trust: A case study on reframing employee defensive routines", *Journal of Innovation and Entrepreneurship*, Vol 10, No. 1, pp. 1-31.

Myers, M., 2013. *Qualitative Research in Business & Management*. 2nd ed. London: SAGE Publications Ltd.

Pol, E., and Ville, S. (2009) "Social innovation: Buzz word or enduring term?", *The Journal of Socio-economics,* Vol 38, No. 6, pp 878-885.

Polese, F., Botti, A., Grimaldi, M., Monda, A., and Vesci, M. (2018) "Social innovation in smart tourism ecosystems: How technology and institutions shape sustainable value co-creation", *Sustainability,* Vol 10, 140

Prahalad, C. K., and Ramaswamy, V. (2000) "Co-opting customer competence", *Harvard Business Review,* Vol 78, No. 1, pp 79-90.

Saji, B. S., and Ellingstad, P. (2016) "Social innovation model for business performance and innovation", *International Journal of Productivity and Performance Management,* Vol 65, No. 92, pp 256-274.

Siaw, C. A., and Sarpong, D. (2021) "Dynamic exchange capabilities for value co-creation in ecosystems", *Journal of Business Research,* Vol 134, pp 439-506.

Vargo, S.L. and Lusch, R.F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68 No. 1, pp. 1-17

Weiss, G., Emery, M. R., Corradini, G., and Živojinović, I. (2020) "New values of non-wood forest products", *Forests*, Vol 11, No. 2, p. 165.

Windasari, N. A., Lin, F. R., and Chen, H. (2017) 'The Role of Social Capital on Co-creating Value for Social Enterprises: The Service-Dominant Logic Perspective'*,* Paper presented at the *50th Hawaii International Conference on System Sciences*, Hawaii, USA.

Yin, R.K. (2009) *Case study research: Design and methods,* Vol. 5, SAGE

Implications of Blockchain Application to Accounting Education and Accounting Practice

Ana Novak, Ivana Barišić and Katarina Žager
Faculty of Economics and Business, University of Zagreb, Croatia
anovak@efzg.hr
ibarisic@efzg.hr
kzager@efzg.hr

Abstract: Accounting is part of the information system of a company that generates the most important information for the decision-making process. This process should be supported by new technologies to respond to all business requirements. Disruptive technologies change the way of performing business transactions and their implementation in business practice was notably accelerated by the pandemic. In this context, Blockchain technology has been articulated as the future of the accounting profession and there is a growing body of research regarding the impact of the blockchain on accounting practice and the accountancy profession. Many advantages arise from blockchain technology's distinctiveness, but also many risks that need special attention. Consequently, evolving conditions require professional accountants around the world to master new skills related to emerging information technologies. Being accustomed to information technologies is one of the basic prerequisites for the quality service that professional accountants offer to clients. Accounting education, especially at universities, has an important role in forming competent professional accountants and enabling required skills that are an essential part of professional competence. Accounting education has a challenging role in this context to incorporate and transfer knowledge regarding new technologies. This paper aims to analyse the recent research to investigate the impact of blockchain technology on accounting practice. The paper also focuses on the analyses of means of the inclusion of blockchain technology into accounting education and curriculum, by conducting a literature review of relevant sources. Research findings enable further understanding of the implications of blockchain technology in the accounting context, both for accounting practice and accounting education. Results can serve accounting educators since this topic is not sufficiently explored and needs further analysis.

Keywords: blockchain, accounting profession, accounting education, teaching methods

1. Introduction

Blockchain is considered to be one of the six “biggest technology trends in accounting and finance“ according to Forbes (Marr, 2020) and along with other disruptive technologies it is expected to have a great impact on the accounting profession in the future. Blockchain was introduced as the core technology behind the first digital cryptocurrency (bitcoin), but its functionality has evolved and has been integrated into many industries (Dai and Vasarhelyi, 2017; CPA Canada and AICPA, 2017; Schmitz and Leoni, 2019; Fuller and Markelevich, 2020). Stratopoulos (2020, p. 65) argues that “while some see blockchain as the end of the accounting profession for others it is an opportunity”.

In today’s digital economy disruptive technology change the way of performing business transactions and their implementation in business practice was notably accelerated by the pandemic. Those conditions did not bypass the accounting practice where information technology has been integrated for a long time. Changing conditions require professional accountants to possess new skills related to disruptive information technology. Accounting education, especially at universities, has an important role in forming competent professional accountants and enabling required skills that are an essential part of professional competence. Accounting education has a challenging role in this context to incorporate and transfer knowledge regarding new technologies. Al-Htaybat et al. (2018, p. 333) investigated new technologies in accounting education from the perspective of accounting academics and support the notion that “addressing such technologies in accounting education is a necessary development to ensure that graduates acquire workplace-relevant knowledge”. Based on the results of the study authors proposed changes to the accounting curriculum that also included the implementation of new technologies such as blockchain. The main objectives of this study are to review the recent research to investigate the potential implications of blockchain technology on accounting practice and to gain insights into the challenges for accounting education related to the inclusion of blockchain technology into accounting curricula.

The following research questions were identified:

- RQ1: How does blockchain technology impact accounting practice?

- RQ2: What challenges have been identified for accounting educators regarding the implementation of blockchain technology in the accounting curricula?

This study uses a literature review to investigate the recent academic research literature regarding the two main topics of this paper: implications of blockchain application to accounting practice and the inclusion of blockchain technology into accounting education in higher education institutions. We researched papers indexed on the Web of Science (publication years from 2018 to 2022) but also prominent accounting education journals such as the Journal of accounting education, Issues in Accounting Education, and the Journal of Emerging Technologies in Accounting. Some articles were also identified with the snowballing method from the reference sections of articles indexed on the Web of science. Reports and discussion papers from globally recognized professional accounting bodies were also included in the analyses.

By synthesizing the findings of the recent research regarding the challenges of blockchain education in accounting curricula, this paper contributes to the growing area of research in accounting education which has not yet been fully explored (Quasim and Kharbat, 2019; Stratopoulos, 2020; Kaden et al. 2021) because of the initial stage of adoption of blockchain in accounting practice (Stratopoulos, 2020). Research findings enable further understanding of the implications of blockchain technology in the accounting context, both for accounting practice and accounting education. Results can serve accounting educators since the paper synthesizes the current practice of blockchain education in accounting programs of higher institutions regarding learning objectives, teaching methods, and pedagogy.

2. Implications of blockchain technology on accounting practice

Blockchain is one of the most disruptive technologies developed in recent years with a great potential to impact and transform accounting practice as well as bring new opportunities and challenges to the accounting profession (Dai and Vasarhelyi, 2017; CPA Canada and AICPA, 2017; ICAEW, 2018; Schmitz and Leoni, 2019, p. 1). Blockchain is "a type of distributed ledger technology where multiple copies of the same ledger are shared among the members of a large network" (Moll and Yigitbasioglu, 2019, p. 12). In blockchain "identical copies of the ledger are maintained and validated collectively by the members of the network, with approved transactions added in blocks that are added to a chronological chain of previously validated blocks, using a cryptographic signature" (Bonsón and Bednárová, 2019, p. 725).

According to the Institute of Chartered Accountants in England and Wales, blockchain is "fundamentally an accounting technology", as it "has the potential to increase the efficiency of the process of accounting for transactions and assets, operating as a system of universal entry bookkeeping" (ICAEW, 2018, p. 1). Blockchain has the potential to automate certain accounting processes (Schmitz and Leoni, 2019) and impact "all recordkeeping processes, including the way transactions are initiated, processed, authorized, recorded and reported" (CPA Canada and AICPA, 2017, p. 2). Blockchain could "enhance the accounting profession by reducing the costs of maintaining and reconciling ledgers, and providing absolute certainty over the ownership and history of assets" (ICAEW, 2018, p. 3).

Schmitz and Leoni (2019, p. 8) summarized the greatest advantages of blockchain emphasized by accounting and auditing academics and practitioners and stated that some of advantages are "that the blockchain increases the efficiency of recording, reconciling and auditing of accounting as well as allows accountants and auditors to save costs and time executing these tasks and reduces the risk of human error". According to Bonsón and Bednárová (2019, p. 735), the application of blockchain technology in accounting could provide "better auditability; increased control, reliability and trust; reduced costs (e.g., of control, transactions, and duplications) and human error; better access to information; and the avoidance of manipulation and fraud by offering a trusted recordkeeping". Dai and Vasarhelyi (2017, p. 5) argued that "blockchain's function of protecting data integrity, instant sharing of the necessary information, as well as programmable and automatic controls of processes, could facilitate the development of a new accounting ecosystem". The authors also stated that "blockchain would play the role of the accounting information system, which distributes the power of transaction verification, storage, and management to a group of computers in order to prevent any unauthorized data changes" (Dai and Vasarhelyi, 2017, p. 6).

The aforementioned are some of the positive implications that the application of blockchain technology in accounting could have. However, the integration of blockchain in accounting also brings many significant challenges such as scalability issues as well as the costs associated with blockchain integration (Fuller and

Markelevich, 2020). There are also concerns about potential limitations of blockchain regarding issues such as transaction verification, the capability of blockchain to prevent and detect fraudulent transactions, as well as concerns regarding data privacy and data security (Coyne and McMickle, 2017; Schmitz and Leoni, 2019; Bonsón and Bednárová, 2019).

According to Bellucci, Cesa Bianchi and Manetti (2022, p. 131) "although there are some proposals for the use of blockchain in accounting, thus far, none have been commonly accepted". Blockchain technology is still in an emerging phase, and it will take years, or even decades, before it reaches its full potential (Pimentel E. and Boulianne, E., 2020, p. 341; ICAEW, 2018, p. 12). However, in the shorter term, it can be expected "that traditional accounting information systems will integrate to some degree with other discrete blockchain applications to receive a portion of their accounting information" (Fuller and Markelevich, 2020, p. 44). Concerning this, accountants must expand their knowledge and skills in order to understand the main characteristics and functions of blockchain to be able to advise on blockchain adoption as well as anticipate the impact of blockchain on their businesses (Schmitz and Leoni, 2019; ICAEW, 2018, p. 10).

3. Challenges regarding the inclusion of Blockchain education into accounting curricula

Changing the business environment in which professional accountants operate creates many challenges for accounting education, especially concerning the gap between "how accounting is practised and what is taught at universities" (Kotb et al., 2019, p. 3). The gap between employers' needs regarding the skills of professional accountants and the skills that have been emphasised throughout accounting education has been identified in accounting literature for more than two decades (Bui and Porter, 2010; Marshall et al., 2010; Webb and Chaffer, 2016). Research suggests that "employers of today's accounting graduates are seeking candidates who exhibit a blend of technical ("hard") skills, digital technology skills, and behavioural skills" (IAESB, 2018, p. 9). Professional accounts are expected to possess enhanced skills regarding technology (Forbes and KPMG, 2017), and to be 'digitally fit' (PWC, 2019) since they provide support to clients who are also undergoing digital transformation.

Accounting curricula must include necessary changes that have a great impact on the accounting practice. According to the results of the survey conducted by Kotb et al. (2019, p. 15) among accounting educators "technological developments represent an important and relevant area that needs to be adequately incorporated in accounting curricula to reflect changes in the marketplace".

Professional accounting organisations also emphasise the importance of digital skills. According to analyses of requirements of competency frameworks in various fields of the accountancy profession (ACCA Competency Framework, IMA Management Accounting Competency Framework, The Chartered Global Management Accountant (CGMA) Competency Framework, The IIA Global Internal Audit Competency Framework, Competency framework for public sector audit professionals at Supreme audit institutions..), a strong emphasis is being placed upon digital skills and although "the need for a certain competence area will vary depending on the career level, digital skills stand out as key ones regardless of the career stage" (Barišić, Novak and Sever Mališ, 2020, p. 12).

Technological competencies are part of the foundational competencies in a Framework for accounting education proposed by a Joint Curriculum task Force (Lawson et al. 2014). Task Force was formed by the Institute of Management Accountants (IMA) and the Management Accounting Section (MAS) of the American Accounting Association (AAA) and aimed at creating "a comprehensive educational Framework" for professional accountants (Lawson et al., 2014, p. 296). Given the circumstance of the modern business environment in which professional accountants operate "mastery of these competencies is necessary for all accountants if they are to add value to their future organizations" (Lawson et al., 20144, p. 301). Similarly, accounting academic programs seeking the Association to Advance Collegiate Schools of Business's (AACSB, 2018, p. 22) accounting accreditation are required to integrate current and emerging information technology into the accounting curriculum. In 2021 American Institute of CPAs (AICPA) and the National Association of State Boards of Accountancy (NASBA) issued the CPA Evolution Model Curriculum with detailed content suggestions, modules, topics, and learning objectives. The use of appropriate technologies is envisaged as part of meeting the learning objectives within the prescribed courses (AICPA and NASBA, 2021a).

Wang (2021) pointed out that unlike the implications of emerging technologies on accounting practice which are noticeable, "our understanding of how it works and its impact on curricula remains unclear". The author also stresses that developing new courses embedding new technologies can be very demanding "given the rapidly changing nature and lack of readily applicable materials" as well as time-consuming for lecturers. In 2021 AICPA and NASBA conducted a survey among university accounting department chairs from small to large accounting programs in the United States regarding topics in their accounting programs. Regarding adopting new technologies and understanding new digital trends, a very low percent (23%) of respondents affirmatively answered that their "accounting program covers digital acumen" and they are mainly embedding it into Accounting Information Systems (AICPA and NASBA, 2021b, p. 7). According to Vasarhelyi (2014, p. 2), Accounting information systems have been the "home" of "technologies and concepts that have not yet been integrated into other elements of the accounting curriculum." Regarding current practice globally, in accounting programs in higher education institutions, skills related to information technology/information communication technology are present both in undergraduate and graduate degrees. According to research conducted by IAESB (2018, p. 10) skills are learned across many different subjects, and "some universities teach these subjects within their accounting department, some rely on IS departments, while others have now merged accounting and IS into one department". According to the recent analysis of IT education in accounting programs of some European universities, IT has been included in the accounting education of most analysed universities through courses such as Big data, Data Analytics, and Blockchain and Fintech innovations (Novak, Barišić and Mamić Sačer, 2021).

Blockchain education has been rather a new field in accounting education and Kaden et al. (2021) summarised the following challenges: lack of guidance on teaching blockchain at a university level as well as lack of curriculum and the need for prior education of instructors since blockchain is an emerging technology. Also, blockchain functions have more technical issues which can be challenging for accounting students who usually don't have programming experience and are most experienced with Excel and other software that is used in accounting. The inclusion of blockchain education has not yet been fully explored and Table 1 presents a summary of recommendations regarding the implementation of blockchain technology education into accounting education programs based on a review of recent scientific papers in prominent accounting education journals.

Table 1: Summary of the recommendations regarding the implementation of blockchain technology education into accounting program_ review of recent papers

	Course organisation	Course objectives/learning objectives	Pedagogy	Course type	Course development effort
Qasim, and Kharbat (2019)	Inclusion of topics into existing courses at: Introductory level, intermediate level and advanced level	understanding the main concepts and how to use Blockchain providing an overview of the fundamental concepts of blockchain applications in business and the use of BT in the accounting cycle understanding the use of BT in performance measures and accountability and understanding the impact of Blockchain on a company's processes and operations.	cases, readings, lectures, and presentations with no technical details – provide a general understanding of using these technologies in the accounting profession. invite experts from the industry to present their experience	In class	
Stratopoulos (2020)	Options: topics included as part of an existing course (e.g., accounting information systems, accounting analytics, or	understanding the blockchain foundational concepts acquiring the foundational knowledge that enables forming an opinion regarding the implications of blockchain for accounting practice	storytelling approach for the concept of transaction and its components the scaffolding approaches a Sudoku-based simulation for key concepts: the idea of a distributed ledger, proof-of-work, miners	In class	

	Course organisation	Course objectives/learning objectives	Pedagogy	Course type	Course development effort
	information systems) a semester-long seminar for upper-year undergraduates and graduate students		- focus on the implementation of blockchain in a supply chain setting		
Stern and Reinstein (2021)	Standalone graduate course/ advised as an elective course Full semester content (11 weeks)	explaining: terminology of blockchain and supporting technology; the connection between blockchain and bitcoin Blockchain requirements for accounting and business use comparing Bitcoin with Ethereum and Hyperledger fabric relations between blockchain, distributed ledger, and shared ledger (discussing advantages and disadvantages) enabling coding and testing smart contracts (work in teams)	Online course Quizzes with multiple choice questions, lecture videos and reading, online discussions, homework assignments, and a team project	Asynchronous online, synchronous online, hybrid, face-to-face teaching modes	600-700 hours for the first half of the course
Kaden et al. (2021)	Included in mandatory graduate data analytics class	understanding of the basics of object-oriented programming, identifying the components of a blockchain and their relations, using R code to interact with a blockchain and manipulate blockchain code to alter data structures and the functionality of the chain	three stage instruction, each stage a week of class time (three hours) was devoted to blockchain in class groups working with code and instructions on theory scaffolded exercises of blockchain programming developing constructive student engagement/group work	In class	

Quasim and Kharbat (2019) provided suggestions on the implementation of blockchain, data analytics, and artificial intelligence into the accounting curriculum at different courses and course levels. According to the authors, these emerging technologies due to their importance for the accounting profession should be included in accounting curricula at all levels: introductory level, intermediate level, and advanced level. Integration was suggested for areas that were previously identified "as main areas in accounting and auditing that are currently exploiting the technologies under examination" such as financial and managerial accounting, auditing, and taxation auditing as well as accounting information systems, which was converted to 'digital accounting' (p. 113). They also emphasise the importance of case studies as "one of the most important tools to be used to enhance the student's capabilities to analyse and interpret the results to build their competence" (p. 113). The main learning outcomes would be to provide an overview to students regarding ways of implementing these emerging technologies into practice and additionally to provide practical evidence by inviting experts from the industry to share their experiences. Authors point out that technical issues regarding these technologies shouldn't be stressed out since "students are not supposed to be technical people" (p. 113).

Stratopoulos (2020) provided teaching notes that serve as a guide for including blockchain in the accounting curriculum. He suggests several ways of including blockchain education for accounting students: incorporating

blockchain topics into existing accounting courses (accounting information systems or similar) throughout one to two weeks, or as a semester-long course. The author elaborates that accounting students are not IT experts so blockchain education for future accounting professionals needs to be a balance between blockchain-related foundational knowledge and the technical aspect (p. 63). Stratopoulos (2020) argues that it is important for students to understand the importance of studying blockchain by providing them with the implications of blockchain on accountants and financial professionals. Moreover, it is advised that students explore, using web search, and discuss implications among themselves. This exercise aims to "convince everyone about the true potential of the market" (p. 65). The author proposes suggestions for providing blockchain education to accounting students that have the following objectives: understanding foundational blockchain concepts and comprehending the "implications of blockchain on the accounting profession" (p. 63-64). The author proposes "using a scaffolding and storytelling approach" to present key technical concepts of blockchain to accounting students and the possibility to present the implementation of blockchain to students using R (p. 64). Stratopoulos (2020) states that technical issues such as proof-of-work, hash, nonce, mining, and so on should be demystified to accounting students through a series of exercises. He uses Nakamoto's (2009) paper as a base for providing technical issues but suggests ways to scaffold learning through demonstrations and breaking these concepts into practical mini-lessons. The focal point of the proposed course is that students understand the functioning of blockchain in a supply chain setting which will help them understand its implications on accounting. The author demonstrates the implementation of blockchain in a supply chain by introducing one area of the Listerine supply chain, the eucalyptus supply chain.

Stern and Reinstein (2021) described the implementation of a full semester blockchain course that was conducted online. According to the authors, this course was the first ever fully implemented blockchain course in the accounting academic program. The course had several blockchain learning objectives whose purpose was to provide an understanding of blockchain technology along with its associated terms. The objectives of the course were also aimed at enabling students to develop blockchain applications as well as to code smart contracts. Learning objectives of the first half of the course were mainly focused on the identifications of Blockchain and Bitcoin, as well as on the analyses of their connection. The authors pointed out that understanding this connection was the basis for understanding blockchain's implication on business and accounting as well. The teaching methods of this online course included recorded instructors' lectures and the learning process was also supported through guided reading. Students were engaged in learning through home assignments and group projects that were supposed to "include implementing the application on a blockchain application". Although the authors provided evidence of successful teaching via student evaluations and exams they also suggested that blockchain courses for accounting students should be an elective rather than a required course, since accounting students are not familiar with programming and the technical issues of blockchain.

Kaden et al. (2021) argue that "very little research offers guidance on how universities can teach blockchain" (p. 283) and propose "a hands-on learning strategy for blockchain instruction that goes beyond definitions or descriptive exercises" (p. 282-283). According to the authors, this was the first study "to implement blockchain coding methods in an accounting education framework" (p. 282). Authors proposed a methodology for a blockchain module that enables students to understand basic concepts regarding blockchain but also to implement coding using R code to interact with the blockchain and manipulate that code. The authors described the implementation of a pilot program in a form of weekly instructional seminars that enabled faculty participants to familiarise themselves with blockchain and coding with the support of instructors through scaffolding techniques. The blockchain module was implemented into the existing course for Master of accountancy students. Authors suggested using blockchain code in accounting education and emphasised that education should be "a coaching relationship rather than as a one-sided lecture" (p. 287). After completing the course students were familiarised with the blockchain and were able to alter the instructor's code regarding the altered objective. Before the class, students reported little understanding of basic blockchain concepts and after the class, the great majority of students reported that they have expanded understanding and "the lecture and coding helped in that understanding" (p. 286). Kaden et al. (2021) point out three suggestions based on their case: a pilot program that can identify potential problems and technical issues before implementation of the course, student engagement in the form of group-based work and greater instructors' involvement in the student exercises through scaffolded techniques.

4. Conclusion

Results of the research and the academic debates undoubtedly show that there is a need for including blockchain education into accounting curricula. Accounting education has been criticised for not being adaptable to changes which have a great impact on the skills of accounting graduates. Information technology should be an indispensable part of accounting curricula and disruptive technology should also find its way into accounting programs. Blockchain technology in accounting practice has yet not fully evolved but accounting students have to be familiarised with that topic. According to the analyses of recent research on this topic conducted in this paper there are various solutions on how to include blockchain education into accounting programs, as stand-alone subjects or as a part of an already existing course. There are several common conclusions that can be drawn from analyses of recent papers: (1) topics relating to blockchain technology should not be technical since accounting students usually don't have programming knowledge; (2) blockchain usefulness and implications for accounting profession should be clearly presented; (3) scaffolding techniques are acceptable strategy when introducing concepts and terms related to blockchain technology; (4) students should be actively and constructively engaged in learning through working in teams and case studying. Blockchain education in accounting programs should be student-centred with the support from accounting educators who are challenged to tackle the technical nature of blockchain technology.

References

AACSB (2022) "2022 Standards for accounting accreditation- July 1, 2022 update", [online], https://www.aacsb.edu/-/media/documents/accreditation/accounting/standards-and-tables/accounting2018standards-july-1-2022.pdf?rev=891ebab92006453194780762b26d5c47andhash=D316ACA43EA3BA28CDB5C4DB005AA00C

Al-Htaybat, K. A., Alberti-Alhtaybat, L. and Alhatabat, Z. (2018) "Educating digital natives for the future: accounting educators' evaluation of the accounting curriculum", *Accounting Education* 27(4), pp.333-357.

American Institute of CPAs (AICPA) and National Association of State Boards of Accountancy (NASBA) (2021a) "CPA Evolution Model Curriculum", [online], https://thiswaytocpa.com/collectedmedia/files/cpa-evolution-model-curriculum-update.pdf

American Institute of CPAs (AICPA) and National Association of State Boards of Accountancy (NASBA) (2021b) "Accounting program curriculum gap analysis", [online], https://evolutionofcpa.org/Documents/Accounting%20Program%20Curriculum%20Gap%20Analysis%20Report%203.15.2021.pdf

Barišić, I., Novak, A. and Sever Mališ, S. (2020) "Professional accountant of today - analysis of essential competency requirements", Proceedings of FEB Zagreb 11th International Odyssey Conference on Economics and Business June 16-20, 2020 Croatia, Faculty of Economics and Business University of Zagreb, Vol.2 No.1 pp.1-886 June 2020, pp. 1-14.

Bellucci, M., Cesa Bianchi, D. and Manetti, G. (2022) "Blockchain in accounting practice and research: systematic literature review", *Meditari Accountancy Research*, Vol. 30, No. 7, pp. 121-146.

Bonsón, E. and Bednárová, M. (2019) "Blockchain and its implications for accounting and auditing", *Meditari Accountancy Research*, Volume 5, pp. 725-740.

Bui, B. and Porter, B. (2010) The Expectation-Performance Gap in Accounting Education: An Exploratory Study. Accounting Education Volume 19, 2010 - Issue 1-2: Generic Skills, pp.23-50.

Coyne, J. G. and McMickle, P. L. (2017) "Can Blockchains Serve an Accounting Purpose*?", Journal of Emerging Technologies in Accounting*, Vol. 14, Issue 2, pp. 101–111.

CPA Canada and AICPA (the Chartered Professional Accountants of Canada and the American Institute of CPAs (2017) „Blockchain Technology and Its Potential Impact on the Audit and Assurance Profession", Deloitte, [online], https://www.cpacanada.ca/en/business-and-accounting-resources/audit-and-assurance/canadian-auditing-standards-cas/publications/impact-of-blockchain-on-audit

Dai, J. and Vasarhelyi, M. A. (2017) "Toward Blockchain-Based Accounting and Assurance", *Journal of information systems*, Vol. 31, No. 3, Fall, pp. 5–21.

Fuller, S. H. and Markelevich, A. (2020) "Should accountants care about blockchain?", *Journal of* Corporate *Accounting and Finance*, Vol. 31, Issue 2, pp. 34-46.

Garanina, T., Ranta, M. and Dumay, J. (2021) "Blockchain in accounting research: current trends and emerging topics" *Accounting, Auditing and Accountability Journal*, Volume ahead-of-print, pp. 1-27.

ICAEW (2018) "Blockchain and the future of accountancy", ICAEW IT Faculty, [online], https://www.icaew.com/-/media/corporate/files/technical/technology/thought-leadership/blockchain-and-the-future-of-accountancy.ashx

International Accounting Education Standards Board (IAESB) (2018) "Information and communications technology literature review", [online], https://www.ifac.org/system/files/publications/files/IAESB-Information-Communications-Technology-Literature-Review.pdf

Kaden, S. R., Lingwall, J. W., and Shonhiwa, T. T. (2021) "Teaching Blockchain through Coding: Educating the Future Accounting Professional", *Issues in Accounting Education*, November 2021, 36 (4), pp. 281-290.

Kotb, A., Abdel-Kader, M., Allam, A., Halabi, H. and Franklin, E. (2019) "Information technology in the British and Irish undergraduate accounting degrees", *Accounting Education*, 28(5), pp. 445-464.

KPMG, Forbes Insight (2017) "Audit 2025: the future is now. Forbes Insights", [online], https://assets.kpmg/content/dam/kpmg/us/pdf/2017/03/us-audit-2025-final-report.pdf

Lawson, R. and Blocher, E., Brewer, P., Cokins, G., Sorensen, J., Stout, D., Sundem, G., Wolcott, S.and Wouters, M. (2013) "Focusing Accounting Curricula on Students' Long-Run Careers: Recommendations for an Integrated Competency-Based Framework for Accounting Education", *Issues in Accounting Education*, Vol. 29, No. 2, pp. 295–317.

Marr, B. (2020) "Biggest Technology Trends In Accounting And Finance", [online], Forbes, https://www.forbes.com/sites/bernardmarr/2020/07/27/the-6-biggest-technology-trends-in-accounting-and-finance/?sh=7248d7073c7e

Marshall, P. D. et al. (2010) "The Accounting Education Gap: Faculty perspectives", *The CPA Journal*, 80(60), pp. 6-10.

Moll, J. and Yigitbasioglu, O. (2019) "The role of internet-related technologies in shaping the work of accountants: New directions for accounting research", *The British Accounting Review*, *51*(6), https://eprints.qut.edu.au/128841/

Nakamoto, S. (2009) "Bitcoin: A peer-to-peer electronic cash system", [online], https://bitcoin.org/bitcoin.pdf

Novak, A., Barišić, I. i Mamić Sačer, I. (2021) "Edukacija o informacijskim tehnologijama u računovodstvu - analiza na području visokog školstva odabranih europskih zemalja", *Ekonomska misao i praksa*, Vol. 30, No. 1, pp. 243-265.

Pimentel, E. and Boulianne, E. (2020) "Blockchain in Accounting Research and Practice: Current Trends and Future Opportunities", *Accounting Perspectives*, Vol. 19, No. 4, pp. 325-361.

PWC (2019) "Elevating internal audit's role: The digitally fit function. State of the Internal Audit Profession Study", [online], https://www.pwc.com/sg/en/publications/assets/state-of-the-internal-audit-2019.pdf

Qasim, A. and Kharbat, F. (2019) "Blockchain Technology, Business Data Analytics, and Artificial Intelligence: Use in the Accounting Profession and Ideas for Inclusion into the Accounting Curriculum", *Journal of Emerging Technologies in Accounting*, Vol. 17, No. 1, pp. 107–117.

Schmitz, J. and Leoni, G. (2019) „Accounting and Auditing at the Time of Blockchain Technology: A Research Agenda", *Australian Accounting Review*, Vol. 00, No. 00, pp. 1-12

Stern, M. and Reinstein, A. (2021) "A blockchain course for accounting and other business students", *Journal of Accounting Education*, Volume 56, 2021, 100742, ISSN 0748-5751.

Stratopoulos, T. C. (2020) "Teaching Blockchain to Accounting Students", *Journal of Emerging Technologies in Accounting*, September 2020, 17 (2), pp. 63-74.

Vasarhelyi, M. (2014) "AIS as a Facilitator of Accounting Change: Technology, Practice, and Education" *Journal of Information Systems*", Vol. 28, No. 2, pp. 1-15.

Wang, T. (2021) "The impact of emerging technologies on accounting curriculum and the accounting profession", *Pacific Accounting Review*, Vol. 34 No. 4, 2022, pp. 526-535.

Webb, J. and Chaffer, C. (2016) "The expectation performance gap in accounting education: a review of generic skills development in UK accounting degrees", *Accounting Education*, 25(4), pp. 349-367.

SMEs Digitalisation Through Clustering, the Role of Open Innovation: A Research Agenda

Mirhiga Peter Okuwhere[1], Thanh Huynh, Cherisse Hoyte and Andrew Johnston
International Centre for Transformational Entrepreneurship (ICTE), Coventry University, UK
omomirhiga@gmail.com

Abstract: Clustering has been a widely pragmatic practice of small and medium enterprises (SMEs) for innovation during the last two decades. Though its application is complicated due to the challenges and issues in low and middle-income countries, it is expected that all SMEs will benefit from the unique learning and innovative opportunities in a cluster. A systematic review and research agenda on how open innovation in a cluster could stimulate digitalisation in SMEs has not been addressed. Hence, this study seeks to review existing literature on the role of clusters in fostering SMEs' digitalisation through open innovation practices. The research objectives are to examine SMEs' practice of open innovation, analyse the benefits and assess the intermediate role of a cluster for digitalisation within the context of SMEs. The paper aims to provide a framework for future research by presenting propositions. The methodology and approach for the study with a discussion on data extraction and synthesis were articulated. A comprehensive review of the literature to justify the approach was applied. A detailed inclusion and exclusion criteria were presented. Also, the selection process for assessing the articles was provided. This review scrutinised published peer-reviewed papers between January 2014 and December 2021. Findings from the reviewed papers show that cluster development will increase specialisation and divide labour among participating firms. It reveals the process of open innovation in SMEs' practice and the management of open innovation practice in SMEs. Also, it will improve collaboration, shared infrastructure, and knowledge sharing for increased market competitiveness. In addition, collaboration in a cluster will reduce the cost of SMEs' digitalisation, promote new firms, and reduce operational costs. Some beneficiaries of this research were highlighted. Finally, directions for future research with suggestions were comprehensively provided.

Keywords: collaboration, cluster, digitalisation, open innovation, small and medium enterprises, technology

1. Introduction

The global economy is gradually moving from natural resources to technology. No economy solely relies on oil, gold or silver in today's evolving world. Technology is derived from knowledge and is the current most thriving commodity. Without technology, there will be no innovation or digitalisation. The use of digital technology and applications to improve existing firm processes, develop business models that will enhance employee effectiveness, boost customer experience, and provide new commodities to the public is described as digital innovation (Warner and Wäger 2019). Digital technologies would aid the digitalisation of small and medium enterprises (SMEs) by adjusting to modern business reality. (Ricci, Battaglia, and Neirotti 2021).

Extant literature is replete with the relationship between SMEs innovation and clusters (Gomezelj 2016; Hunt and Kiefer 2017; Kim and Shim 2018; Turkina and van Assche 2018; Chen, Zhang, and Fu 2019). However, most of these studies focused on how businesses within clusters encourage innovation among themselves. For instance, Kim and Shim (2018) assert that knowledge sharing is classified among businesses within clusters. Clustered businesses are more imaginative than geographically scattered ones (Belso-Martínez, Mas-Tur, and Roig-Tierno 2016). Clusters promote both innovation and growth in SMEs (Mudambi et al., 2017).

Therefore, our contribution to existing studies on the role of a cluster in SMEs' digitalisation is to uncover the external influence using open innovation (OI). Likewise, we will contribute to the body of knowledge by revealing the intermediate role of clusters in SMEs' digitalisation through the adoption of OI. Helpful guidance for future research in this promising and unique field will be provided to interested scholars. According to Sahut, Iandoli, and Teulon (2021), SMEs' digitalisation is enhanced by collaboration with a diverse range of technology partners located at greater distances from the businesses. Ben Arfi and Hikkerova (2021) reveal that OI activities such as cooperation and information sharing with partners substantially influence the ability of SMEs to innovate and grow. Nevertheless, their implementation frequently necessitates a significant restructuring of the business model. Many SMEs lack the resources to deal effectively due to a scarcity of human, financial, and managerial resources. In actuality, SMEs may be less able to adequately analyse the advantages and costs of these new technologies and plan and execute their successful adoption (Yunis, Tarhini, and Kassar 2018). SMEs might

[1]Corresponding author

overcome this shortage by leveraging their external networks through OI, encouraging embracing digital innovation technology (Nambisan, Wright, and Feldman, 2019). The role of the external partners could range from raising awareness of the advantages of digital innovation technologies to offering appropriate information and implementation support that would help to lessen scepticism about investing in these technologies (Crupi et al. 2020). Clustering has garnered a great deal of attention as a strategy for increasing the innovation and competitiveness of SMEs seeking to take advantage of OI. Consequently, our paper aims to answer the following research questions: what are the OI practices of SMEs? And what is the input of clusters to SMEs' digitalisation through the adoption of OI?

2. Theoretical framework

Social Capital Theory

Pillai et al. (2017) reveal that social capital is a necessary prerequisite for the quest for supplementary knowledge. The social networks underpin learning processes in which organisations seek and employ new information. Many studies have also shown that firms are embedding inside their network of interactions to develop the business learning potential (Evans et al., 2017; Najafi-Tavani et al., 2018; Wang et al., 2018). Through resource sharing, collaboration, and adaptability, an inherent logic of exchange enhances a firm's economic and innovative success. As a result, the firm's success is greatly influenced by the networks of ties it maintains outside of the business (Leenders and Dolfsma 2016). Turkina and van Assche (2018) affirm that social capital theory promotes the formation of clusters that assist businesses in connecting with suppliers and other partners to obtain complementary or interdependent resources and enhance their learning capabilities that could generate innovation. Firms form clusters and alliances not just to get access to new resources but also to learn how to maximise the value of their existing resources (Delgado, Porter, and Stern 2014). A learning network fosters open innovation by encouraging the generation of new ideas, creativity, and efficacy in developing unique processes, products, and patents (Lauritzen and Karafyllia, 2019). Learning through social capital could promote innovation rather than a single firm working alone (Martínez-Pérez, García-Villaverde, and Elche 2016).

Clusters are the structural component of social capital, facilitating face-to-face interactions and promoting information transfer, tacit knowledge and creativity (García-Villaverde, Parra-Requena, and Molina-Morales 2018). SMEs located in clusters benefit from the social capital network and have a high innovation potential (Kim and Shim 2018). The social capital process is particularly critical for clustered firms (Ritala and Stefan, 2021).

3. Research methodology

This comprehensive literature review aims to critically examine research results from selected literature and summarise articles using systematic techniques (Snyder 2019). The study approach and procedures are thoroughly detailed in this section. It starts with a discussion of the study's research topic and concludes with data extraction and synthesis for its goal. Also, the justification for using a systematic literature approach and data gathering techniques are detailed.

Search strategy

For the study, the identification of keywords was based on the authors' prior experience, an initial assessment of the literature, and brainstorming sessions. Identified keywords include "SMEs," "small businesses," "open innovation," "cluster," "business cluster", "open innovation," etc. These keywords were then organised into search strings: [*open innovation* AND *small and medium-sized enterprises* OR *SMEs* OR *small businesses* *business cluster*]. Scopus and web of science were consulted as the search database for this study.

Table 1: Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
1. Studies that look at the strategic alliance, collaboration and partnership as a tool or source of innovation for innovative SMEs. 2. Studies focusing on OI that consider SMEs as their point of analysis or vice versa 3. Only journal articles, books, and book chapters were taken into account	1. Sources of evidence that do not match study objective. 2. Sources of evidence not written in Englis 3. Source of evidence requires payment access

To guide our assessment for inclusion, we considered collaboration and partnership as a tool or source of innovation; research that focused on OI and used SMEs as their point of analysis or vice versa and journal articles and books. While for the exclusion, we removed sources of evidence that did not match the research; we did not use papers not written in the English language and sources of data that did not match the topic.

Study selection process

The initial database search yielded over 32,000 results, of which we removed duplicated articles. The sources of evidence were limited to recent origin (January 2014 to December 2021) because these papers reflect the newest knowledge on the roles of a cluster for SMEs' Digital Innovation through Open Innovation. After customising the date range and removing irrelevant materials, the papers available for the title and abstract screening were 1,356. The titles and abstracts were then screened for the first selection of eligible articles. Nine hundred twenty-three articles were excluded based on duplicate, title and abstract screening. The full-text screening was done for the second selection of relevant articles based on inclusion and exclusion criteria. Thirty-seven articles were eligible for full-text review, and these thirty-seven papers were used for the systematic literature review.

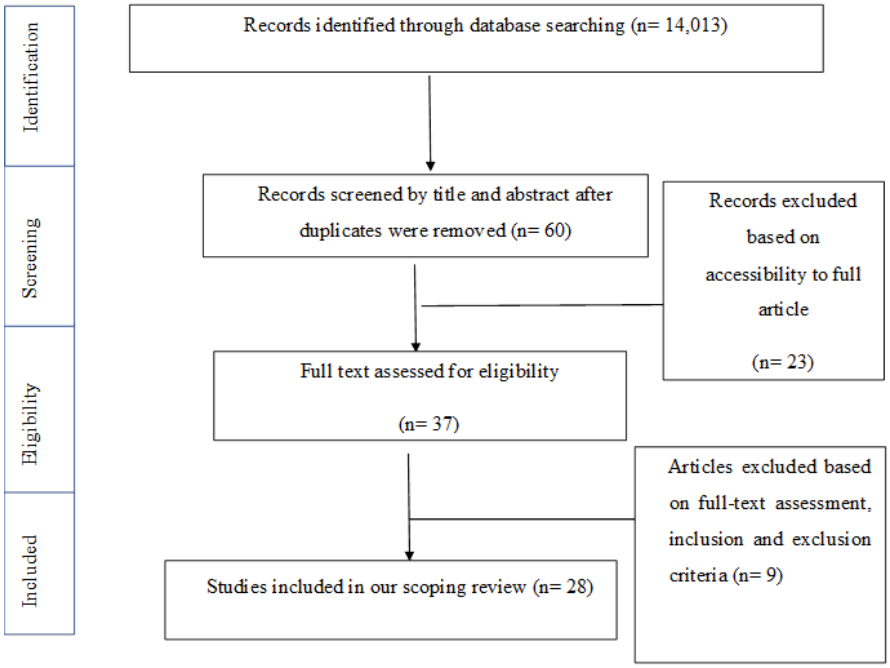


Figure 1: Prisma flow chart of the studies identification and selection process

We assessed the number of articles that overtly discussed OI, cluster and digitalisation within the context of SMEs. As presented in table 2, the papers evaluated either separately or two of the variables together. Though there has been increased research around this area, none of the articles attempted to research the combination of OI, cluster and SMEs digitalisation. The publication inclination proposes that this would be an exciting area of research for scholars.

Also, we evaluated journals on this research area and found the following: Journal of Small Business Management (n = 4), Journal of Business Research (n = 4), Research Policy (n = 3), Small Business Economics (n = 2), Entrepreneurship & Regional Development (n = 2), International Journal of Contemporary Hospitality Management (n = 2), Strategic Entrepreneurship Journal (n = 1), Journal of Product Innovation Management (n = 1), Industry and Innovation (n =1), R & D Management (n = 1), World Development (n= 1), Entrepreneurship Theory and Practice (n = 1), Journal of Travel Research (n = 1), Journal of Business Venturing (n = 1), Journal of International Business Studies (n= 1), Long Range Planning (n = 1) and IEEE Transactions on Engineering Management (n = 1)

Table 2: Journals used for the study

Journal Name	#	Author's name
Journal of Small Business Management	4	Brunswicker and Vanhaverbeke (2015), Chang and Webster (2018); Taura and Radicic (2019); Aliasghar et al., (2020)
Journal of Business Research	4	Eller et al., (2020); Fossen and Sorgner (2021); Matarazzo et al., (2021); Shao and Sun (2021)
Research Policy	3	Delgado, Porter, and Stern (2014); Hervas-Olivera, Lleoa, Cervello (2017), Chen, Zhang, and Fu (2019)
Small Business Economics	2	Ben Arfi and Hikkerova (2021); Sahut, Iandoli. and Teulon, (2021)
Entrepreneurship & Regional Development	2	García-Villaverde, Parra-Requena, and Molina-Morales (2017); Bliemel et al., (2019)
International Journal of Contemporary Hospitality Management	2	Martínez-Pérez., García-Villaverde, and Elche, (2016); Kim and Shim (2017)
Strategic Entrepreneurship Journal	1	Autio et al., (2018)
Journal Product Innovation Management	1	Baker, Grinstein, and Harmancioglu (2016)
Industry and innovation	1	Cassetta et al., (2020)
R & D Management	1	Denicolai, Ramirez, and Tidd (2014)
World Development	1	Gebreeyesus and Pierre (2013)
Entrepreneurship Theory and Practice	1	George, Merrill and Schillebeeckx (2021)
Journal of Travel Research	1	Martínez-Pérez et al., (2019)
Journal of Business Venturing	1	Luo et al., (2020)
Journal of International Business Studies	1	Turkina and Van Assche, (2018)
Long Range Planning	1	Warner and Wäger, (2019).
IEEE transactions on engineering management	1	Woods, Galbraith, and Hewitt-Dundas, (2019)

4. Results

The outcomes of the systematic revealed the following

Open innovation practices of SMEs

Studies such as Autio et al. (2018) suggest that entrepreneurial ecosystems could vary from traditional clusters. They highlighted the advantage of digital exploitation for organisations' entrepreneurial opportunities (EO) in searching and redesigning their business model. EO can be spur through voluntary horizontal knowledge spillovers by cluster-external locus. Baker, Grinstein, and Harmancioglu (2016) affirm that external networks benefit SMEs with weak EO and boost their innovative performance more than those with solid EO. In recent years, research on OI practices in SMEs has extended and stirred increasing attention. Although the importance of knowledge conversion through OI within businesses was identified (Leckel, Veilleux, and Dana 2020), the growing literature on OI emphasises the role of inbound knowledge sources for SMEs' digitalisation (Lauritzen and Karafyllia 2019; Nambisan, Siegel, and Kenney 2018; Flor, Oltra-Mestre, and Sanjurjo 2019). Also, studies by Nambisan, Wright, and Feldman (2019); Taura and Radicic (2019); North, Aramburu, and Lorenzo (2020) have also shown that e-business digital technologies help in internationalisation. In comparison, scholars such as Turkina and van Assche (2018), Urzelai and Puig (2019), and Luo et al. (2020) explored the opportunities provided by clusters for SMEs to develop digital technology and sustain development. In particular, some of these researches have suggestions that can contribute to and accelerate SMEs' start-up and infrastructural growth.

Management of Open innovation practices of SMEs

Some authors noted that OI might be used as a new paradigm for managing innovation in SMEs (Brunswicker and Vanhaverbeke 2015; Torchia and Calabrò 2019; Woods, Galbraith, and Hewitt-Dundas 2022). However, (Luo et al. 2020) assert that the factor affecting the adoption of OI in SMEs varies. Still, they are mostly related to SMEs' restricted access to external resources and the limited amount of technical assets they may offer for sale to potential customers. A lack of financial resources prevents SMEs from gathering critical information and knowledge and selecting partners with whom to collaborate (Taura and Radicic, 2019). As a result of their lack of access to extensive knowledge repositories, their ability to absorb new information is severely limited (Bliemel et al., 2019). This ability to recognise, grip, and use external information is described as the OI practice of the firm (Torchia and Calabrò, 2019). It contrasts with larger enterprises, which can easily monitor their surroundings and identify potential partners quickly due to their strategic position, colossal capital or asset base (Papa et al., 2021).

Proposition 1: OI is significantly beneficial to SMEs

According to our sample of articles, the advantages of OI adoption for SMEs have been well investigated (Luo et al., 2020; Taura and Radicic, 2019). When it comes to enjoying the benefits of openness, SMEs have shown to be more effective than big corporations (Martínez-Pérez et al., 2019). Businesses in the SME sector that successful OI attempts have more experience experimenting with and deploying OI approaches at both the firm and project levels than their less successful competitors (Urzelai and Puig 2019). Moreover, such successful SMEs make better use of the available resources (Luo et al., 2020). In addition, organisational characteristics have contributed to forming an OI culture and the expansion of SMEs' capacity for innovation (Sahut, Iandoli, and Teulon 2021. For the most part, SMEs who participate in OI are trailblazers rather than laggards in their field (Naqshbandi 2018).

Proposition 2: Cluster as a catalyst for SMEs digitalisation through OI

SMEs often accept just a few technologies, such as cloud computing, while others, such as autonomous robotics, horizontal and vertical system integration, and the Industrial Internet of things, are still in the early phases of adoption (Gebreeyesus and Mohnen 2013). These technologies involve a more radical restructuring of SMEs, demanding the acquisition of particular skills and the development of competencies that many enterprises lack (Zangiacomi et al., 2020). To develop these resources, SMEs would increase their network of external partners and form clusters of cooperation with these actors, as this would be pursuing in-depth collaboration (Ahn et al. 2019). Collaborating with competitors helps firms access technical skills that would be costly to develop and time-consuming if they should do it alone (Cozzolino and Rothaermel 2018).

Proposition 3: The intermediate role of clusters in SME digitalisation

Studies showed that innovation intermediates might assist SMEs in more easily developing OI procedures in clusters (Bayona-Saez et al. 2017; Figueiredo and Piana 2018; Flor, Oltra-Mestre, and Sanjurjo 2019; Guertler and Sick 2021; Shao and Sun 2021). As an innovation intermediary, a cluster facilitates technology transfer between businesses and universities by providing access to scientific and technical resources for innovation and a vast face-to-face network of collaborators (Squicciarini 2017). These intermediaries perform three basic tasks: connecting persons, cooperating or supporting one another, and offering technical services. Connect actions include the production of network databases, the building of networks, and the administration of networks (Squicciarini 2017). Cooperate or support activities comprise knowledge sharing, healthy competition, and direct or indirect collaboration (Shao and Sun 2021). In contrast, technical services enable innovation to thrive (van Oorschot, Hofman, and Halman 2018).

Theoretical Implications

The link between OI and digitalisation is currently understudied, even though environmental factors may influence both (Kurnia et al., 2015). Scholars like Dunne et al. (2016), Prajogo (2016); Prasad and Junni (2016); Barasa et al. (2017), and Wang et al. (2020) have studied how innovation is greatly influenced by the environment in which the business operates. Some specific variables, such as the amount of research and development, the type of goods, and technical expertise, have been shown to influence SMEs' decisions in adopting digitalisation (Cassetta et al., 2019; Fossen and Sorgner, 2021; Pappas et al., 2021). SMEs in low-tech sectors, in particular, should adjust their business models more dramatically than SMEs in high-tech industries

to incorporate digital innovation technology (George, Merrill, and Schillebeeckx 2021). Since their workers' technical skills are limited, low-tech SMEs face more implementation challenges. They usually operate in a less dynamic setting, and their managers are more resistant to change (Eller et al., 2020). As a result, collaboration with other organisations may be crucial for SMEs in low-tech sectors. Still, its impact on the adoption of digital innovation technologies is less clear, as their poor absorptive capacity may restrict their ability to grip new information (Thomä and Zimmermann 2020). The diagram below depicts how clusters could stimulate digitalisation in SMEs through OI.

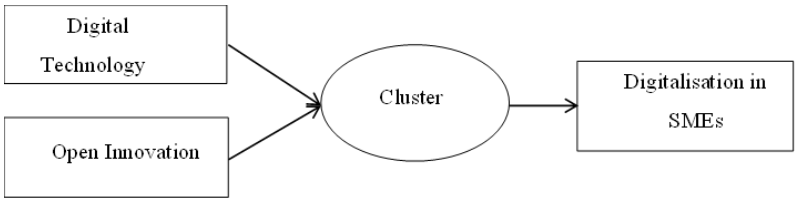


Figure 2: How cluster could stimulate SMEs' digitalisation

Clusters have an impact on the successful application of OI for SME digitalisation. According to Denicolai, Ramirez, and Tidd (2014), high-tech and low-tech businesses provide various settings for knowledge generation and exchange, resulting in differing degrees of OI. The degree of complexity in industrial knowledge bases influences the link between OI and firm success. The knowledge-sharing process and creation can be affected by the level of R&D, healthy competition sources, and failure risk (Woods, Galbraith, and Hewitt-Dundas 2022). These elements could impact SMEs' willingness and ability to embrace external partners through OI based on extensive or intensive connections (Aliasghar, Sadeghi, and Rose, 2020). We intend to fill a vacuum in the literature by studying the moderating role of clusters on SMEs' digital innovation by adopting OI. In the illustration in figure 1 above, we propose that cluster has a beneficial influence on SMEs' adoption of digital innovation through OI. In the subsequent sections, we further addressed this. Finally, we propose that SME clustering has a distinct intermediary between OI and digitalisation.

Our findings would be relevant to members of business boards of directors, chief executive officers (CEOs) and captains of industries. It may inspire the various tiers of government to formulate policies that will directly or indirectly support clusters development and promote SMEs' digitalisation through OI, as shown by our findings. Furthermore, cluster administrators should focus more on collaborative activities, which are critical to the advancement of digitalisation. They may also utilise their office to persuade those in leadership authority to allocate more funds to OI initiatives in budgetary allocations. Also, additional resources to boost OI in clusters by leveraging collaboration with universities and research institutions should be encouraged. Stakeholders and intending entrepreneurs interested in gaining a better grasp of how cluster governance could support OI may treasure our findings. Similarly, our results would help entrepreneurs be more aware of the advantages of involving themselves in OI and the need to increase their creative skills.

5. Further research

Future research should concentrate on an empirical examination of the propositions presented in this study to generalise the findings. Hence, there is a need to empirically authenticate the recommendations that OI is significantly beneficial to SMEs. Cluster as a catalyst for SMEs' digitalisation through OI. And the intermediate role of clusters in SME digitalisation. There is also a need for a wider variety of clusters and a quantitative approach. The interplay between entrepreneur innovation strategies, governance processes, and inventive performance should focus on more research in the future. Subsequently, from our findings, more entrepreneurs may decide to participate in collaborative initiatives to spur innovation and raise their value creation. As a result of their efforts, members of cluster governance may be persuaded to alter their practices and put a greater emphasis on facilitating cooperation.

6. Limitation of the study

Even though this study would be a source of inspiration to researchers in SMEs digitalisation, cluster and open innovation, it does have some limitations. Firstly we provided a comprehensive review of thirty-seven articles published between 2014 and 2021. However, we imply that researchers test any of our propositions using tools like causality test or structural equation modelling. Secondly, this study could not outline observations and reports because it only used empirical studies and literature reviews.

References

Ahn, J.M., Roijakkers, N., Fini, R., and Mortara, L. (2019) "Leveraging Open Innovation to Improve Society: Past Achievements and Future Trajectories". R&D Management [online] 49 (3), 267–278. available from <https://onlinelibrary.wiley.com/doi/full/10.1111/radm.12373> [12 April 2022]

Aliasghar, O., Sadeghi, A., and Rose, E.L. (2020) Process Innovation in Small-and Medium-Sized Enterprises: The Critical Roles of External Knowledge Sourcing and Absorptive Capacity. [online] available from <https://www.tandfonline.com/action/journalInformation?journalCode=ujbm20>

ben Arfi, W. and Hikkerova, L. (2019) "Corporate Entrepreneurship, Product Innovation, and Knowledge Conversion: The Role of Digital Platforms". Small Business Economics 2019 56:3 [online] 56 (3), 1191–1204. available from <https://link.springer.com/article/10.1007/s11187-019-00262-6> [10 April 2022]

Autio, E., Nambisan, S., Llewellyn, |, Thomas, D.W., and Wright, M. (2017) Digital Affordances, Spatial Affordances, and the Genesis of Entrepreneurial Ecosystems.

Baker, W.E., Grinstein, A., and Harmancioglu, N. (2016) "Whose Innovation Performance Benefits More from External Networks: Entrepreneurial or Conservative Firms". Journal of Product Innovation Management 33 (1), 104–120

Barasa, L., Knoben, J., Vermeulen, P., Kimuyu, P., and Kinyanjui, B. (2017) "Institutions, Resources and Innovation in East Africa: A Firm Level Approach". Research Policy [online] 46 (1), 280–291. available from <http://creativecommons.org/licenses/by/4.0/> [12 April 2022]

Belso-Martínez, J.A., Mas-Tur, A., and Roig-Tierno, N. (2016) "Synergistic Effects and the Co-Existence of Networks in Clusters". Https://Doi.Org/10.1080/08985626.2016.1255429 [online] 29 (1–2), 137–154. available from <https://www.tandfonline.com/doi/abs/10.1080/08985626.2016.1255429> [10 April 2022]

Cassetta, E., Monarca, U., Dileo, I., di Berardino, C., and Pini, M. (2019) Industry and Innovation The Relationship between Digital Technologies and Internationalisation. Evidence from Italian SMEs The Relationship between Digital Technologies and Internationalisation. Evidence from Italian SMEs. [online] available from <https://www.tandfonline.com/action/journalInformation?journalCode=ciai20>

Chen, K., Zhang, Y., and Fu, X. (2019) "International Research Collaboration: An Emerging Domain of Innovation Studies?" Research Policy 48 (1), 149–168

Cozzolino, A., Journal, F.R.-S.M., and 2018, undefined (2018) "Discontinuities, Competition, and Cooperation: Coopetitive Dynamics between Incumbents and Entrants". Wiley Online Library [online] 39 (12), 3053–3085. available from <https://onlinelibrary.wiley.com/doi/abs/10.1002/smj.2776> [12 April 2022]

Crupi, A., del Sarto, N., di Minin, A., Gregori, G.L., Lepore, D., Marinelli, L., and Spigarelli, F. (2020) "The Digital Transformation of SMEs – a New Knowledge Broker Called the Digital Innovation Hub". Journal of Knowledge Management 24 (6), 1263–1288

Delgado, M., Porter, M.E., and Stern, S. (2014) “Clusters, Convergence, and Economic Performance”. Research Policy 43 (10), 1785–1799

Denicolai, S., Ramirez, M., and Tidd, J. (2014) "Creating and Capturing Value from External Knowledge: The Moderating Role of Knowledge Intensity". R&D Management [online] 44 (3), 248–264. available from <https://onlinelibrary.wiley.com/doi/full/10.1111/radm.12065> [12 April 2022]

Dragsdahl Lauritzen, G. and Karafyllia, M. (2019) "Perspective: Leveraging Open Innovation through Paradox". Journal of Product Innovation Management [online] 36 (1), 107–121. available from <https://onlinelibrary.wiley.com/doi/full/10.1111/jpim.12474> [11 April 2022]

Dunne, T.C., Aaron, J.R., McDowell, W.C., Urban, DJ, and Geho, P.R. (2016) "The Impact of Leadership on Small Business Innovativeness". Journal of Business Research 69 (11), 4876–4881

Economics, D.P.-I. journal of production and 2016, undefined (2015) "The Strategic Fit between Innovation Strategies and Business Environment in Delivering Business Performance". Elsevier [online] available from <https://www.sciencedirect.com/science/article/pii/S0925527315003114> [12 April 2022]

Eller, R., Alford, P., Kallmünzer, A., and Peters, M. (2020) Antecedents, Consequences, and Challenges of Small and Medium-Sized Enterprise Digitalization ☆. [online] available from <https://doi.org/10.1016/j.jbusres.2020.03.004>

Evans, S., Vladimirova, D., Holgado, M., Fossen, K. van, Yang, M., Silva, E.A., and Barlow, C.Y. (2017) Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models.

Flor, M., … M.O.-M.-I.T. on, and 2019, undefined (2019) "An Analysis of Open Innovation Strategies in Firms in Low and Medium Technology Industries". Ieeexplore.Ieee.Org [online] available from <https://ieeexplore.ieee.org/abstract/document/8716590/> [11 April 2022]

Fossen, F.M. and Sorgner, A. (2021) “Digitalisation of Work and Entry into Entrepreneurship”. Journal of Business Research 125, 548–563

García-Villaverde, P.M., Parra-Requena, G., and Molina-Morales, F.X. (2018) "Structural Social Capital and Knowledge Acquisition: Implications of Cluster Membership". Entrepreneurship and Regional Development 30 (5–6), 530–561

Gebreeyesus, M., Development, P.M.-W., and 2013, undefined (n.d.) "Innovation Performance and Embeddedness in Networks: Evidence from the Ethiopian Footwear Cluster". Elsevier [online] available from <https://www.sciencedirect.com/science/article/pii/S0305750X12001519> [12 April 2022]

George, G., Merrill, R.K., and Schillebeeckx, S.J.D. (n.d.) Digital Sustainability and Entrepreneurship: How Digital Innovations Are Helping Tackle Climate Change and Sustainable Development.

Gomezelj, D.G. (2016) "A Systematic Review of Research on Innovation in Hospitality and Tourism". International Journal of Contemporary Hospitality Management 28 (3), 516–558

Hunt, R.A. and Kiefer, K. (2017) "The Entrepreneurship Industry: Influences of the Goods and Services Marketed to Entrepreneurs". Journal of Small Business Management [online] 55, 231–255. available from <https://doi.org/10.1111/jsbm.12329> [10 April 2022]

Kim, N. and Shim, C. (2018) "Social Capital, Knowledge Sharing and Innovation of Small- and Medium-Sized Enterprises in a Tourism Cluster". International Journal of Contemporary Hospitality Management 30 (6), 2417–2437

Kurnia, S., Choudrie, J., … R.M.-J. of B., and 2015, undefined (2015) "E-Commerce Technology Adoption: A Malaysian Grocery SME Retail Sector Study". Elsevier [online] 68 (9), 1906–1918. available from <https://www.sciencedirect.com/science/article/pii/S0148296314004251> [12 April 2022]

Leckel, A., Veilleux, S., and Dana, L.P. (2020) "Local Open Innovation: A Means for Public Policy to Increase Collaboration for Innovation in SMEs". Technological Forecasting and Social Change 153, 119891

Leenders, RTAJ and Dolfsma, W.A. (2016) "Social Networks for Innovation and New Product Development". Journal of Product Innovation Management 33 (2), 123–131

Luo, L., Ma, X., Makino, S., and Shinkle, G.A. (2020) "Cluster Status and New Venture Creation". Journal of Business Venturing 35 (5), 105985

Martínez-Pérez, Á., Elche, D., García-Villaverde, P.M., and Parra-Requena, G. (2019) "Cultural Tourism Clusters: Social Capital, Relations with Institutions, and Radical Innovation". Journal of Travel Research 58 (5), 793–807

Martínez-Pérez, Á., García-Villaverde, P.M., and Elche, D. (2016) "The Mediating Effect of Ambidextrous Knowledge Strategy between Social Capital and Innovation of Cultural Tourism Clusters Firms". International Journal of Contemporary Hospitality Management 28 (7), 1484–1507

Mudambi, R., Mudambi, S.M., Mukherjee, D., and Scalera, V.G. (2017) "Global Connectivity and the Evolution of Industrial Clusters: From Tires to Polymers in Northeast Ohio". Industrial Marketing Management 61, 20–29

Najafi-Tavani, S., Najafi-Tavani, Z., … P.N.-I. marketing, and 2018, undefined (n.d.) "How Collaborative Innovation Networks Affect New Product Performance: Product Innovation Capability, Process Innovation Capability, and Absorptive Capacity". Elsevier [online] available from <https://www.sciencedirect.com/science/article/pii/S0019850118301056> [11 April 2022]

Nambisan, S., Siegel, D., and Kenney, M. (2018) "On Open Innovation, Platforms, and Entrepreneurship". Strategic Entrepreneurship Journal 12 (3), 354–368

Nambisan, S., Wright, M., and Feldman, M. (2019) "The Digital Transformation of Innovation and Entrepreneurship: Progress, Challenges and Key Themes". Research Policy 48 (8), 103773

Naqshbandi, MM (2018) "Organisational Characteristics and Engagement in Open Innovation: Is There a Link?" : Https://Doi.Org/10.1177/0972150918757845 [online] 19 (3_suppl), S1–S20. available from <https://journals.sagepub.com/doi/abs/10.1177/0972150918757845> [12 April 2022]

North, K., Aramburu, N., and Lorenzo, O.J. (2020) "Promoting Digitally Enabled Growth in SMEs: A Framework Proposal". Journal of Enterprise Information Management 33 (1), 238–262

Pappas, N., Caputo, A., Pellegrini, M.M., Marzi, G., and Michopoulou, E. (2021) "The Complexity of Decision-Making Processes and IoT Adoption in Accommodation SMEs". Journal of Business Research 131, 573–583

Pillai, K.G., Hodgkinson, G.P., Kalyanaram, G., and Nair, S.R. (2017) "The Negative Effects of Social Capital in Organisations: A Review and Extension". International Journal of Management Reviews 19 (1), 97–124

Prasad, B. and Junni, P. (2016) "CEO Transformational and Transactional Leadership and Organizational Innovation: The Moderating Role of Environmental Dynamism". Management Decision 54 (7), 1542–1568

Ricci, R., Battaglia, D., and Neirotti, P. (2021) External Knowledge Search, Opportunity Recognition and Industry 4.0 Adoption in SMEs. [online] available from <https://doi.org/10.1016/j.ijpe.2021.108234>

How to Increase the Efficiency of Social Enterprises in Russia During the COVID-19 Pandemic?

Ruslan Pavlov
Central Economics and Mathematics Institute of the Russian Academy of Sciences, Moscow, Russia
pavlovru@mail.ru

Abstract: The paper considers the examples of economic activities of social enterprises during the COVID-19 pandemic. It is shown that often social enterprises are more effective than common enterprises in their responses to the processes caused by the COVID-19 pandemic. A model of interaction between different actors enhancing the efficiency of social enterprises in Russia by means of providing the continuous source of cashfrow is provided. At the macro-level of this model it's necessary to mention such institutions as the Ministry of Finance, because it is engaged in planning and controlling the process of public procurement activities, The Public Relations Committee, as it provides subsidies to nonprofit organizations and social enterprises based on the competition rules and the Public Chamber, as it is engaged in distributing the Presidential Grants to nonprofit organizations and social enterprises. The institutions that provide financial help to social enterprises in the range of 1 to 50 million rubles belong to the meso-level institutions in this model. They consist of the Moscow regional division of the All-Russian Popular Front, the charitable foundation KAF, the fund "Our Future" and the company Unilever. At the micro-level of this model there are two institutions: Impact Hub Moscow and Awesome Foundation. A contact should be set between these organizations to exchange the experience in the area of supporting social entrepreneurs and attracting the micro-grants of Awesome Foundation as the supplementary sources of support for the winners of the competition held by Impact Hub Moscow. This system should be balanced by setting direct contacts between each institution at the respective level so that it could enable these institutions to act effectively at each level of that model. First, we should conclude that these institutions should not act as isolated units. They should be implemented into the system of different actors supporting social enterprises, along with such potential investors as private sector companies and microfinance institutions. Second, these actors should interact in such manner that enables a cooperation between them. Conclusions refer to how these institutions should be arranged to make a system of interconnected units supporting social enterprises at three levels.

Keywords: social enterprise, COVID-19 pandemic, innovation, private sector.

1. Introduction

Nowadays the problems caused by the COVID-19 pandemic become very urgent, because almost all the sectors of national economies are influenced by this phenomenon. Social enterprises are often treated as efficient tools in the struggle against pandemic. It is sufficient to present just few examples concerning the role of social enterprises in the fight against COVID-19 to exemplify their ability to overcome the difficulties caused by this phenomenon.

So, for instance, now different reports suggest the distribution of counterfeit medications is on the rise, filling gaps in the market caused by production delays in India and China. Innovators that provide quality-assurance services can help providers and consumers validate the authenticity of essential goods. For example, the RxDelivered platform in Nigeria connects pharmacists and consumers to a network of licensed wholesalers and manufacturers, from which they batch-certify product quality prior to delivery. This social enterprise has reported a tenfold increase in week-on-week customers, which it attributes to a growing demand for authenticated masks and medication (Staples et al., 2020).

Another example is connected with the social enterprise Root Capital, which works in the most remote communities of Africa, Latin America, and Indonesia. Working with socially-minded enterprises across its global network, over the last several months this enterprise has been able to deliver services and much-needed supplies (face masks, soap, medicine, and more) to hundreds of thousands of rural families (Foote, 2020).

The third example is connected with Amazon Conservation Team, which is filling a public service vacuum in highly remote indigenous communities of the Amazon. Among other things, they are translating public health information into native languages and sharing it through radio and WhatsApp, channels that they know indigenous communities utilize. Social entrepreneurs are ready, able, and willing to reach underserved

groups—in many cases, they already have reach into these communities. By leveraging those connections, they can help flatten the disproportionate impacts of the pandemic.

The fourth example is connected with YouthBuild USA that tackles a systemic challenge: the estimated 4.5 million young adults aged 16-24 in America that were neither in work nor in school even before COVID-19 hit. Between February and June of 2020, the rate of "disconnected" youth (out of work and out of school) more than doubled making YouthBuild's work even more vital. According to John Valverde, YouthBuild USA's president and CEO, young people who graduated in 2008 during the Great Recession "were just starting to recover when COVID-19 hit." Projections already indicated that these youth had lost a third of their lifetime earning potential. Now, says Valverde, "not only will they be further set back, but young people graduating in 2020 will experience the same, if not worse, impacts. That's why YouthBuild has shifted its model to focus not just on building jobs and skills, but on the mental health and wellness of its students—and on creating strong community connections that can help young people weather the storm of COVID-19" (Foote, 2020).

The last example deals with Citizen Schools, another social enterprise focused on young adults, which is tackling the pandemic-related challenge of students' education and wellbeing in the age of distance learning. According to Emily McCann, CEO of Citizen Schools, "Citizen Schools is mobilizing volunteers to offer additional support to middle school students across the country in ways that are engaging, joyful, and skill building" (Foote, 2020). The organization's COVID-19-related innovations also include virtual "apprenticeships" in which students work with volunteers to solve authentic community problems in small groups; one-on-one and small group tutoring in English, math, and science; and Career Connection Conversations that allow students to indulge their curiosity and build their social network.

2. Who helped social enterprises in their struggle against COVID-19?

The COVID Response Alliance for Social Entrepreneurs was founded in April 2020 by 60 leading organizations to help mobilize support for social entrepreneurs and to raise awareness of the vital role they play during the crisis and beyond (COVID Response Alliance for Social Entrepreneurs, 2020). Here 6 cases concerning the role of members of the COVID Response Alliance for Social Entrepreneurs in the struggle of social enterprises against the COVID-19 pandemic will be considered.

The first case is connected with Family Independence Initiative (FII). Founded in 2001, FII provides families with direct cash transfers, a digital platform and peer groups to accelerate the exchange of financial and social capital in low-income communities across the USA. FII has collaborated with over 250 community-based organizations to help families escape the cycle of poverty. Through the GiveTogetherNow campaign and the UpTogether platform, FII raised over $100 million and provided direct cash transfers to over 100,000 low-income families who were struggling to make ends meet and to care for their loved one. The Alliance member involved into its activity was Schwab Foundation for Social Entrepreneurship. This organization is collating all the information that may be of use to social innovators from external sources, including access to financial support, access to legal resources and access to technology.

Another example is connected with Instituto Muda. Established in 2007, Instituto Muda provides recycling collection services in residential areas, companies and schools around São Paulo. It allocates more than 300 tons of recyclable materials per month to cooperatives that employ people living below the poverty line. During the COVID-19 pandemic Instituto Muda stepped in to provide the cooperatives not only with financial help to pay their workers to support their families, but also with a supply of masks, equipment and disinfectant gel. The Alliance member that was involved in this process was Yunus Social Business. This organization turns donations into investments in sustainable Social Businesses that provide employment, education, healthcare, safe water and clean energy to over 9 million people worldwide. As well as finance it provides growth support to help its Social Businesses create the most social impact possible.

The third example is connected with Praekelt, a mobile technology company that harnesses the power of communication between patients, health workers and the health system to ensure that patients are informed and empowered; health workers are supported and valued; and health system officials have the information they need to make informed and effective decisions to improve service delivery and quality. During the COVID-19 pandemic with countries and organizations experiencing a massive need for direct communication of reliable information, Praekelt partnered with the World Health Organization and WhatsApp to develop the

WHO's global public health WhatsApp information tool for citizens. In addition, 11 national health systems, primarily in Africa and South-East Asia, launched local versions of this service. These solutions provide citizens and health workers with reliable, up-to-date information and relevant services related to COVID-19 and are reaching over 20 million people in 20 languages worldwide. The Alliance member that was involved in this process was Johnson & Johnson. This company is delivering critical support for communities and health workers on the frontlines. In March 2020 the Johnson & Johnson Family of Companies and the Johnson & Johnson Foundation committed $50 million dollars to support frontline health workers—from meals to protective equipment, extra training to mental health. This commitment expands upon a $250 million multi-year commitment the company made earlier that year to support those at the frontlines guided by the Johnson & Johnson Center for Health Worker Innovation.

The fourth example is connected with Jan Sahas, a 20-year-old community organization working with excluded social groups on safe migration and workers' protection in 14,000 villages and urban areas in 57 districts in India. In response to COVID-19, Jan Sahas provided food to over 420,000 migrants, 11,000 personal protective equipment kits, and emergency transportation to 17,000 migrants and their families. It is now launching a grassroots-led collaboration with approximately 80 partners to ensure the safe, responsible recovery of migrant families and their livelihoods post-COVID. The Alliance member involved in this process is Ashoka that is helping small and medium-sized enterprises resist the economic effects of the crisis: using social media to promote businesses and advertise their services at a low cost and reach a new pool of potential clients.

The fifth example is connected with Eneza Education, which provides SMS-based learning to students who do not have access to a classroom or need additional support. In the wake of COVID-19-related school closures, Eneza Education leveraged strategic partnerships to open its platform without charge to learners in Kenya and Côte d'Ivoire, reaching 2.2 million learners who do not have steady access to the internet with its USSD/SMS-based learning resources. It has now launched its platform in Rwanda to serve users in that country. The Alliance member that was involved in that process was Sorenson Impact Foundation. It was founded by James Lee Sorenson, who was intrigued many years ago with the idea of finding market solutions to meet the needs of underserved communities and since then he has established the Sorenson Impact Foundation, which invests in scalable, innovative social entrepreneurs.

The last example is connected with Barefoot College Zanzibar, which is a joint venture set up in 2015 by Barefoot College and the Government of Zanzibar. Barefoot College Zanzibar has been training women solar engineers, women beekeepers and women seamstresses for five years. At the start of COVID-19, the Government of Zanzibar turned to Barefoot College to provide personal protective equipment to more than 70 communities on the island. Its community outreach team educated communities with the result that the incidence of community transmission was cut by more than 80%. The Alliance member that was involved in that process was Catalyst 2030. It is a special platform for redesigning the way of supporting social enterprises. It invites the funding community – including philanthropists, foundations, impact investors, corporate donors, government agencies, and multilateral organizations – to fundamentally rethink and redesign the way systems change approaches are being supported.

3. Why social entrepreneurs are needed now more than ever

Social entrepreneurs have been working to solve market failures and demonstrate sustainable models to build inclusive economies for years. These entrepreneurs bring vital products and services to those on the fringes of society, while acting as first responders during a crisis and sustain jobs and social security at a time, when the effects of losing one's income can be particularly devastating. Moreover, social enterprises typically create jobs for local people, resulting in direct and indirect impacts on the local supply chain and broader economy – all of which is viewed very positively in the current economic environment (Galbraith and Molinari, 2014).

The Schwab Foundation 2020 Report entitled "Two decades of Impact" demonstrates how its network of 400 leading social innovators and entrepreneurs alone have improved the lives of more than 622 million people in over 190 countries by protecting livelihoods, driving movements for social inclusion and environmental sustainability, and providing improved access to health, sanitation, education and energy (Schwab Foundation…, 2020).

When COVID-19 brought disarray to communities across the world, and social entrepreneurs everywhere instantly assumed first responder roles. From providing reliable information, services and care to the most vulnerable to developing community tracing initiatives or mental health support through mobile phones, the work of the social entrepreneurs became even more critical during the pandemic.

Over the last few months notable stories of social entrepreneurs who have gone above and beyond their regular mandates have emerged. Many chose to maintain jobs through the pandemic despite their halting businesses, while those in a position to do so provided last-mile support – for example by delivering essentials like masks and sanitizers to those unable to afford the bare minimum to keep themselves safe. Their existing relationships with low-income customers or beneficiaries and the trust they had built on the ground positioned them well as early responders to the pandemic.

The need for social entrepreneurs is clearer now than ever before. They are a crucial social safety net for our systemic inequalities and market failures. The social entrepreneurs who are "system change leaders" have an especially invaluable role to play in triggering a reset of today's markets and societies. They have managed to enable whole groups of society to become agents of their own change and have effectively managed to navigate the complex arrangements of institutions of power (COVID Response Alliance for Social Entrepreneurs, 2020).

Social entrepreneurs are uniquely positioned to represent a new yardstick for leaders in the 21st century. Their knowledge, experience and existing on-the-ground infrastructure can play a vital role in revitalizing the sustainable development agenda and building more inclusive, shockproof and resilient markets and societies.

Yet, many social entrepreneurs face significant and immediate operational and viability challenges and need backing. Significant capital and non-financial support are vital to put social entrepreneurs in a position to effectively protect the most vulnerable in the crisis and help shape the transition to a new social and economic reality.

4. What should be done to enhance the efficiency of social enterprises in Russia during the Covid-19 pandemic?

Here we should provide a model of possible interaction between different institutions supporting the development of social entrepreneurship in Russia. At the macro-level of this model we should mention such institutions as the Ministry of Finance as it is engaged in planning and controlling the process of public procurement execution, the Public Relations Committee of Moscow as it provides subsidies for non-profit organizations and social enterprises on a competitive basis and the Public Chamber of the Russian Federation as it is engaged in providing the Presidential grants for non-profit organizations and social enterprises on a competitive basis also. The nature of these institutions as macro-level ones can be explained by the scope of their activity: it should be the policy held by these institutions at the country level or at the Federation subject level.

The institutions that provide the financial aid to social enterprises in the range of 1 to 50 million rubles belong to the meso-level institutions. According to this criterion, we should refer the Moscow Regional Department of All-Russian Popular Front, the charity foundation KAF, the fund "Our Future" and the company "Unilever" to this group. So, for instance, the first of these organizations distributes grants among non-profit nongovernmental organizations, according to the dimensions determined in the President's decrees and orders. The amount of one grant for realizing a project is not more than 1 million rubles. The fund KAF is engaged in distributing grants among the winners of the competition "Creating possibilities", the participants of which apply for the projects aimed at creating and developing the possibilities to realize the potential among socially excluded people (retired people, adult people with disabilities on hearing and vision) or at increasing the availability of the environment. The fund "Our Future" is engaged in supporting social entrepreneurs, according to three dimensions: the All-Russian competition "Impetus of good", the All-Russian competition of projects "Social entrepreneur" and the competition "Direct investment into social entrepreneurship". The first of them presents the selection of winners for the contribution for development and promotion of social entrepreneurship. The total amount of the premium is not less than 1,6 million rubles. The second of them presents a competition among the representatives of small business solving some problems in the social area that need some funds to launch or to develop their project. The fund provides the

interest-free loan in the amount of 10 million rubles to them. Finally, the third of them presents acquiring a share in the charter capital of the company-winner of this competition at the sum of 50 million rubles (Tsygankov, 2019). The competition "Lipton Goodstarter" held by the company "Unilever" presents a choice of the most worthy among different socially useful projects that have a commercial potential. The winner gets a prize at the sum of 300 thousand rubles (Tsygankov, 2019). One should set a horizontal link between these institutions, and that means that these organizations should exchange experience in the field of expertise of socially valuable projects, and in the case of necessity they should set a system of mutual financing on the credit basis, and that would be very relevant in the period of crisis.

At the micro-level of this model there are two institutions: Impact Hub Moscow and Awesome Foundation. Impact Hub Moscow presents a platform for establishing contacts between social entrepreneurs and potential investors. Also this organization is holding a competition among young social entrepreneurs that are not elder than 30 years old, the winners of which get a premium and the ability to go to Vienna to the meeting with the winners of the competition from other countries. Awesome Foundation presents an international organization that provides micro-grants to social entrepreneurs in the amount of 30 thousand rubles. One should establish contacts between these organizations of micro-level to exchange experience in the field of supporting social entrepreneurs and attracting micro-grants of Awesome Foundation as supplementary sources of financing for the winners of the competition held by Impact Hub Moscow.

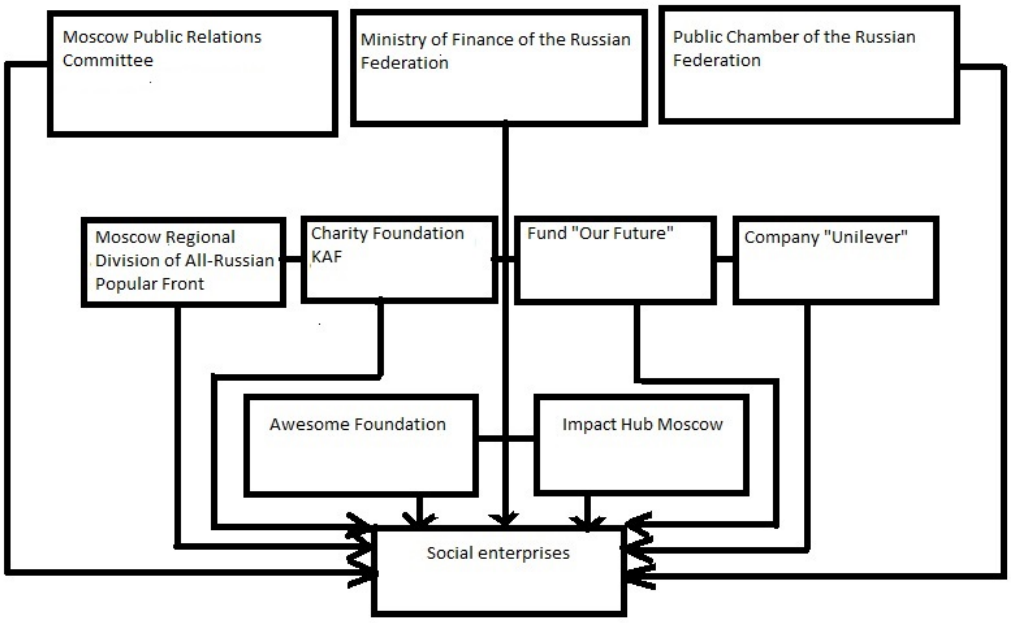


Figure 1: Interaction between different elements of the support system for social enterprises in Russia

As it was said before, Instituto Muda stepped in to provide the cooperatives not only with financial help to pay their workers to support their families, but also with a supply of masks, equipment and disinfectant gel. So, one thing that is suggested by this fragment is that the organizations that support social enterprises should provide them with financial help and something else in order to diversify their supply.

This model of interaction between different institutions supporting the development of social entrepreneurship presents a model of institutional support of social entrepreneurship adopted to the Russian conditions. As the formation of such institutions as the social stock exchange and the transparent microfinance market requires too much time for establishing and development, one should focus primarily on the institutions that are in effect now. All the institutions that are reflected in this model are already present in the Russian economy as the instruments of supporting social entrepreneurship. Though there is no mutual coordination and mutual exchange of experience and financial resources between them. This theoretical model has to fill this gap in some way.

5. In conclusion

So, we have considered the processes of interaction between different institutions supporting the development of social entrepreneurship in Russia, and also a model of possible interaction of several institutions as the catalysts of efficient development of social enterprises was provided. As the examples provided in the second section of this paper suggest, such institutions of support for social enterprises can take the form of establishing offices with this as extra-task/duty. Or those solutions can have the form of annual meeting of funding and funded pairs, organizing a research project in order to get the best interaction solutions, web platforms dedicated to such interaction, discussion forums on the subject, proposals for various funding institutions to sponsor together the same event in the benefit of social enterprises, etc.

All the arrangements in the foreign countries are held at the expense of the government as the main factor of supporting social enterprises. Thus, in Russia also the care of social entrepreneurship should be the prerogative of the government, as the result to which such policy leads is rather substantial and significant for the development of social sector. Especially it should be taken into account in the Covid-19 era, when social enterprises demonstrate the efficiency that is higher than that demonstrated by the ordinary enterprises in the process of struggle for security in the environment of spread of the new coronavirus infection.

References

COVID Response Alliance for Social Entrepreneurs (2020) COVID-19 Action Agenda Leaders on the Front Line: Why Social Entrepreneurs Are Needed Now More than Ever [online], World Economic Forum http://www3.weforum.org/docs/COVID19_SocEnt_Alliance_Report_2020.pdf

Foote W. (2020) How Social Entrepreneurs Will help us fight COVID-19 and Build Back Better [online], Forbes, https://www.forbes.com/sites/willyfoote/2020/11/17/how-social-entrepreneurs-will-help-us-fight-covid-19-and-build-back-better/?sh=76084fbe5c93

Galbraith B. and Molinari F. (2014) The role of the business school in supporting social enterprises: practices and perspectives // Social Innovation and Entrepreneurship: Case Studies, Practices and Perspectives. Ed. by B. Galbraith and F. Molinari. ACPI, Reading, pp. 1-13.

Schwab Foundation for Social Entrepreneurship (2020), Two decades of Impact, 2020 Impact Report [online], World Economic Forum, http://www3.weforum.org/docs/WEF_Schwab_Foundation_2020_Impact_Report.pdf

Staples M.H., St-Denis K., Allen A., Yadav P. (2020) Opinion: How social enterprises are playing a role in COVID-19 response [online], Devex, https://www.devex.com/news/opinion-how-social-enterprises-are-playing-a-role-in-ovid-19-response-97146

Tsygankov A. (2019) 14 Russian resources where the financing for social projects can be found [online], The greenhouse of social projects. https://te-st.ru/2016/12/21/where-to-look-for-funding-for-social-projects-in-russia/ (In Russ.)

Entrepreneurship: The Ideas of J.A. Schumpeter and R.A. Dahl

Tor Helge Pedersen
Inland University College of Applied Sciences, Lillehammer, Norway
Tor.Helge.Pedersen@inn.no

Abstract: The concepts of public and political entrepreneurship were introduced in relation to public administration in the 1960s. Early examples were constructed in relation to institutional change (Eisenstadt 1964; 1980), the bridging role of the entrepreneur between different spheres in local communities (Barth 1972), and the carrying out of urban redevelopment and social programs in local government (Dahl 1961; Murphy 1971). Although the concepts of entrepreneurship were used later to describe a variety of phenomena (Sheingate 2003), there are few comparisons of the differences and similarities between early contributions on public- and private-sector entrepreneurship. Motivated by few comparisons, this paper compares the contributions of Joseph A. Schumpeter and Robert A. Dahl as early examples by asking the following guiding question: What are the important similarities and differences in their ideas—and what is the relevance of their work today? While Schumpeter is seen as a main figure in the literature on entrepreneurship, Dahl's very early contributions are less well known. Schumpeter treated the entrepreneur and the entrepreneurial function in at least 15 publications, whereas Dahl (1961) used the concept in his case study of power in the Mayor Lee–era of the city of New Haven. The theoretical discussion is based on key publications by Schumpeter (15 publications) and from the New Haven case (4 publications). The discussion and comparison have at least two implications for research and practice. Schumpeter's conception of entrepreneurship was broader than expected and also relevant in studying entrepreneurship in the public sector. Future studies should still explore Schumpeter's ideas in other contexts to enhance our knowledge of what ideas should be developed further. Dahl's conception of political entrepreneurship may inform policy makers and researchers regarding entrepreneurship in a political context, which is not easy. Future case studies and practical efforts should therefore be aware that many contemporary entrepreneurs may only be partially political entrepreneurs compared to those in Dahl's conception.

Keywords: public entrepreneurship, private entrepreneurship, Schumpeter, R.A. Dahl, theoretical comparison

1. Introduction

Over the last 50 years, the concept of entrepreneurship has been used in different ways and in different contexts (Windrum 2008; Klein et al, 2010; Leyden and Link 2015). Schumpeter and Dahl both made early contributions to and formed early conceptions of entrepreneurship, although Schumpeter is more known in the literature on entrepreneurship. Between 1908 and 1949, Schumpeter mentioned or discussed the term in at least 15 publications. Within the public-sector context and public administration, Dahl was early to introduce and use the term "political entrepreneur" in a study of local power, stating, "Although a gifted political entrepreneur might not exist in every political system, whenever he appeared, he would make himself felt" (1961, p. 6). Dahl used the first part (1950s) of the Mayor Lee era in New Haven (1954–1970) as an example of the rise of an entrepreneur who managed to establish a coalition of different community forces, carry out an urban development program, and increase his power through reorganizing and the creation of a new organization. Since Dahl's introduction of the term "political entrepreneur," several have followed his example and used it in their work, though not necessarily directly referring to his contributions (Sheingate 2003). Today, the field of entrepreneurship is diverse, with studies on different types of entrepreneurship, including public-sector entrepreneurship (Klein et al, 2010; Mazzucato 2013; Leyden and Link 2015; Dhliwayo 2017), from various theoretical positions.

This paper takes a historical approach to comparing Schumpeter and Dahl's ideas of entrepreneurship. The objective of the paper is to contribute to the discourse on public- and private-sector entrepreneurship by focusing on these two early scholars. The comparison highlights how entrepreneurship was understood, including conceptions of entrepreneurship, contexts of entrepreneurship and entrepreneurial activities, resources of the entrepreneur, drivers of entrepreneurial activities, and the nature of leadership.

Methodologically, this theoretical discussion is based on a selection of key publications by Schumpeter and Dahl on entrepreneurship. Instead of discussing the variety of contributions being published today, this paper limits its attention to two classics within the field of entrepreneurship. Between 1908 and 1949, Schumpeter had at least 15 publications discussing innovation (e.g., 1927, 1935) and/or entrepreneurship (e.g., 1908, p. 351; 1912, pp. 158-9; 1918, pp. 113, 116; 1928b, 1928c). However, some of Schumpeter's publications are more centrally related to the term and theory of entrepreneurship (1912, 1928b, 1928c, 1934, 1939, 1947,

1949), and are therefore concentrated on here. Among different early contributions to the field of public entrepreneurship (Eisenstadt, 1964, 1980; Ostrom 1965; Barth 1972), Dahl's (1961) was selected for this theoretical discussion. Initially connected to community power discourse, Dahl's study came first within public sector entrepreneurship and looked more deeply into the entrepreneurial activities of a political entrepreneur in local government. The redevelopment program and the organizational innovations Mayor Lee set up were innovations (Polsby 1963; Murphy 1971) in terms of novelty, radical change, and economic and social impact—for example, many new local jobs were made available for low-income citizens, and the tax bases were strengthened due to municipal finance programs (Wolfinger 1974, p. 195). Including Dahl (1961) in a comparison with Schumpeter is, on the one hand, part of the originality of this paper. Except for Sheingate (2003), Dahl's important work is not mentioned in the other included literature. On the other hand, this entails less literature on Dahl. In addition to Dahl's study, the present discussion is based on four publications on Mayor Lee–era New Haven (Dahl 1961; Polsby 1963; Murphy 1971; Wolfinger 1974). These studies from the same Yale milieu have been useful in providing additional insights. The remainder of the paper is organized as follows: first, Schumpeter's and Dahl's contributions are presented. Then, these contributions are discussed in relation to the different dimensions outlined above.

2. Joseph A. Schumpeter

Schumpeter's idea of entrepreneurship as a crucial factor in economic development was included in his early German writings in both 1908 and 1912. Schumpeter's approach to entrepreneurship has been understood in several ways. On the one hand, it has been understood as a macro-economic concept or macro-level approach to innovation and entrepreneurship (Ruttan 1959), seeing entrepreneurship and innovation from the perspective of the economy (Penrose 1959). This approach can further be understood in terms of the system perspective. Schumpeter uses the term "economic system" when discussing "new combinations" (Schumpeter 1934, p. 68). For example, Fagerberg argues that the notion of "entrepreneurial function" points to a system perspective wherein capitalist society might be seen as a system in which the introduction of new combinations is one among several important functions (2003, p. 131). Through this, he is talking about internal factors of change. Those who perform the entrepreneurial function—that is, carry out innovations—set in motion activities such as introducing new combinations (novelties), which other entrepreneurs follow, and thus upsetting the economic system's equilibrium. For example, "depression is nothing more than the economic system's reaction to the boom" (1934, p. 224).

Moreover, Schumpeter's framework operates on different levels (Dopfer 2012). At the micro-level is the entrepreneur who carries out innovations (entrepreneurial activities) and thus removes obstacles for the other entrepreneurs (1934, p. 229; 1935, p. 6). The meso-level refers to the swarming of entrepreneurs and followers imitating the original innovation: "The appearance of one or few entrepreneurs facilitates the appearance of others" (1934, p. 228). Finally, this leads to changes, or more specifically, economic impacts on certain industries or the economy as a whole from within (macro-level). While the meso-level can be studied as the spread of innovations and the swarming of entrepreneurs, the micro-level can be studied as the initial entrepreneurial activities.

Conception of entrepreneurship

Schumpeter treated entrepreneurship primarily as an economic phenomenon. Three features characterize this entrepreneur and his motivations—he dreamed about building something up, he was competitive, and he had "the will to conquer" (Schumpeter, 1934, p. 93). Finally, Schumpeter discusses "the joy of creating, of getting things done" (1934, p. 93). Schumpeter did not see the desire to make money as a driving force for the entrepreneur (Swedberg 2021).

Schumpeter emphasized the term "entrepreneurial function," which entails making a new combination or carrying out innovations (1939, p. 102). The defining characteristic of the entrepreneur and their function "is simply the doing of new things or the doing of things that are already being done in a new way" (Schumpeter 1947, p. 151). The basic idea of Schumpeter's (1934) theory is that entrepreneurship consists of putting together a new combination (one of the five types of innovation) of already existing elements within the economy: "The new combinations must draw the necessary means of production from some old combinations" (1934, p. 68). He stressed that innovation should be separated from invention, which he saw as economically irrelevant (1934, p. 81). Schumpeter (1942) also said that "the function of entrepreneurs is to

reform or revolutionize the pattern of production" (1942, p. 132). Thus, the entrepreneur innovates in the following five ways (new combinations):

> *[…] by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way, by opening up a new source of supply of materials or a new outlet for products, by reorganizing an industry and so on. (p. 132)*

He mentions examples such as railroad construction, electric-power production, steam and steel, and the motorcar, but also colonial ventures and successful products (p. 132).

Schumpeter saw setting up new firms as a central part of entrepreneurship: "New combinations are, as a rule, embodied, as it were, in new firms which generally do not arise out of the old ones but start producing beside them" (1934, p. 66). He said that the "typical industrial entrepreneur of the nineteenth century was perhaps the man who put into practice a novel method of production by embodying it in a new firm" (1947, p. 154), but he also noted there had been changes (e.g., type of entrepreneur) over the years (1928a, 1939, 1942).

Schumpeter concluded later that every "social environment has its own ways of filling the entrepreneurial function" (1949, p. 52) and that it also "may be and often is filled co-operatively" (1949, p. 53). He described entrepreneurs, such as John Law and the Pereire brothers, who added the function of the banker to the entrepreneurial function, carrying out their respective ventures (1939). He said that in times of great concern, the entrepreneur may be a salaried employee, a manager, the owner of controlling parcels of shares (1939: 103), and sometimes a company promoter (1939, p. 103; 1947, p. 154). Schumpeter remarked that in many cases, "it is difficult or even impossible to name an individual that acts as 'the entrepreneur' in a concern" (1949, p. 53). Schumpeter had a broad conception of entrepreneurship, saying, "The entrepreneurial function itself is not confined to capitalist society" (1939, p. 223). He also mentioned examples from socialist societies (1939, pp. 111, 118). Schumpeter identified historical examples of public entrepreneurship (e.g., 1939, pp. 118, 301, 346), such as the public servants in the German states after the Thirty Years' War (1939, p 235; 1947, p. 153) who "directly filled the entrepreneurial function, particularly in mining" (1939, p. 235). A later example involves a state department:

> *[T]he practice of farmers in this country has been revolutionized again and again by the introduction of methods worked out in the Department of Agriculture and by the Department of Agriculture's success in teaching these methods. In this case then it was the Department of Agriculture that acted as an entrepreneur. (Schumpeter 1949, pp. 52–3)*

Over time, Schumpeter changed his ideas regarding how entrepreneurship should be studied. For example, he proposed a historical investigation into entrepreneurship in his later publications (1946, 1947, 1949). Schumpeter also concluded that the entrepreneurial function could be performed in several ways. Finally, Schumpeter (1942, p. 132) observed and predicted that the social function of entrepreneurship was losing importance: "innovation itself is being reduced to routine" (1942, p. 132).

3. Robert A. Dahl

Robert A. Dahl was a political scientist particularly connected to topics like democratic theory and community power. In the New Haven study, Dahl (1961) attempted to identify those who governed in New Haven by seeking answers to various formulated questions; he used three broad research strategies. First, he carried out a historical analysis of the transformations of New Haven's ruling groups. Second, he conducted case analyses of three arenas of policy making—party nominations to public office, urban redevelopment, and public education—based on detailed interviews and participant observations of actual decisions. These cases provide information about the distribution and use of influence. Third, he carried out a cross-sectional analysis of the distribution of resources among New Haven's citizenry. As Dahl was conducting his field research about the city, Democrat Richard C. Lee had recently defeated New Haven's previous Republican mayor in the election of 1953. Before Lee took office in 1953, he had lost two races for mayor in 1949 and 1951, but during the latter campaign, the need for urban redevelopment came to his attention. He was aware of federal aid in the Housing Act of 1949 that was part of Truman's Fair Deal and established the federal urban renewal program (Polsby 1963; Wolfinger 1974). Redevelopment became his positive issue in the 1953 campaign; he emphasized the importance of improving the condition of New Haven and proposed new institutions. The redevelopment program is especially relevant as an example here as an example of entrepreneurship.

Conception of entrepreneurship

When Dahl (1961) introduced the term "political entrepreneur," he was referring to Machiavelli and *The Prince* rather than Schumpeter. He wrote the following in his introduction of his study, commenting on earlier studies on the topic of community power: "One difficulty with all these explanations was that they left very little room for the politician. He was usually regarded merely as an agent—of majority will, the political parties, interest groups or the elite. He had no independent influence" (Dahl 1961, p. 6). He argued that Machiavelli "stressed the enormous political potential of the cunning, resourceful, masterful leader" (p. 6). He explained: "In this view, majorities, parties, interest groups, elites, even political systems are all to some extent pliable; a leader who knows how to use his resources to the maximum is not so much the agent of others as others are his agents" (p. 6). Dahl's entrepreneur is an independent actor in the political system.

Dahl's (1961) political entrepreneur reorganizes and sets up programs and organizations. The first organization or governance organ Mayor Lee set up after much effort was a representative non-partisan commission, the Citizen Action Commission (CAC), in 1954 to identify solutions to address the city's decline. It had 24 members (in total more than 400 with subcommittees), including leading business and civic personalities, among others (Dahl 1961). Dahl claimed that, "The importance of the CAC in assuring acceptability for the redevelopment program can hardly be overestimated" (p. 133). The CAC "endorsed the proposals of the city administration made the program appear nonpartisan, virtually nullified the effectiveness of partisan attacks" (p. 133). The CAC helped to sell (or speak up on behalf of) the urban redevelopment program and gave the program an aura of having been endorsed by the people (Polsby 1963). Not only did Lee co-opt business leaders in this fashion, but he informally attached the new organization to his command post. The CAC also attracted much positive attention, as well as many had many visitors and followers from other cities, which increased the legitimacy of the program.

In Mayor Lee's first two years in power, he also reorganized the existing fragmented agencies, departments, and units under a new office—the Office of the Development Administrator. The creation of this office represented the centralization of redevelopment "in the hands of the mayor and his redevelopment team" (Dahl 1961, p. 200). Lee had deep knowledge of the city government and was sensitive to potential obstacles. He established his authority over the organizations that might be obstacles to his purposes. He recruited dedicated people from outside (e.g., Edward Logue) who coordinated the work of all the units and agencies that were involved in redevelopment (p. 121). The development administrator was powerful because of Lee's commitment to the redevelopment issue (Polsby 1963). The office and four agencies became a bureaucracy operating independently of the city's traditional agencies (Murphy 1971). The CAC and the new redevelopment apparatus were important in carrying out the redevelopment program. Mayor Lee later oversaw the creation of a public antipoverty organization in 1962 to coordinate and deliver a wide range of new services, many of them delivered in a new way, to the poor. This attracted Ford Foundation and federal funding and became a prototype for the federal Community Action Program (Wolfinger 1974; Murphy 1971). Both the redevelopment program and the later antipoverty program involved the creation of new or better services, and both programs were carried out by coalitions of public, private, and voluntary local and federal actors.

Mayor Lee managed to convert a formally weak mayor's position into one of strength (Dahl 1961). However, like those who attempted to do so before him, Mayor Lee did not manage to change or revise the form of government in New Haven. He tried in 1954 and 1958 but was defeated by a "tacit coalition" of Democrats and Republicans (Wolfinger 1974). However, his informal methods were more successful—for example, during his period in power, the office of the mayor became increasingly central to the city's political and governmental life (Murphy 1971). Therefore, Dahl concluded that this mayor changed the local political order. A political order is about a "pattern of influence" (Dahl 1961, 102) and the overall arrangement rather than individual institutions. It refers to an institutionalized and relatively stable distribution of tasks, way of operation, authority, power, and responsibility among institutions and actors. Dahl focused on how the political entrepreneur Mayor Lee changed the political order two times—first, into "a coalition of chieftains" and thereafter into an "executive-centered coalition" (1961, p. 200). Urban development provided the key to more centralized control: "In effect, then, Lee converted support for redevelopment into acquiescence in a new pattern of influence, the executive-centered order" (p. 202). The executive-centered order was legitimized by the need to coordinate decisions on redevelopment.

4. Similarities and differences

This section compares Schumpeter's and Dahl's ideas on entrepreneurship. Table 1 highlights keywords in relation to the dimensions introduced in part 1.

Table 1: Similarities and differences between Schumpeter and Dahl

	Schumpeter	Dahl
Conception	Economic phenomenon Create new combinations (innovations) that are carried out	Social/political phenomenon Carry out changes, impact on context, opportunity identification
Context and entrepreneurial activities	Mostly private sector, but not limited to it Create/carry out innovation	Local government Broad range of activities, not only carry out innovations
Resources	Existing elements and ideas	Slack, political and financial resources
Drivers	Not demand, the entrepreneur initiates change	Not demand, the entrepreneur initiates change
Leadership	Special type of (change) management	No agent of others or interests, highly independent actor Special type of (change) management

Conception

Schumpeter contrasted the entrepreneur with the manager; he distinguished between "the entrepreneurial and managerial function" (1939, p. 102). Later, he also distinguished between adaptive and creative responses (1947), connecting entrepreneurship to the latter. Schumpeter said that one is an entrepreneur, whatever the type, only when one actually "carries out new combinations" (1934, p. 78; 1939, p. 103). Schumpeter discussed different types of modern entrepreneurship (1928b) in different economic contexts, such as competitive and trustified economies (1928c), as well as cases where the state serves the entrepreneurial function (e.g., 1939, 1949). Entrepreneurial activities and function may be individual, collective, and even split between several individuals, as Schumpeter observed of the railroad industry: "This entrepreneurship was split between several individuals and not always easy to attribute to any single one" (1939, p. 327). Entrepreneurship is dependent on context (1949, p. 52). Therefore, Schumpeter saw entrepreneurship as context dependent—for example, in trustified capitalism, it became "increasingly impersonal and decreasingly [a] matter of leadership and individual initiative" (1928a, p. 385). Dahl built his conception on Machiavelli rather than Schumpeter. In contrast to Schumpeter, who treated the entrepreneur as an economic phenomenon, Dahl's political entrepreneur is a mixed political and social phenomenon. Schumpeter emphasized the term "entrepreneurial function," while Dahl focused on the idea of one entrepreneur knowing how to utilize their resources to the maximum and function as an independent leader. As mentioned above, the new redevelopment administration became independent of city politics. As also noted, this was the case with other new organizations, such as the CAC and the antipoverty organization of 1962 (Community Progress Inc.).

Contexts of entrepreneurship and entrepreneurial activities

Despite several Schumpeter examples from the public sector, in contrast to Dahl, Schumpeter's entrepreneur is largely related to the economic sphere (economic system). Schumpeter's entrepreneur disrupts this economic system. Schumpeter's point of departure is the static economy, where production and consumption are both organized in specific combinations that work relatively well and according to well-known methods (Swedberg 2021). The entrepreneur is the one who breaks up one of the existing combinations and recombines its parts in a new, profitable manner (p. xii).

Dahl's (1961) entrepreneur is "a disrupter" but is clearly related to the public sector. Dahl also sees in the entrepreneur "an investment banker's willingness to take risks that held the promise of large-run payoffs" (p. 119). The New Haven case is about an entrepreneurial mayor who carried out changes, as well as set up organs and organizations to carry out new programs with social and economic impact. Lee created a unified and centralized redevelopment administration, carried out programs, set up novel organizations, and changed the political order. When Dahl encountered changes in the political order, he adopted a pluralist and dynamic

view of city politics, assuming that "the political system itself" is not an immutable product "of democratic ideas, belief, and institutions inherited from the past" (p. 325). It can be changed (p. 325).

Resources of the entrepreneur

While Schumpeter discussed combining existing resources in a new way (1934, p. 68), Dahl portrayed a leader who knows how to maximize their resources (slack and political). Mayor Lee drew on the unused resources of his office to create new institutions and involve new groups in his administration (Wolfinger 1974). He managed to convert latent agreement into active support (Dahl 1961, p. 202). Lee had detailed knowledge of the city and its people, gathered local support, and mobilized latent support. Political slack is a condition that the political entrepreneur can exploit. Dahl likely knew that there was a gap between actual and potential citizen influence and that citizens' "political resources are, so to speak, slack in the system" (p. 305), since "in liberal societies, politics is a sideshow in the great circus of life" (p. 305). In addition to this, he exploited other resources from outside. He attracted funding from outside (Ford Foundation, federal government), and he recruited talented managers (often from outside, who were not bound by local traditions). While Schumpeter's entrepreneur excels at thinking up new combinations and carrying them out, Dahl's entrepreneur identifies a positive issue (political opportunity) and seeks to carry it out.

Drivers of entrepreneurial activities

Schumpeter argued that it is usually the producer (entrepreneur) who initiates economic change (1934, p. 65; 1939, p. 73). Some entrepreneurs are more "pioneers" than others, and "those who follow the pioneers are still entrepreneurs, though to a degree that continuously decreases to zero" (1939, p. 414). Redevelopment in New Haven did not come from citizen demand. It was due to an entrepreneurial push (Dahl 1961, p. 115). The entrepreneurial mayor put redevelopment on the agenda and understood that political and administrative support had to be organized, structured, and given specific purpose and direction. Mayor Lee created an executive-centered coalition of three political forces—partisan politicians, the business community (CAC), and bureaucratic departments and agencies. Dahl (1961) said, "It was the need for redevelopment that created the need for an executive-centered order" (p. 200). Mayor Lee came to power by addressing the issue of urban renewal: "The evident need for a high degree of coordination among city agencies if re-development were to be carried out" (p. 310). This increased the position of Development Administrator's power over redevelopment.

Nature of leadership

Schumpeter saw entrepreneurial leadership as a special case of leadership—entrepreneurial (Schumpeter 1928a, p. 379; 1934, p. 89; 1949, pp. 51–52). Moreover, in New Haven, entrepreneurial leadership was an instrument of organizational and political change (Dahl 1961). Dahl perceived Lee as a "gifted political entrepreneur" (p. 6) and as a mayor with a large repertoire of political skills and an unusual ability to perform a variety of different roles. The redevelopment issue depended upon broadly based community consensus that was systematically built and nurtured by the mayor (Polsby 1963). When there was uncertainty during the first two years, Lee managed with great effort to gather local support for the plans and new organizations/organs. Dahl (1961) thus described the entrepreneur as a change leader and coalition-builder. Dahl (1961) saw Mayor Lee as standing at "the center of intersecting circles" and noted that Lee "could not command, he had to bargain" (p. 204). Lee was able to find areas of agreement and managed to "dampen down potential disagreements" (p. 310). Dahl also discussed the necessary conditions for transformation into an executive-centered political order, such as slack resources, avoiding counter-mobilization (p. 309), and the need for coordination "among city agencies if redevelopment were to be carried out" (p. 310). Dahl (1961) focused most on the political entrepreneur. Mayor Lee carried out organizational changes (within redevelopment), carried out social programs, set up new governance organs, set up new organizations, recruited key personnel, and attracted funding from outside. Both Schumpeter and Dahl saw entrepreneurship as a type of change, initiated by entrepreneurs (not by demand) management that had economic or social impact.

5. Conclusion

Concluding remarks and limitations

In this paper, I have compared two early conceptions of entrepreneurship to shed light on the similarities and differences between public and private entrepreneurship. Therefore, this paper is limited to Schumpeter and Dahl's ideas and not the variety of approaches and forms that are available today. However, this has allowed for more in-depth exploration of Schumpeter and Dahl—for example, looking at a significant number of Schumpeter publications and several sources on the Mayor Lee case (e.g., Polsby 1963; Wolfinger 1974). Overall, some notable differences between the two theorists (e.g., context, type of resources, entrepreneurial activities) were found, but not as significantly as expected. The political entrepreneur carries out changes in a political-sector or more complex public-sector context (many different organizations and interests) and uses a broad repertoire of skills and resources. The next section exemplifies the relevance of Schumpeter's and Dahl's ideas today.

Future studies

The Schumpeter case, though mostly connected to the economic sphere, opens up entrepreneurship for study in the public-sector context. Although there exists work in this direction (e.g., Mazzucato 2013; Mazzucato and Penna 2016), future studies could follow up and explore more of Schumpeter's ideas. Today, the entrepreneurial function may be carried out in many different parts of public administration in different countries. In some of these cases, Schumpeter's ideas might be relevant. Dahl's Mayor Lee is an example of carrying out new programs with economic, social, and political impact. The Mayor Lee study, especially together with Murphy's (1971) and Wolfinger's (1974), provides an analysis of what political and policy entrepreneurship might be and how it might not be found in every political context (Dahl 1961, p. 6). However, this should not exclude future in-depth case studies of entrepreneurship today. Dahl's (1961) study could be an inspiration or example of what entrepreneurship means in a public sector context. Even though many contemporary entrepreneurs may only partly be political entrepreneurs, they may still be worth a study.

References

Barth, F (1972) "Introduction" in Barth, F (ed.) *The role of the entrepreneur in social change in Northern Norway* (pp 5-18), Universitetsforlaget, Oslo.

Dahl, RA (1961) *Who governs? Democracy and power in an American City*, New Haven: Yale University Press.

Dhliwayo, S (2017) "Defining public-sector entrepreneurship: A conceptual operational construct," *The International Journal of Entrepreneurship and Innovation*, Vol 18, No 3, pp 153-163.

Dopfer, K (2012) "The origins of meso economics: Schumpeter's legacy and beyond," *Journal of Evolutionary Economics,* Vol 22, No 1, pp 133–160.

Eisenstadt, SN (1964) "Institutionalization and change," *American Sociological Review*, Vol 29, No 2, pp 235–247.

Eisenstadt, SN (1980) "Cultural orientations, institutional entrepreneurs, and social change: Comparative analysis of traditional civilisations," *American Journal of Sociology*, Vol 85, pp 406–454.

Fagerberg, J (2003) "Schumpeter and the revival of evolutionary economics: An appraisal of the literature," *Journal of Evolutionary Economics*, Vol 13, pp 125–159.

Klein, PG, Mahoney, JT, McGahan, AM, & Pitelis, CN (2010) "Toward a theory of public entrepreneurship," *European Management Review*, Vol 7, No 1, pp 1-15.

Leyden, DP and Link, AN (2015) *Public sector entrepreneurship: US technology and innovation policy*, Oxford University Press, New York.

Mazzucato, M (2013) *The entrepreneurial state*, Anthem Press, London.

Mazzucato, M and Penna, CCR (2016) "Beyond market failures: The market creating and shaping roles of state investment banks," *Journal of Economic Policy Reform*, Vol 19, No 4, pp 305-326.

Murphy, RD (1971) *Political entrepreneurs and urban poverty: The strategies of policy innovation in New Haven's model anti-poverty project*, Heath Lexington Books, Lexington, MA.

Ostrom, E (1965) Public entrepreneurship: A case study in ground water basin management, doctoral dissertation, University of California, Los Angeles.

Penrose, E (1959) *The theory of the growth of the firm*, Oxford University Press, Oxford.

Polsby, NW (1963) *Community power and political theory*, Yale University Press, New Haven.

Ruttan, VW (1959) "Usher and Schumpeter on invention, innovation, and technological change," *Quarterly Journal of Economics,* Vol 73, No 4, pp 596–606.

Santarelli, E & and Pesciarelli, E (1990) "The emergence of a vision: The development of Schumpeter's theory of entrepreneurship," *History of Political Economy,* Vol 22, No 4, pp 677–696.

Schumpeter, JA (1908) *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*, Duncker & Humblot, Leipzig.

Schumpeter, JA (1912) *Theorie der Wirtschaftlichen Entwicklung*, Duncker & Humblot, Berlin.

Schumpeter, JA (1918/1991) "The crisis of the tax state" [*Die krise der Steuerstaates*], in Swedberg, R (ed.) (1991) *Joseph A. Schumpeter: The economics and sociology of capitalism* (pp 99–140), Princeton University Press, Princeton, NJ.

Schumpeter, J.A. (1919/1951) "The sociology of imperialism," in Sweezy, PM (ed.) (1951) *Imperialism and social classes by Joseph A. Schumpeter* (pp 3–130), Augustus M. Kelley, Inc, New York.
Schumpeter, JA (1927) "Explanation of the business cycle," *Economica,* Vol 7, pp 286–311.
Schumpeter, JA (1928a) "The instability of capitalism," *The Economic Journal,* Vol 38, pp 361–386.
Schumpeter, JA (1928b) "Entrepreneur [*Unternehmer*]" in Becker, MC, Knudsen, T & Swedberg, R (eds.) (2011) The entrepreneur: Classic texts by Joseph A. Schumpeter (pp 227–260), Stanford University Press, Stanford, CA.
Schumpeter, JA (1928c) "The entrepreneur in today's economy [*Der Unternehmer in der Volkswirtschaft von heute*]," in Becker, MC, Knudsen, T & Swedberg, R (eds.) (2011) *The entrepreneur: Classic texts by Joseph A. Schumpeter* (pp 261–285), Stanford University Press, Stanford, CA.
Schumpeter, JA (1934/1983) *Theory of economic development*, Transactions Publishers, New Brunswick & London.
Schumpeter, JA (1935) "The analysis of economic change," *The Review of Economic Statistics,* Vol 17, No 4, pp 2–10.
Schumpeter, JA (1939) *Business cycles* (vols. 1–2), McGraw Hill Company, New York.
Schumpeter, JA (1942) *Capitalism, socialism and democracy* (2nd ed., 1947)*,* Harper & Brothers Publishers, New York.
Schumpeter, JA (1946/1991) "Comments on a plan for the study of entrepreneurship" in Swedberg, R (ed.) (1991) *Joseph A. Schumpeter: The economics and sociology of capitalism* (pp 406–428), Princeton University Press, Princeton, NJ.
Schumpeter, JA (1947) "The creative response in economic history," *The Journal of Economic History,* Vol 7, No 2, pp 149–159.
Schumpeter, JA (1949/1967) "Economic theory and entrepreneurial history," in Aitken, HGJ (ed.) *Explorations in enterprise* (pp 45–64), Harvard University Press, Cambridge MA.
Sheingate, AD (2003) "Political entrepreneurship, institutional change, and American political development," *Studies in American Political Development*, Vol 17, pp 185–203.
Swedberg, R (2021) "Introduction to the Routledge Classics edition," in Schumpeter, JA (2021) *Theory of Economic Development* (pp viii–xv), Routledge, London & New York.
Windrum, P (2008) "Innovation and entrepreneurship in public services," in Windrum, P & Koch, P (eds.) *Innovation in public sector services*, Edward Elgar, Cheltenham.
Wolfinger, R. (1974) *The Politics of Progress*, Prentice Hall, Englewood Cliffs, NJ.

How Swiss Start-Ups Deal With Business Model Innovation

Stefan Philippi, Andreas Hinz and Laila Kabous
Institute of Management, School of Business, FHNW University of Applied Sciences and Arts Northwestern Switzerland, Windisch, Switzerland
stefan.philippi@fhnw.ch
andreas.hinz@fhnw.ch
laila.kabous@fhnw.ch

Abstract: The term business model innovation refers to the introduction of innovations that differ from state-of-the-art business models in the same field. Current research indicates that business model innovations are more resilient (e.g. to imitation) overall and more successful in the long term compared to traditional types of innovation (e.g. product innovations). Working on business model innovation, therefore, can provide valuable insights, particularly for start-ups looking to grow and scale up under conditions of extreme uncertainty. Business model innovation involves the innovation of two of four core elements of a business model: customer, value proposition, value chain and revenue mechanism. A business model can be described using these four elements in a sophisticated and comprehensive manner. Moreover, these elements help us to determine whether a business model innovation exists. However, do start-ups really use the advantages of business model innovation and to what extent? This research paper addresses this issue and examines the role business model innovation plays for start-ups as well as how it has been implemented. To gain these insights, we examine the business plans of 24 finalists of a Swiss innovation competition in 2021 in a multi-stage process. We systematically reviewed and analysed business plans individually using pre-defined innovation criteria for each of these four elements of a business model. The individual analysis allows a robust assessment to be able to make a comprehensible classification. On reviewing the results, we were surprised by how many of the analysed start-ups are pursuing business model innovations, and that they often innovate more than two elements of their business models. According to our findings, start-ups nowadays deal with business model innovation more often than they did in previous research studies. We can also show that business model innovations are often more complex than they were in the past.

Keywords: business model innovation, start-up, business plans as research sample, entrepreneurship, innovation

1. Introduction

Innovative business models have increasingly become the focus of business research. They are widely recognised as a key factor in competitive differentiation and sustainable business success and find great acceptance (Affenzeller, 2014; Bocken and Snihur, 2020; Bouwman et al., 2019; Clauss, 2017; Filser et al., 2021; Foss and Saebi, 2018, 2017; Gassmann et al., 2013; Schwarz et al., 2016; Sjödin et al., 2020; Wirtz, 2020). One reason is that pure product and process innovation are increasingly seen as insufficient (Bucherer et al., 2014) and business model innovation [BMI] is seen as key to improving performance (Faria et al., 2021; García-Gutiérrez and Martínez-Borreguero, 2016; Kim et al., 2020; Loon and Quan, 2021; Montemari et al., 2022) and is seen as more promising for the future (Amit and Zott, 2012; García-Gutiérrez and Martínez-Borreguero, 2016; Johnson et al., 2008; von den Eichen et al., 2014).

BMI is about finding new ways for companies to create value (Faria et al., 2021). When addressing BMI, the focus is often on established companies (Amit and Zott, 2012; Bouwman et al., 2019; Ghezzi and Cavallo, 2020). However, small and medium-sized companies have also become the subject of research (Bouwman et al., 2019; Ghezzi et al., 2022; Klewitz and Hansen, 2014). The debate between entrepreneurship and BMI is also receiving increasing attention (Faria et al., 2021; Filser et al., 2021; Silva et al., 2020; Spieth et al., 2014). This includes start-ups, which are inherently faced with a very challenging environment, as they focus on developing and marketing new products or services under conditions of great uncertainty (Ries, 2017). As young companies with innovative business ideas and ambitious growth plans, they are likely to engage in business model innovation (Minsch and Can, 2020). This is the starting point of this research, which addresses the following question: How do Swiss start-ups deal with BMI in practice and how do they innovate their business models?

Within the Swiss Innovation Challenge [SIC] an innovation and start-up support programme in Switzerland, we have access to start-ups and their business plans, which serve as the basis for our analysis. The primary focus lies on a BMI classification of SIC 2021 finalists.

The paper is structured as follows: after a brief presentation of the initial situation, i.e. the SIC, there follows a discussion of the literature. The theoretical discussion of the topic creates a basis for the study itself. After this,

the methodological procedure of the research is presented. The above-mentioned questions are explored and answered in the empirical examination. Finally, the overall findings are summarized, along with a discussion of the limitations and further possible future research.

2. Starting point, the Swiss Innovation Challenge

The SIC is a support programme with an integrated competition aimed at promoting innovation in Switzerland (Swiss Innovation Challenge, 2022). Start-ups are selected based on their innovation rather than their field of activity to encourage the widest possible spectrum and to support as many eligible projects as possible (Kabous et al., 2019; Philippi and von Büren, 2021). The support programme is based on three pillars: knowledge transfer, individual coaching and mentoring, and networking (Anklin et al., 2017). The core of the programme is the competition, which lasts several months and determines the best innovations in an elimination process (Anklin et al., 2017). Participants go through three phases (Anklin et al., 2017): around 100 teams take part in the first phase, of which the jury selects 50 teams for the second phase and 25 finalists for the third phase (Reineke and Philippi, 2017). The disciplined selection process ensures that around 25 innovative and economically promising projects make it into the final round.

3. Theoretical framework

The discussion of business models [BM] has been a topic of business research for several decades (Asemokha et al., 2021; Baber et al., 2019; Belussi et al., 2019). Different definitions of BM can be found in the literature. Foss and Saebi (2018, 2017) have shown that even at a general level, the understanding of what exactly is meant by a BM (Csik, 2014) is limited, and that it is often used without an explicit definition (Bouwman et al., 2019). The simplest definition suggests that a BM describes the logic by which an organisation or company creates, delivers and generates value (Bogers and Jensen, 2017; Osterwalder et al., 2010; Taran et al., 2015; Zott et al., 2011). In addition, three (Filser et al., 2021; Hock-Doepgen et al., 2021; Trapp, 2014) or four elements (Csik, 2014; Gassmann et al., 2017, 2013; Gassmann and Frankenberger, 2016; Lang, 2020) of a BM can be identified:

- Customer Segment: who are the target customers? A precise understanding of the relevant customers or customer segments (Gassmann et al., 2017; Jodlbauer, 2020).
- Value Proposition: what is offered to the customers (Chesbrough, 2010; Rayna and Striukova, 2016)? All the components to satisfy the needs of customers (Gassmann et al., 2017; Rusnjak, 2014; Weis, 2012). Values can be quantitative or qualitative in nature (Osterwalder et al., 2010).
- Value Chain: how is this value proposition created and distributed to the customer? Brings together the resources, capabilities and processes needed to create the value proposition (Abdelkafi et al., 2013; Csik, 2014; Rayna and Striukova, 2016).
- Revenue Model: how is revenue generated and why is it profitable? The relevant mechanisms that lead to the generation of costs, but also to income (Csik, 2014; Jodlbauer, 2020).

3.1 Business model innovation

BMI is recognised as a standalone type of innovation from a terminological and content perspective (Philippi and von Büren, 2021) and has been discussed extensively in research for some time now (Belussi et al., 2019; Filser et al., 2021; Foss and Saebi, 2017; Kukkamalla et al., 2021). This highlights that the topic has lost none of its appeal (Foss and Saebi, 2017; Loon and Quan, 2021; Ramdani et al., 2019).

Despite this attention, BMI has not yet been studied and understood to the same extent as BM (Foss and Saebi, 2017). It is also often pointed out that the theoretical foundation could be further strengthened (Bogers and Jensen, 2017; Casadesus-Masanell and Zhu, 2013; Foss and Saebi, 2017; Taran et al., 2015). This is hardly surprising, considering that research on this topic has only been conducted more intensively since the beginning of the new millennium, following the burst of the internet bubble, which suddenly forced companies to look for new approaches to continue to be successful on the market (Holzmann et al., 2013).

There is still no standard definition for a BMI, (Csik, 2014; Loon and Quan, 2021), but it can basically be understood as the introduction of a completely new BM or the change of an existing BM (Augsten et al., 2017; Casadesus-Masanell and Zhu, 2013; Chesbrough, 2010; Csik, 2014; Dopfer, 2018; Spieth et al., 2014; Zott and Amit, 2015). More specifically, a BMI innovates individual elements of the above-mentioned BM or the entire BM. However, there is disagreement as to which of the four elements of a BM are of greater relevance and how

many elements must be changed to be categorised as BMI (Foss and Saebi, 2017; Lang, 2020). The predominant view is that two of the four elements of a BM need to be innovated to speak of a BMI (Csik, 2014; Lang, 2020; Philippi and von Büren, 2021; Schallmo, 2013); this paper shares this view. The BM elements include customers, value proposition, value chain and revenue mechanisms (Csik, 2014; Gassmann et al., 2017, 2013). Novel products or services are thereby often the core element of a BMI (Foss and Saebi, 2017; Hock-Doepgen et al., 2021). However, BMI is more than just a bundle of other types of innovation; the novelty lies in the consideration of products and processes as well as their interdependencies within the overall system (Schwarz et al., 2016).

The degree of innovation can be either incremental or radical and thus fundamentally change the BM (Holzmann et al. 2013; Osterwalder et al., 2010; Schallmo, 2015, 2013). A distinction can be made between a BM that is new to the world, new to the industry/market or new to the company (Stampfl, 2016; Zott and Amit, 2015). BM that are new to the world are extremely rare by now (Gassmann et al., 2012; Stampfl, 2016), while the combination of existing approaches is more common (Casadesus-Masanell and Zhu, 2013; García-Gutiérrez and Martínez-Borreguero, 2016; Silva et al., 2020). In this research, we focus on BMI that are new to an industry/market/sector, which is in line with most of the research (Stampfl, 2016; Trapp, 2014).

3.2 Added value of BM innovation

There is broad consensus in the literature that BMI is of great importance for a firm's survival and economic performance in order to achieve a competitive advantage (Amit and Zott, 2012; Foss and Saebi, 2017; Lindgardt et al., 2012; Ramdani et al., 2019). The appeal of BMI lies primarily in the fact that it allows companies to define new rules in the industry/market/sector. This high differentiation potential is also assessed as the key advantage (Casadesus-Masanell and Zhu, 2013; Csik, 2014; Faria et al., 2021; Zott and Amit, 2015). Moreover, new BMs are more difficult to imitate compared to product or service innovations. Thus, by creating a BMI, companies gain competitive advantages, which differentiates them from competitors and provides higher long-term impact compared to other innovations (Bucherer et al., 2014; Csik, 2014; Lindgardt et al., 2012). Gassmann, Frankenberger and Csik (2013) also point out that, viewed over a period of five years, BMI is on average more profitable than product and service innovations.

In general, established companies only spend a small fraction of innovation budgets on developing new and innovative BM (Gassmann et al., 2013). New, even revolutionary BMs are rarely developed by established companies, but far more often by start-ups. This gives them an advantage over established companies and helps them to differentiate themselves (Zollenkop, 2011).

4. Methodological approach

Business plans of 24 finalists of the SIC in 2021 are reviewed for evidence of BMI. Quality management within SIC has resulted in high-quality business plans.

Many analyses of BMI rely on qualitative methods or case studies (Belussi et al., 2019; Sniukas, 2020) and secondary data often form the foundation (Bouwman et al., 2019). In contrast, available business plans written by start-ups participating in SIC represent interesting primary data. This gives us access to a unique database to gain insights into how start-ups deal with BMI. Many studies often take a retrospective view, looking for changes between a starting point and the current situation (Hock-Doepgen et al., 2021; Trapp, 2014). Given the young age of start-ups, this is hardly ever reflected in their business plans. However, the novelty of their BM can be evaluated by comparing them with industry standards to determine whether a BMI is present or not (Abdelkafi et al., 2013).

The data was collected in a multi-stage process, based on an analysis of the available business plans. The four elements of the BM as shown above were used to classify business plans and to find evidence for BMI. If two of the four elements are classified as innovative, the observed start-up is assumed to pursue BMI.

To evaluate whether an element of the BM has been innovated or not, we analysed the start-up's direct competitors. In doing so, we clarified whether the corresponding BM element follows the common industry logic or differs from it. If we found a discrepancy, the element was classified as innovative. For example, if the typical revenue model in a given industry is mainly based on product sales, while the examined start-up also generated other revenue streams (e.g. rentals), it was classified as an innovative BM element. To further increase validity, the analysis was conducted independently by the research team and consolidated at the end.

Through careful examination of the theory, a basic framework was created that brings about a consistent view of BMI. The validity of the applied criteria (Schöneck and Voss, 2013), has been tested and validated in numerous studies (Csik, 2014; Gassmann et al., 2013; Gassmann and Frankenberger, 2016).

5. Empirical results

The SIC focusses on innovative start-ups. Since the sample studied is made up of finalists, it is not surprising that all start-ups are innovative and can be assigned to an innovation type.

Table 1: Overview of the types of innovation in the research sample

Innovation type	
Business model innovation	41.7%
Product innovation	41.7%
Service innovation	12.5%
Process innovation	4.1%
Social innovation	0.0%
Structural/organisational innovation	0.0%
Marketing innovation	0.0%
Management innovation	0.0%
Market innovation	0.0%
Total	**100%**

As can be seen in Table 1, BMI and product innovation cases account for around 41% of the cases examined. This translates to 54.2% when we combine product and service innovation. A comparable study conducted on the SIC for the years 2015, 2016 and 2017 shows that 73.1% of cases focused on product and service innovation (Kabous et al., 2019; Philippi and von Büren, 2021; Philippi and Hinz, 2018), while only 18.3% displayed evidence for BMI (Philippi and von Büren, 2021). Our data for 2021 suggests that 41.7% of cases focus on BMI, which is a significant increase. This could relate to the fact that the implementation of BMI requires access to appropriate internal and external knowledge, whereby external knowledge is of great importance, especially for small companies, as well as a certain willingness to take risks (Hock-Doepgen et al., 2021). The observation that start-ups have increasingly focused on BMI over the last few years also suggests that start-ups try to gain access to relevant knowledge. In addition, start-ups often try to compensate for disadvantages due to their small size by developing innovative BM to get competitive advantages (Holzmann et al., 2013), as this enables them to differentiate themselves from established companies competing on the same market (Zollenkop, 2011).

None of the projects were classified as a structural innovation or organisational innovation, marketing innovation or management innovation. This is explained by the fact that these types of innovation are less common and are often not even classified as such by the people who initiate or implement them.

Looking at the elements of BM like target customers, value proposition, value chain and revenue mechanics, BMI is evident in 41.7% of reviewed cases where at least two of these elements are innovated. Figure 1 illustrates which elements of the BM have been innovated.

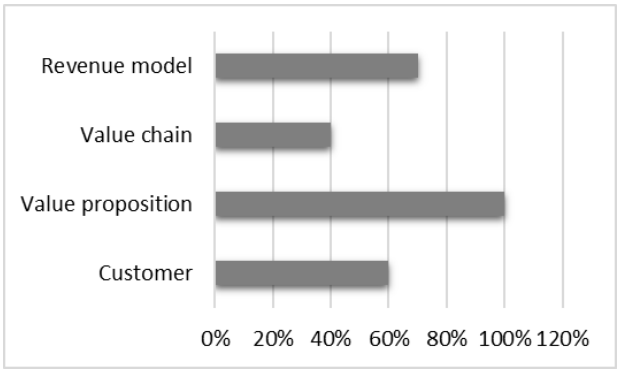


Figure 1: Innovated elements of the business model

In all business plans that could be assigned to the BMI category, the value proposition was classified as innovative (cf. Figure 1). This is not surprising since the innovation of a service or a product is the most common type of innovation, which often coincides with the value proposition. The revenue mechanism was changed in 70% of the BMI cases 10 BMI (see Figure 1). Slightly fewer start-ups developed innovations in the value chain (40%) and with target customers (60%). This shows a clear difference to the earlier study. At that time, both target customers and the value chain were innovated far less frequently (Philippi and Hinz, 2018). This seems to confirm that today's start-ups have greater knowledge in dealing with different levers of BMI.

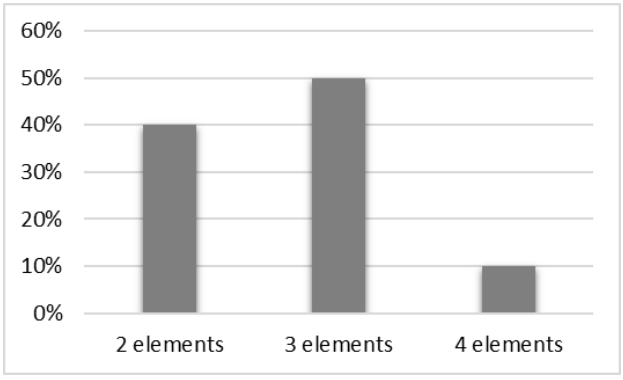


Figure 2: Adaptation in the elements of a business model (% of the BMI cases)

If we look further at how many elements of a BM were the subject of an adaptation or innovation, we see that in most cases three elements of a BM underwent an innovation (cf. Figure 2), four out of ten start-ups (40%) innovated two elements and one start-up even managed a BMI by adapting all four elements. This is surprising, because innovating several elements of the BM is always complex (Csik, 2014). Furthermore, this is a change from the previous study, where most companies innovated two elements and only a few innovated three; no company innovated four elements (Kabous et al., 2019).

By far the most frequent combination of changed elements of a BM was observed between customer / value proposition / revenue model with 30% of all BMI. Value proposition / revenue model was innovated by two start-ups, while all other combinations occurred only once (cf. Figure 3).

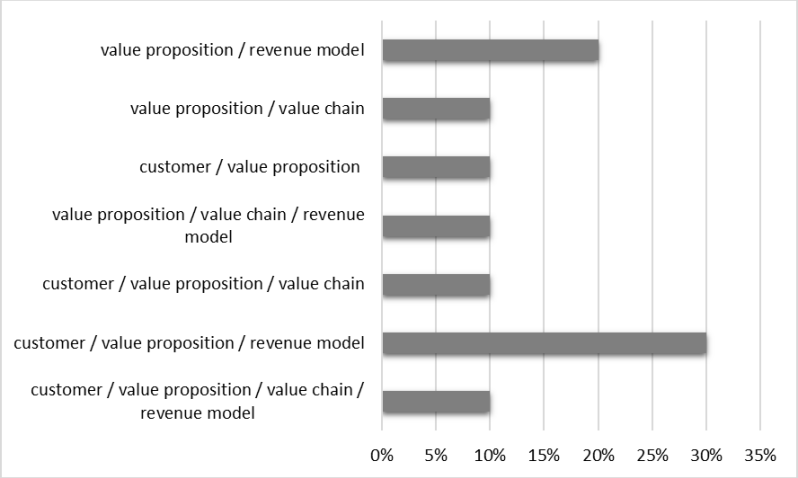


Figure 3: Combinations of the innovative elements of a business model

6. Conclusion and future research

BMI is becoming increasingly important in business, among established companies and especially among start-ups (Bouwman et al., 2019; Faria et al., 2021; Filser et al., 2021; Ghezzi and Cavallo, 2020; Silva et al., 2020). As illustrated, this is due to the fact that product and service innovation is increasingly seen as insufficient (Bucherer et al., 2014) and BMI is seen as key to improving performance (Faria et al., 2021; Kim et al., 2020; Loon and Quan, 2021; Montemari et al., 2022). Through SIC we have access to highly innovative start-ups in Switzerland, enabling us to address the question of how prevalent BMI may be in these contexts.

The aim of the paper was to find out how Swiss start-ups (within the SIC) deal with BMI in practice and how they innovate their business models. In the analysis of 24 cases, BMI accounted for 41.7% and product and service innovation for 54.2%. A similar study on SIC for the years 2015 to 2017 showed that 73.1% of the cases were focused on product and service innovation, while only 18.3% contained references to business model innovation. A significant increase can therefore be observed for the year 2021. This increase is astonishing because research from von den Eichen et. al (2014) has identified various barriers that prevent the step towards BMI from being taken. These include awareness barriers, search barriers, system barriers and logic barriers (von den Eichen et al., 2014). One possible explanation for this growth of BMI is the increased access to knowledge around BMI. This is also confirmed by the finding that many projects innovated not only two out of four elements of a BMI, but slightly more often three, and in one case even four elements. The more elements innovated, the more robust and complex the BMI. During the analysis, it also became apparent that many projects, when analysed more closely, had potential for BMI. We were also able to determine this in the previous study (Kabous et al., 2019; Philippi and von Büren, 2021; Philippi and Hinz, 2018), but this time the number of projects with further potential was significantly lower. The study can clarify the status of BMIs among the start-ups in the final round, especially in the context of SIC. The available data and contacts offer an opportunity to clarify further questions here, above all the examination of how BMIs come about, and which decision-making processes take place in the start-ups. This decision-making process should certainly be considered in future research projects. Likewise, the question remains to what extent BMI differs from other types of innovation in terms of success, longevity, and sustainability. Especially in the context of start-ups, such research promises interesting insights. The competition's solid data base and the prospect of being able to generate further data in the future presents opportunities that should be exploited and that could also make a significant contribution to research in the field of BMI. Several hundred business plans are already available for analysis. Another area that offers opportunities is linking with other approaches such as effectuation or lean start-up.

References

Abdelkafi, N., Makhotin, S. and Posselt, T. (2013), "BM innovations for electric mobility - what can be learned from existing BM patterns?", *International Journal of Innovation Management*, Vol. 17 No. 01, p. 1340003.

Affenzeller, P. (2014), "Erlösmodell als Gestaltungselement bei der Entwicklung von Geschäftsmodellen", in Granig, P., Hartlieb, E. and Lercher, H. (Eds.), *Innovationsstrategien*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 137–146.

Amit, R. and Zott, C. (2012), "Creating Value through BM Innovation", *MIT Sloan Management Review*, Vol. 53 No. 3, pp. 41–49.

Anklin, R., Philippi, S. and Schindler, D. (2017), "Innovation", *Basellandschaftliche Zeitung, Beilage "Swiss Innovation Challenge"*, Liestal, 18 October.

Asemokha, A., Musona, J., Ahi, A., Torkkeli, L. and Sareenketo, S. (2021), "BM Innovation in the Internationalization of SMEs: The Role of Causation and Effectuation", presented at the Hawaii International Conference on System Sciences.

Augsten, T., Brodbeck, H. and Birkenmeier, B.U. (2017), *Strategie und Innovation: die entscheidenden Stellschrauben im Unternehmen wirksam nutzen*, Springer Gabler, Wiesbaden.

Baber, W.W., Ojala, A. and Martinez, R. (2019), "Effectuation logic in digital BM transformation: Insights from Japanese high-tech innovators", *Journal of Small Business and Enterprise Development*, Vol. 26 No. 6/7, pp. 811–830.

Belussi, F., Orsi, L. and Savarese, M. (2019), "Mapping BM Research: A Document Bibliometric Analysis", *Scandinavian Journal of Management*, Vol. 35 No. 3, p. 101048.

Bocken, N. and Snihur, Y. (2020), "Lean Startup and the BM: Experimenting for novelty and impact", *Long Range Planning*, Vol. 53 No. 4, p. 101953.

Bogers, M. and Jensen, J.D. (2017), "Open for business? An integrative framework and empirical assessment for BM innovation in the gastronomic sector", *British Food Journal*, Vol. 119 No. 11, pp. 2325–2339.

Bouwman, H., Nikou, S. and de Reuver, M. (2019), "Digitalization, BMs, and SMEs: How do BM innovation practices improve performance of digitalizing SMEs?", *Telecommunications Policy*, Vol. 43 No. 9, p. 101828.

Bucherer, E., Eisert, U. and Gassmann, O. (2014), "Auf dem Weg zur systematischen Geschäftsmodellinnovation", in Granig, P., Hartlieb, E. and Lercher, H. (Eds.), *Innovationsstrategien*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 119–136.

Casadesus-Masanell, R. and Zhu, F. (2013), "BM innovation and competitive imitation: The case of sponsor-based BMs: BM Innovation and Competitive Imitation", *Strategic Management Journal*, Vol. 34 No. 4, pp. 464–482.

Chesbrough, H. (2010), "BM Innovation: Opportunities and Barriers", *Long Range Planning*, Vol. 43 No. 2–3, pp. 354–363.

Clauss, T. (2017), "Measuring BM innovation: conceptualization, scale development, and proof of performance: Measuring BM innovation", *R&D Management*, Vol. 47 No. 3, pp. 385–403.

Csik, M. (2014), *Muster Und Das Generieren von Ideen Für Geschäftsmodellinnovationen*, Bamberg: Difo-Druck.

Dopfer, M. (2018), "Why BM Innovation Matters to Startups", in Richter, N., Jackson, P. and Schildhauer, T. (Eds.), *Entrepreneurial Innovation and Leadership*, Springer International Publishing, Cham, pp. 77–85.

von den Eichen, S.F., Matzler, K. and Freiling, J. (2014), "Woran Geschäftsmodellinnovationen scheitern", in Granig, P., Hartlieb, E. and Lercher, H. (Eds.), *Innovationsstrategien*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 147–159.

Faria, V.F. de, Santos, V.P. and Zaidan, F.H. (2021), "The BM Innovation and Lean Startup Process Supporting Startup Sustainability", *Procedia Computer Science*, Vol. 181, pp. 93–101.

Filser, M., Kraus, S., Breier, M., Nenova, I. and Puumalainen, K. (2021), "BM innovation: Identifying foundations and trajectories", *Business Strategy and the Environment*, Vol. 30 No. 2, pp. 891–907.

Foss, N.J. and Saebi, T. (2017), "Fifteen years of research on BM innovation: How far have we come, and where should we go?", *Journal of Management*, Vol. 43 No. 1, pp. 200–227.

Foss, N.J. and Saebi, T. (2018), "BMs and BM innovation: Between wicked and paradigmatic problems", *Long Range Planning*, Vol. 51 No. 1, pp. 9–21.

García-Gutiérrez, I. and Martínez-Borreguero, F.J. (2016), "The Innovation Pivot Framework: Fostering BM Innovation in Startups: A new tool helps entrepreneurs design BMs by identifying the sources of competitive advantage embedded in an innovation.", *Research-Technology Management*, Vol. 59 No. 5, pp. 48–56.

Gassmann, O., Csik, M. and Frankenberger, K. (2012), "Aus alt mach neu: Ein Fahrplan für Innovationen", *Harvard Business Manager*, Vol. 34 No. 6, pp. 18–19.

Gassmann, O. and Frankenberger, K. (2016), "Geschäftsmodelle entwickeln: Von der Kunst zum Handwerk", in Granig, P., Hartlieb, E. and Lingenhel, D. (Eds.), *Geschäftsmodellinnovationen*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 17–33.

Gassmann, O., Frankenberger, K. and Csik, M. (2013), "Geschäftsmodelle: Branchenlogik durchbrechen", in Gassmann, O. and Sutter, P. (Eds.), *Praxiswissen Innovationsmanagement: Von Der Idee Zum Markterfolg*, Carl Hanser Verlag GmbH Co KG, pp. 175–193.

Gassmann, O., Frankenberger, K. and Csik, M. (2017), *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler BM Navigator*, Vol. 2. Auflage, Hanser Verlag, München.

Ghezzi, A. and Cavallo, A. (2020), "Agile BM Innovation in Digital Entrepreneurship: Lean Startup Approaches", *Journal of Business Research*, Vol. 110, pp. 519–537.

Hock-Doepgen, M., Clauss, T., Kraus, S. and Cheng, C.-F. (2021), "Knowledge management capabilities and organizational risk-taking for BM innovation in SMEs", *Journal of Business Research*, Vol. 130, pp. 683–697.

Holzmann, P., Gustafsson, V. and Schwarz, E.J. (2013), "Geschäftsmodellinnovation und Entrepreneurship", in Krause, D.E. (Ed.), *Kreativität, Innovation, Entrepreneurship*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 353–369.

Jodlbauer, H. (2020), *Geschäftsmodelle erarbeiten: Modell zur digitalen Transformation etablierter Unternehmen*, Springer Fachmedien Wiesbaden, Wiesbaden.

Johnson, M.W., Christensen, C.M. and Kagermann, H. (2008), "Reinventing Your BM", *Harvard Business Review*, Vol. 86 No. 12, pp. 50–60.

Kabous, L., Loosli, C. and Philippi, S. (2019), "Digitalisierung ja, aber nicht ausschliesslich", Digitalisierung und andere Innovationsformen Im Management, *Innovation und Unternehmertum*, Vol. 2, pp. 145-176.

Kim, I.-H.S., Ku, T.-Y.D. and Lee, B.-Y.M. (2020), "BM schema: BM innovation tool based on direct causal mechanisms of profit", *Technology Analysis & Strategic Management*, Vol. 32 No. 4, pp. 379–396.

Klewitz, J. and Hansen, E.G. (2014), "Sustainability-oriented innovation of SMEs: a systematic review", *Journal of Cleaner Production*, Vol. 65, pp. 57–75.

Kukkamalla, P.K., Bikfalvi, A. and Arbussa, A. (2021), "The new BMW: BM innovation transforms an automotive leader", *Journal of Business Strategy*, Vol. 42 No. 4, pp. 268–277.

Lang, M. (2020), "Modern BM Innovation Methodologies: A Systematic Literature Review (2015-2020)", *Business Management and Strategy*, Vol. 11 No. 2, p. 94.

Lindgardt, Z., Reeves, M., Stalk, Jr., G. and Deimler, M. (2012), "BM Innovation: When the Game Gets Tough, Change the Game", in Deimler, M., Lesser, R., Rhodes, D. and Sinha, J. (Eds.), *Own the Future*, 1st ed., Wiley, pp. 291–298.

Loon, M. and Quan, X.I. (2021), "Theorising BM innovation: An integrated literature review", *Australian Journal of Management*, Vol. 46 No. 3, pp. 548–577.

Minsch, R. and Can, E. (2020), *Internationaler Wettbewerb Um Jungunternehmen: Die Schweiz Braucht Startup-Visa.*, Economiesuisse.

Montemari, M., Taran, Y., Schaper, S., Nielsen, C., Thomsen, P. and Sort, J. (2022), "BM innovation or BM imitation – That is the question", *Technology Analysis & Strategic Management*, pp. 1–15.

Osterwalder, A., Pigneur, Y. and Clark, T. (2010), *BM Generation: A Handbook for Visionaries, Game Changers, and Challengers*, Wiley, Hoboken, NJ.

Philippi, S. and von Büren, D. (2021), "Geschäftsmodellinnovation in den Unternehmenswettbewerben Swiss Startup und Swiss Innovation Challenge", in Peter, M.K. (Ed.), *Strategieentwicklung im digitalen Zeitalter.*, Fachhochschule Nordwestschweiz.

Philippi, S. and Hinz, A. (2018), "Business model innovation in Switzerland: The unused potential.", presented at the 8th Annual International Conference on Business & Economics, Singapore

Ramdani, B., Binsaif, A. and Boukrami, E. (2019), "BM innovation: a review and research agenda", *New England Journal of Entrepreneurship*, Vol. 22 No. 2, pp. 89–108.

Rayna, T. and Striukova, L. (2016), "360° BM Innovation: Toward an Integrated View of BM Innovation: An integrated, value-based view of a BM can provide insight into potential areas for BM innovation.", *Research-Technology Management*, Vol. 59 No. 3, pp. 21–28.

Reineke, R.-D. and Philippi, S. (2017), *Swiss Innovation Challenge, Handbuch 2017*, FHNW, Windisch.
Ries, E. (2017), *Lean startup: schnell, risikolos und erfolgreich Unternehmen gründen*, 5. Auflage., Redline Verlag, München.
Rusnjak, A. (2014), *Entrepreneurial BMing*, Springer Fachmedien Wiesbaden, Wiesbaden.
Schallmo, D. (2013), *Geschäftsmodell-Innovation*, Springer Fachmedien, Wiesbaden.
Schallmo, D. (2015), *Bestehende Ansätze Zu BM Innovationen*, Springer Fachmedien Wiesbaden, Wiesbaden.
Schöneck, N.M. and Voss, W. (2013), *Das Forschungsprojekt*, Springer Fachmedien Wiesbaden, Wiesbaden.
Schwarz, E.J., Krajger, I. and Holzmann, P. (2016), "Prozessmodell zur systematischen Geschäftsmodellinnovation", in Granig, P., Hartlieb, E. and Lingenhel, D. (Eds.), *Geschäftsmodellinnovationen*, Springer Fachmedien Wiesbaden, Wiesbaden, pp. 65–77.
Silva, D.S., Ghezzi, A., Aguiar, R.B. de, Cortimiglia, M.N. and ten Caten, C.S. (2020), "Lean Startup, Agile Methodologies and Customer Development for BM innovation: A systematic review and research agenda", *International Journal of Entrepreneurial Behavior & Research*, Vol. 26 No. 4, pp. 595–628.
Sjödin, D., Parida, V., Jovanovic, M. and Visnjic, I. (2020), "Value Creation and Value Capture Alignment in BM Innovation: A Process View on Outcome-Based BMs", *Journal of Product Innovation Management*, Vol. 37 No. 2, pp. 158–183.
Sniukas, M. (2020), *BM Innovation as a Dynamic Capability: Micro-Foundations and Case Studies*, Springer International Publishing, Cham.
Spieth, P., Schneckenberg, D. and Ricart, J.E. (2014), "BM innovation–state of the art and future challenges for the field", *R&D Management*, Vol. 44 No. 3, pp. 237–247.
Stampfl, G. (2016), *The Process of BM Innovation*, Springer Fachmedien Wiesbaden, Wiesbaden.
Swiss Innovation Challenge. (2022), "Was ist die Swiss Innovation Challenge?", *SWISS INNOVATION CHALLENGE*, available at: https://www.swissinnovationchallenge.ch/ (accessed 14 April 2022).
Taran, Y., Boer, H. and Lindgren, P. (2015), "A BM Innovation Typology: A BM Innovation Typology", *Decision Sciences*, Vol. 46 No. 2, pp. 301–331.
Trapp, M. (2014), *Realizing BM Innovation*, Springer Fachmedien Wiesbaden, Wiesbaden.
Weis, B.X. (2012), *Praxishandbuch Innovation*, Gabler Verlag, Wiesbaden.
Wirtz, B.W. (2020), *BM Management: Design - Process - Instruments*, Springer International Publishing, Cham.
Zollenkop, M. (2011), "Geschäftsmodellinnovation im Spannungsfeld zwischen Unternehmensgründung und Konzernumbau", in Bieger, T., zu Knyphausen-Aufseß, D. and Krys, C. (Eds.), *Innovative Geschäftsmodelle*, Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 201–211.
Zott, C. and Amit, R. (2015), "BM Innovation", in Shalley, C., Hitt, M.A. and Zhou, J. (Eds.), *The Oxford Handbook of Creativity, Innovation, and Entrepreneurship*, Oxford University Press, pp. 395-406.
Zott, C., Amit, R. and Massa, L. (2011), "The BM: Recent Developments and Future Research", *Journal of Management*, Vol. 37 No. 4, pp. 1019–1042.

The Importance of Entrepreneurship on Economic Development. Evidence From the OECD Countries

Sara Proença[11] and Elias Soukiazis [2]
[1]Polytechnic Institute of Coimbra/ESAC, CERNAS, Bencanta, Coimbra, Portugal
[2]University of Coimbra, CeBER, Faculty of Economics, Coimbra, Portugal
sproenca@esac.pt
elias@fe.uc.pt

Abstract: The process of a country's economic growth and development is a very complex phenomenon, influenced by numerous factors, which has attracted the attention of researchers and policymakers over time. Several studies highlight the important role of entrepreneurship on economic growth, by introducing innovative technologies, creating new products, promoting new jobs and employment opportunities, but also improving competition and competitiveness. Although the impact of entrepreneurship on economic growth has been broadly analysed in the economic literature over the recent years, few studies have examined the impact of entrepreneurship on economic development. The aim of this paper is to fill this gap, using the Human Development Index (HDI) as a suitable proxy for measuring economic development, taken from the United Nations statistics. HDI is a composite measure of average achievement in key dimensions of human development, such as, life expectancy, education level and standards of living. On the other hand, Entrepreneurship is measured by Total Entrepreneurial Activity (TEA) taken from the Global Entrepreneurship Monitor, which expresses the percentage of population with age between 18 and 64, who are either a nascent entrepreneur or owner-manager of a new business. The empirical model is drawn from the endogenous growth theory, assuming that entrepreneurship and human capital skills are the key drivers of economic development, along with capital stock. The empirical analysis is based on unbalanced panel data regressions for a sample of 37 OECD countries using annual data for the period 2000-2018. Estimating a dynamic panel data model by using the GMM two-step system approach, we obtain evidence indicating the positive association between the development level and entrepreneurship, as well as the positive impact of human capital and capital stock on development. Our empirical results are in line with the endogenous growth theory approach, showing that entrepreneurship can be considered as an additional factor input in the countries' economic development pathway.

Keywords: entrepreneurship, economic development, human development index, panel data, dynamic regressions

1. Introduction

Identifying the factors explaining economic growth and development is always a challenging matter that attracted the attention of researchers and policymakers over time. While neoclassical theory (Solow, 1956, Swan, 1956) claims that physical capital and labor are the two most important sources of a nation's economic growth, the endogenous growth theory (Romer, 1986, Lucas, 1988, Barro, 2001) holds that investment in human capital, knowledge diffusion and technology are key drivers of economic growth and human development. More recent developments in growth theory highlight the importance of business activities in creating wealth and new labor opportunities. In this sense, entrepreneurship plays an important role in enhancing economic activity by introducing innovative technologies, creating new products and services, promoting new jobs and employment opportunities, but also by improving competition and competitiveness (Schumpeter, 1934, Baumol and Strom, 2007, Khyareh and Rostami, 2018). This view is supported by the findings of the World Economic Forum (2013) showing that rapidly growing entrepreneurship is an important source of innovation, productivity growth and employment, and therefore an important determinant of economic and social development.

Studies on the role of entrepreneurship in economic growth, generally measured by the gross domestic product (GDP) cover a wide range of fields and approaches (Stoica et al., 2020, Boudreaux et al., 2019, Audretsch, et al., 2015, Acs et al., 2012). However, there are few studies in the literature that investigate the impact of entrepreneurship on the country´s development level (see Neumann, 2020 for a recent review). In this regard, it should be noted that the terms "economic growth" and "economic development" reflect different views of economic improvement, and it is worth to point out some differences since our study focuses on the latter. Economic growth is a narrow term, that refers to the quantitative increase of wealth (increase of real output of goods and services) measured by the increase in GDP or per capita income. Economic development, in turn, is a wider concept that apart from growth of the national income it includes qualitative aspects of wealth, such as:

[1]Corresponding author: Sara Proença, Escola Superior Agrária do Instituto Politécnico de Coimbra, Bencanta, 3040-316 Coimbra, Portugal.

education, health, social equity, and environmental quality, reflecting the quality of living standards. It measures the quality of growth, and not its quantity alone, which is crucial for the human well-being.

This paper contributes to the growing literature by examining the empirical relationship between entrepreneurship and economic development (not growth), using the Human Development Index (HDI) as a suitable proxy for measuring economic development. HDI is a composite measure of average achievement in key dimensions of human development, such as: life expectancy at birth to measure health standards, education level measured by the adult literacy rate, and real GDP per capita to serve as a proxy for the resources needed for improving the standard of living. HDI thus looks not only at the GDP growth rate but also considers education, health, gender, and income parameters to measure human development of a country, reasons that motivated its choice as a proxy for measuring the level of economic development. Entrepreneurship, in turn, is measured by Total Entrepreneurial Activity (TEA) taken from the Global Entrepreneurship Monitor, which expresses the percentage of population with age between 18 and 64, who are either a nascent entrepreneur or owner-manager of a new business. The empirical analysis estimates a dynamic development model of 37 OECD countries using annual data for the period 2000-2018.

The remainder of the present paper is organized as follows. Section 2 briefly reviews the literature on the relationship between entrepreneurship and economic performance. Section 3 explains the research methodology, the empirical model, and descriptive statistics on the variables used in the empirical model. Section 4 presents and discusses the main findings of the empirical analysis. Section 5 sets out the main conclusions and policy implications.

2. Literature review

Over the last decades, many researchers have found empirical evidence supporting a positive relationship between entrepreneurship and economic growth. For example, Acs et al. (2012) in an empirical study of 18 countries observed that in addition to investments in R&D and human capital, entrepreneurial activity has a positive impact on growth. The authors point out that entrepreneurship is a mechanism that facilitates the spillover of knowledge and is, thus, conducive to economic growth. In the same line, Audretsch and Keilbach (2004) using data for German regions state that entrepreneurship capital (defined as the capacity for economic agents to generate new businesses) is a significant and important factor shaping economic output and productivity.

The relationship between entrepreneurship and economic performance was also examined by Bosma et al. (2018) for a sample of 25 European countries over the period 2003–2014. The authors found that productive entrepreneurship has a positive impact on economic growth and that institutional quality, financial stability, small government, and perceived skills to start a business are the most significant predictors of such productive entrepreneurship. Galindo and Méndez (2014), in turn, highlight a virtuous cycle between entrepreneurship, economic growth, and innovation, where the three factors have positive effects to each other.

A more recent study by Stoica et al. (2020) examines the potential effect on economic growth (measured as per capita GDP) of different types of entrepreneurship, in particular early-stage, opportunity-driven and necessity-driven entrepreneurship, and how this impact differs depending on the stage of economic growth of a country. Considering a sample of 22 European countries classified into two groups according to their stage of economic performance over the period 2002-2018, the authors provide empirical evidence that supports the positive impact of all forms of entrepreneurship on economic growth for the whole sample of European countries, with opportunity-driven entrepreneurship having a stronger impact in transition countries and necessity-driven entrepreneurship in innovation-driven countries. In the same line of research, Urbano and Aparicio (2016) used the Total Entrepreneurial Activity (TEA), opportunity TEA, and necessity TEA as three different types of entrepreneurship to test their impact on economic growth in 43 countries in the period from 2002 to 2012. The empirical results show that all types of entrepreneurial activities positively affect economic growth in all countries of the sample, but the positive effect of overall TEA is higher in OECD than in non-OECD countries.

Empirical evidence which supports the view that the impact of entrepreneurship on economic performance differs depending on the stage of economic growth of a country is also corroborated by other recent studies. Ivanović-Djukić et al. (2018), using data for 21 European countries, demonstrate that the positive impact of entrepreneurial activity on economic growth is higher in developed European countries than in developing

countries. Additionally, the authors show that the greatest effect on economic growth is high-growth expectation entrepreneurship, followed by opportunity entrepreneurship, while the smallest impact was made by necessity entrepreneurship. Doran et al. (2018), in turn, showed that entrepreneurial activity has a positive effect on GDP per capita in high income countries in contrast to the middle/low-income countries, where the impact is negative. Stel et al. (2005), considering a sample of 36 countries over the 1999-2003 period, found that the entrepreneurial activity rate (measured by nascent entrepreneurs and owner/managers of young businesses) has a negative effect in the poorer countries and positively affects the rich countries, and that this is related to lower human capital skills of entrepreneurs in poorer countries. Similarly, Valliere and Peterson (2009), found that entrepreneurship has a positive and significant impact on economic growth in developed countries but not in emerging countries. Additionally, Vivarelli (2013) argues that increasing survival or self-employed entrepreneurship can be counter-productive to economic performance in less developing countries.

The literature review highlights that while several studies have been investigated the role of entrepreneurship on economic growth, generally measured in terms of gross domestic product (GDP), there is a lack of studies examining the relationship between entrepreneurship, educational level, and human development. Therefore, the present study builds on the existing literature by providing empirical evidence on the impact of entrepreneurship on the country´s development level measured by the human development index (HDI).

3. Model, data and methodology

To carry out the analysis of the relationship between entrepreneurship and economic development, this study develops an econometric model that presents some particularities. In contrast to the conventional growth theory, the dependent variable indicates the country´s development level which is explained by the standard factor inputs represented by the capital stock and human capital to be consistent with the endogenous growth theory (Romer, 1986, 1994) which predicts that the driving force of economic growth depends on internal factors such as investment in human capital, innovation, and knowledge creation. Entrepreneurship is an additional covariate testing its importance on the development level. A lagged dependent variable is used to verify whether past development levels are important for explaining current levels, and this specification is consistent with the partial adjustment mechanism that allows to distinguish the short-run and long-run effects of factor inputs, as well as the speed of adjustment of the actual variation of the development level to its optimal level. The empirical model to estimate assumes the following form:

$$lnHDI_{it} = \alpha_i + \beta_1 lnHDI_{it-1} + \beta_2 TEA_{it} + \beta_3 lnKpc_{it} + \beta_4 lnHK_{it} + u_{it} \quad \text{Eq. (1)}$$

where, i is the country index and t denotes the time period. The dependent variable (HDI_{it}) is expressed by the human development index taken from the United Nations, which is a composite measure of average achievement in key dimensions of human development, such as life expectancy, education level and income. Among the explanatory variables, entrepreneurship is of particular interest, expressed by the total entrepreneurial activity, and measured by the proportion of the population between 18 and 64 years who are either nascent entrepreneurs or owners-managers of a new business, using data from the Global Entrepreneurship Monitor (GEM). In addition, we also control for the effect of gross fixed capital formation, measured in per capita terms (Kpc_{it}), and the human capital (HK_{it}), given by the mean years of schooling. The coefficient α_i is a country-specific effect which captures time-invariant country characteristics, and u_{it} is the error term with the usual stationary properties. All variables are in the logarithmic form, except TEA which is expressed in percentage.

Table 1 provides a summary of the variable's definition, data sources and the respective descriptive statistics. We use an unbalanced panel dataset[2] composed by 37 OECD countries for the period 2000-2018. It is shown that the mean value of the human development index is 0.863 with a minimum value of 0.655 corresponding to Turkey and Colombia and the maximum 0.954 corresponding to Norway. The mean value of the total entrepreneurial activity is 8.46%, with the highest value of 27.35% found in Colombia (in 2016) and a minimum value of 1.5% in Japan, which reveals a large heterogeneity among the countries of the sample with regard to entrepreneurial activity. It should be said that less developed countries show higher values of entrepreneurial activity, but this is mostly necessity-driven rather than opportunity-driven entrepreneurship. Due to unfavorable

[2] Data on *TEA* are given for a smaller period and due to this the estimation approach uses 471 total observations.

economic conditions, high unemployment rates and lack of other opportunities, many people of these countries decide to create their own business to earn a sustainable income (for this argument, please see Stoica et al., 2020). The mean years of schooling is 11.2 with the lower value of 5.5 years found in Turkey and the highest of 14.1 years in Germany. The lowest capital stock per head is found in Colombia and the highest in Ireland.

Using the data described in Table 1, we estimate the development Equation (1) applying the most adequate method described by Arrelano and Bond (1991). To overcome endogeneity problems arising from the lagged dependent variable, the authors suggested the Generalized Method of Moments (GMM) approach, which consists in taking the first differences of variables and instrumenting the first differenced lagged values of the dependent variable by using previous lagged levels. The predetermined (lagged dependent variable) and other endogenous regressors in first differences are instrumented by suitable lags of their own levels. Arrelano and Bover (1996) and Blundell and Bond (1998), in a later work, suggested a modification of the original model, recommending the use of lagged levels and lagged differences as well. The GMM approach has one-step and two-step variants, the latter being asymptotically more efficient, since a finite-sample correction is made to the standard errors of coefficients, as indicated by Windmeijer (2005). The dynamic version of the development equation is estimated by using the GMM two-step difference system approach with robust standard errors and this approach is consistent with the partial adjustment mechanism.

Table 1: Variables, data sources and descriptive statistics

Variables	Definition	Source	Obs	Mean	SD	Min	Max
HDI	Human Development Index (0-1) a composite index measuring average achievement in three basic dimensions of human development - a long and healthy life, knowledge and a decent standard of living	United Nations (UN) http://hdr.undp.org/en/data	703	0.86299	0.05781	0.655	0.954
TEA	Total Entrepreneurial Activity (%) Percentage of population between 18 and 64 years who are either nascent entrepreneurs or owner-managers of a new business	Global Entrepreneurship Monitor (GEM) http://www.gemconsortium.org/data	471	8.4631	4.6635	1.48	27.35
Kpc	Gross Fixed Capital Formation per capita (million US dollars)	OECD Data https://data.oecd.org	703	0.0075	0.0035	0.0009	0.0257
HK	Human Capital Mean years of schooling	UN http://hdr.undp.org/en/data	703	11.2266	1.7166	5.5	14.1

4. Empirical findings

The results of estimating the development equation, as given in Equation (1), are shown in Table 2. The first point to highlight is that all variables' coefficients are statistically significant (at the 1% or 5% level), the second order autocorrelation indicates the absence of autocorrelated errors (at 5% of significance level), and the Hansen test validates the instruments used in the regression.

Table 2: Panel regression estimates

Method: Dynamic panel-data estimation, two-step difference GMM, robust standard errors Dependent variable: $lnHDI_{it}$					
Variable	Coefficient	Corrected Std. Error	t-ratio	p-value	
$lnHDI_{it-1}$	0.59564	0.05556	10.72	0.000	***

Method: Dynamic panel-data estimation, two-step difference GMM, robust standard errors Dependent variable: $lnHDI_{it}$					
Variable	Coefficient	Corrected Std. Error	t-ratio	p-value	
TEA_{it}	0.00071	0.00028	2.57	0.014	**
$lnKpc_{it}$	0.00750	0.00319	2.35	0.024	**
$lnHK_{it}$	0.11397	0.02669	4.27	0.000	***
Observations	393				
Groups	35				
AR (1)	z = -3.55 p-value = 0.000				
AR (2)	z = -1.79 p-value =0.074				
Hansen	$chi^2(131) = 34.51$ Prob > chi2 = 1.000				
Speed of adjustment	0.40436				

Notes: ***, ** denote statistical significance of coefficients at 1% and 5% levels, respectively. Robust standard errors according to Windmeijer (2005) correction are used. AR (1) and AR (2) are the Arellano-Bond tests for first and second order autocorrelation in first differences. The Hansen-test is used for testing over-identified restrictions (validating the instruments). The lagged dependent variable is assumed endogenous, instrumented by its own lagged values, the lagged values of all the other exogenous variables and the time trend variable.

Another relevant point to emphasise is that the lagged dependent variable is statistically significant at the highest 1% level, confirming therefore the hypothesis that past values of the development level (HDI) are important for determining its current levels. This evidence also ensures the appropriateness of the dynamic specification in comparison to a static model that ignores past history of development levels and estimates of the latter could be biased due to omission of relevant variables. The importance of estimating a dynamic model also lays on the fact that it allows to measure the speed of adjustment[3] between the actual variation of the development level and its desired level. The calculated value (see at the bottom of Table 2) shows that the adjustment process is not very fast, that is, approximately 40% of the actual variation in development is adjusted to its desired level within the same year.

The focus of our study is to examine the impact of entrepreneurship (given by TEA) on development level using a panel data of 37 OECD countries for the period 2000-2018. We observe that entrepreneurial activity has a positive and statistically significant effect on the level of development of the OECD countries. The regression results reveal that, in the short run, a one percentage point increase in entrepreneurial activity is associated with a 0.071% increase in the development level, everything else constant. In the long run, the expected effect is even higher, with an impact on the development level of 0.176%. Accordingly, entrepreneurship can be considered as an additional factor input generating higher economic development. As mentioned above, the increase of the entrepreneurial activity stimulates economic development by introducing innovative technologies, creating new products and services, promoting new business models, new jobs and employment opportunities, improving competition and competitiveness, all with positive social and economic benefits that boost the level of development of countries. This result is consistent with previous findings in the literature (Stoica et al., 2020, Ivanović-Djukić et al., 2018, Galindo and Méndez, 2014), suggesting that entrepreneurship has a positive impact on economic performance.

Regarding the other standard factor inputs (gross fixed capital formation and the human capital) the effects are the expected ones. It is shown that the increase in development level in the short-run is around 0.0075%, and in the log-run 0.019%, for every one percent increase in gross capital per head. This is the standard contribution of physical capital in the growth theory and therefore in economic development doctrine. We should clarify that gross capital is measured in per capita terms to take into consideration the population size of countries

[3]The partial adjustment mechanism is defined as:
$(HDI_{i,t}-HDI_{i,t-1})=\delta(HDI^*_{i,t}-HDI_{i,t-1})$ with $HDI^*_{i,t}$ the unknown desired level of development level and δ the adjustment coefficient. The left-hand side of this relation indicates the actual variation of the development level, and the right-hand side represents its desired variation. According to this relation, the speed of adjustment is given by subtracting from one the value of the estimated coefficient of the lagged dependent variable.

composing the sample. The impact of human capital on the development level is also positive and statically significant, revealing that a 1% increase in the average years of schooling, in the short-run, is responsible for 0.11% increase in the development level, while in the long-run is even higher and equivalent to 0.28% increase in economic development. According to the endogenous growth theory (Romer, 1986, Lucas, 1988, Barro, 2001), human capital defined as the skills, talent, and experience carried by the workforce of a country, is considered as the engine of growth and our empirical results offer additional evidence that education is the key factor for further development. This outcome is in line with previous empirical studies such as those found by Stoica et al. (2020), Acs et al. (2012) and Bosma et al. (2018).

5. Conclusions

This research investigates the importance of entrepreneurship on economic development, using a dynamic econometric model to carry out the empirical analysis on the OECD countries. We estimate the relationship between the country´s development level measured by the human development index (HDI), and entrepreneurship given by total early-stage entrepreneurial activity (TEA). The economic development equation also includes the standard factor inputs represented by the gross fixed capital formation per head and human capital, to be consistent with the endogenous growth theory.

The overall regression results are satisfactory in terms of statistical significance and sign expectations of the coefficients, confirming the predictions of the endogenous growth theory. In particular, our empirical findings sustain a positive and statistically significant relationship between entrepreneurship and the economic development level, in the short and long run perspectives, showing that entrepreneurship can be seen as an additional factor input in the countries' economic development pathway. The expected positive effect is also observed regarding the standard factor inputs represented by human and physical capital. Policymakers should therefore consider these positive effects when designing economic policies. Recognizing the importance of entrepreneurship as a contributing factor to economic development it is crucial that policymakers prioritize entrepreneur-friendly ecosystems to drive innovative new businesses, trade, and investment.

References

Acs, Z.J., Audretsch, D.B., Braunerhjelm, P., Carlsson, B. (2012). Growth and entrepreneurship. *Small Business Economics*, 39(2), 289–300. https://doi.org/10.1007/s11187-010-9307-2

Audretsch, D.B., Keilbach, M. (2004). Entrepreneurship capital and economic performance. Regional Studies, 38(8), 949–959. https://doi.org/10.1080/0034340042000280956

Arellano, M., Bond, S., (1991). Some tests of specification in panel data: Monte Carlo evidence and the application to employment equations. *Review of Economic Studies* 58 (2), 277-297.

Arrelano, M., and Bover, O., (1996). Another look at the instrumental variable estimation of error components models. *Journal of Econometrics* 68, 29-52.

Audretsch, D.B., Belitski, M., Desai, S. (2015). Entrepreneurship and economic development in cities. *The Annals of Regional Science*, 55, 33–60. https://doi.org/10.1007/s0016 8-015-0685-x

Barro, R. (2001). Human capital: growth, history and policy-A session to honor Stanley Engerman. Human Capital and Growth. *American Economic Review*, 91(2), 12–17. https://doi.org/10.1257/aer.91.2.12

Baumol, W., Strom, R. (2007). Entrepreneurship and Economic Growth. *Strategic Entrepreneurship Journal,* 1, 233-237. https://doi.org/10.1002/sej.26

Blundell, R., and Bond, S., (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics* 87, 115-143.

Bosma, N., Content, J., Sanders, M. *et al*. (2018). Institutions, entrepreneurship, and economic growth in Europe. *Small Business Economics*, 51, 483–499. https://doi.org/10.1007/s11187-018-0012-x

Boudreaux, C.J., Caudill, S. (2019). Entrepreneurship, Institutions, and Economic Growth: Does the Level of Development Matter? MPRA Paper 94244, University Library of Munich, Germany. http://dx.doi.org/10.2139/ssrn.3424797

Doran, J., McCarthy, N., O'Connor, M. (2018). The role of entrepreneurship in stimulating economic growth in developed and developing countries. Cogent Economics & Finance, 6(1), 1442093. https://doi.org/10.1080/23322039.2018.1442093

Galindo, M., Méndez, M. (2014). Entrepreneurship, economic growth, and innovation: Are feedback effects at work? *Journal of Business Research*, 67(5), 825-829. https://doi.org/10.1016/j.jbusres.2013.11.052

Ivanović-Djukić, M., Lepojević, V., Stefanović, S., van Stel, A., Petrović, J. (2018). Contribution of Entrepreneurship to Economic Growth: A Comparative Analysis of South-East Transition and Developed European Countries. *International Review of Entrepreneurship*, 16(2), 257-276.

Khyareh, M., Rostami, N. (2018). Competitiveness and Entrepreneurship, and their Effects on Economic Growth. *International Journal of Management, Accounting and Economics*, 5(10), 813-828. http://www.ijmae.com/article_114828_60ac55f68bc2b9ff85d81465e356e00e.pdf

Lucas, R.E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42. https://doi.org/10.1016/0304-3932(88)90168-7

Neumann, T. (2020). The impact of entrepreneurship on economic, social and environmental welfare and its determinants: a systematic review. *Management Review Quarterly*. https://doi.org/10.1007/s11301-020-00193-7

Romer, P.M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002-1037. https://doi.org/10.1086/261420

Romer, P.M. (1994). The Origins of Endogenous Growth. *Journal of Economic Perspectives*, 8(1), 3–22. https://doi.org/10.1257/jep.8.1.3

Schumpeter, J. (1934). *The Theory of Economic Development. An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Harvard University Press: Cambridge, MA, USA. ISBN 9780674879904.

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94. https://doi.org/10.2307/1884513

Stel, A.v., Carree, M., Thurik, R. (2005). The Effect of Entrepreneurial Activity on National Economic Growth. *Small Business Economics*, 24, 311–321. https://doi.org/10.1007/s11187-005-1996-6

Stoica, O., Roman, A., Rusu, V. (2020). The Nexus between Entrepreneurship and Economic Growth: A Comparative Analysis on Groups of Countries. *Sustainability*, 12(3), 1-19. https://doi.org/10.3390/su12031186

Swan, T.W. (1956). Economic growth and capital accumulation. *Economic Record*, 32, 334–361. https://doi.org/10.1111/j.1475-4932.1956.tb00434.x

Urbano, D., Aparicio, S. (2016). Entrepreneurship capital types and economic growth: International evidence. *Technological Forecasting and Social Change*, 102, 34-44. https://doi.org/10.1016/j.techfore.2015.02.018

Valliere, D., Peterson, R. (2009). Entrepreneurship and economic growth: Evidence from emerging and developed countries. Entrepreneurship & Regional Development, 21:5-6, 459-480. https://doi.org/10.1080/08985620802332723

Vivarelli, M. (2013). Is Entrepreneurship Necessarily Good? Microeconomic Evidence from Developed and Developing Countries. Industrial and Corporate Change, 22(6), 1453-1495. https://doi.org/10.1093/icc/dtt005

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, 126, 25-51.

World Economic Forum (2013). *Entrepreneurial Ecosystems around the Globe and Company Growth Dynamics*. World Economic Forum: Davos, Switzerland. https://www3.weforum.org/docs/WEF_EntrepreneurialEcosystems_Report_2013.pdf

Lean Startup Practices: Operationalizing the Technological Business Planning Process in an Academic Environment

Luciana Reis[1], June Fernandes[1], Márbia Araújo[1] and Martin Beaulieu[2]
[1]Universidade Federal de Ouro Preto (UFOP), João Monlevade, Brazil
[2]HEC Montréal, Montréal, Québec, Canada
lucianapaula@ufop.edu.br
june@ufop.edu.br
marbia.araujo@aluno.ufop.edu.br
martin.beaulieu@hec.ca

Abstract: The generation of innovation in the academic environment involves the development of technology/product, technological transfer and business, which together make up the Technological Business Planning Process (TBPP). This process can be divided into three stages: world of technology (initial stage), world of transition from technology to product and business (intermediate stage), and world of business (final stage). In this context, there is the Lean Startup (LS) methodology, which comprises a set of potential practices to facilitate the operationalization of these stages of development. However, the existing literature is incipient and lacks guidance on the LS practices with the greatest potential to contribute to each of these stages, which constitutes a theoretical gap. Thus, this research aims to identify the LS practices most used by researchers-entrepreneurs in the different stages of the Technological Business Planning Process. The methodological approach used was the case study in an important Brazilian public university. In this context, nine innovation projects in the process of generating technological business were analyzed. The results show four main contributions: i) the practices contributed mainly to the intermediate phase of the TBPP; ii) BMC and MVP were considered the most important practices to operationalize TBPP; iii) the LS practices contributed significantly to the knowledge management between team projects; and iv) the combined implementation of the practices highlighted the benefits for TBPP. This study contributes to technology innovation management in the academic environment and provides some gaps that can be developed in future works in technological projects context.

Keywords: lean startup practices, technological business planning process, technology innovation management, technology transfer, academic spinoffs

1. Introduction

Technological projects developed in the academic environment play an important role in generating wealth and social development (Boguszewicz-Kreft *et al*., 2021; Aguiar *et al*., 2019; Still and Satell, 2017; Vohora, Wright and Lockett, 2004). These projects are expected to result in innovations, technologies and products that can be commercialized via technology transfer to established companies or startups (Diánez-González, Camelo-Ordaz and Fernández-Alles, 2021; Boh *et al*., 2016; Reis *et al*., 2014).

The realization of these innovations in the academic environment is conditioned on three subprocesses: i) technological product planning process (Cooper, 2008; Ajamian and Koen, 2002), ii) business planning process (Vohora, Wright, and Lockett, 2004) and iii) technology transfer process (Ravi and Janodia, 2022; Siegel *et al*., 2004). These three processes result in the Technological Business Planning Process (TBPP) (Majdouline, El Baz and Jebli, 2022; Reis, Fernandes, Armellini, 2021; Fernandes *et al*., 2017) that give rise to the New Technology-Based Ventures (Leitão, Pereira and Gonçalves, 2022). The TBPP is used as a guiding instrument for entrepreneurial actions, by systematizing the stages of innovation, from the world of technology to the world of business.

In this context, the Lean Startup (LS) methodology emerges with a set of practices that can contribute to the generation of technological businesses (Fernandes *et al*., 2017; Still and Satell, 2017), and consequently, to support technological innovation. However, the literature points out that TBPP deserves a clearer and more detailed definition (Fernandes *et al*., 2017). Another point highlighted in the literature is that the technology transfer process is fraught with several challenges (Fasi, 2022; Ravi and Janodia, 2022; Takata *et al*., 2022; Wulandari and Subriadi, 2022; Boguszewicz-Kreft *et al*., 2021; Taouaf *et al*., 2021). Different failures are observed in the initial business development plans due to the lack, for example, of a minimum viable product (MPV) (Wulandari and Subriadi, 2021). Thus, many of these challenges and difficulties come from the lack of knowledge, on the part of the technological development teams, about the Lean startup practices that are capable of contributing to each of the stages of the TBPP in the academic environment. Studies pointed that

future research should explore how LS practices contribute to the processes of technological and innovation projects, using the Lean Startup cycle of Build-Measure-Learn (Chesbrough and Tucci, 2020; Mansoori, Karlsson and Lundqvist, 2019), especially in academics spinoffs (Galli, 2019).

Assuming that LS practices can contribute to the operationalization of the TBPP, in its different stages, this research aims to identify the LS practices most used by researchers-entrepreneurs in the different stages of the Technological Business Planning Process. Based on the research, it is expected to elucidate the contributions of LS practices to TBPP and encourage entrepreneurial researchers to engage in strengthening technological innovations based on academic research.

In addition to this introductory section, the second section will present a literature review, with the LS approach and theoretical frameworks of Technological Business Planning Process. The third section will present the research method. The fourth section we present the case study, a table of frequency of using LS practices in different TBPP stages. The fifth section discusses the contributions of using LS practices. Finally, in the sixth section is presented the conclusion, limitations e future research.

2. Literature review

2.1 Technological Business Planning Process (TBPP)

TBPP (Fernandes *et al*., 2017) is the result of three subprocesses: i) technology planning process (TPP) (Cooper, 2008; Ajamian and Koen, 2002) which aims to help the integration of the technology-product-market triad, for crossing the Valley of Death (Takata *et al*., 2020; Fernandes *et al*., 2017), ii) technology transfer planning process (TTPP) that represents the phases and legal aspects of protecting the commercialization of technologies and academic research products (Ravi and Janodia, 2022; Siegel *et al*., 2004) and iii) business planning process (BPP) (Majdouline, El Baz and Jebli, 2022; Vohora, Wright, and Lockett, 2004) which includes the definition of the business model, logistical, financial, organizational and production strategies (Reis *et al*., 2014).

The three subprocesses start with the development of scientific research and technological development. In sequence, the first subprocess details the development of the technology on a laboratory, pre-commercial and, finally, commercial scale. The second comprises the phase of identifying patenting possibilities, the patenting phase itself, and market prospecting. At this point, the patent can be traded to an established company or a nascent company, when the transfer is formalized and the transfer performance is verified. The third presents the identification of business opportunities, opportunity structuring, prototype company, technology-based nascent company and new technology-based company.

From the literature (Fasi, 2022; Boguszewicz-Kreft *et al*., 2021; Taouaf *et al*., 2021; Takata *et al*., 2020; Fernandes *et al*., 2017) it was possible to structure Figure 1 to represent the intergration of the three subprocesses. The integration of the three processes is possible from three distinct stages: i) World of technology (*initial*): the researcher is immersed in the academic environment in order to identify theoretical problems with real practical needs; ii) world of transition from technology to product and business (*intermediate*): the three processes become distinct, and the first approximations with the market begin; iii) World of business (*final*): represents the insertion of the business in the market through a commercial product.

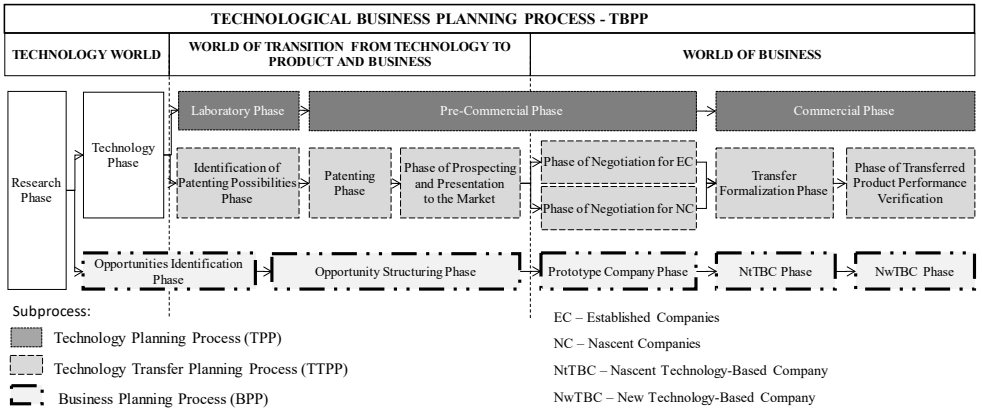


Figure 1: Technology Business Planning Process (TBPP)

To help operationalize the TBPP stages, there are practices based on lean thinking, with academic and professional value, representing a way of specifying value and minimizing applied efforts (Reis *et al*., 2021). The LS brings a set of practices capable of contributing to this operationalization (Fernandes *et al*., 2017; Still and Satell, 2017).

2.2 Lean Startup (LS) approach: Better practices to develop business modeling

Lean Startup (LS) is a movement dedicated to understanding and supporting innovative businesses that operate in high-risk environments (Hinz and Eisenbart, 2019). The LS practices make it possible to identify the target audience, foster the relationship with the customer, add value to the product or service, identify market trends, map the competitors, as well as other critical factors that can assist in the success of the business model, its flexibility and adaptability (Harms and Schwery, 2020).

Observing the reality experienced by startups, we need to develop ways to guide the process of developing products and business models in order to reduce the barriers of entry of these startups to the market, reduce risks and uncertainties, with less waste of resources (Araújo, Reis and Morais, 2021; Reis *et al*., 2021; Borseman *et al*., 2016). In the context of the TBPP, LS stands out as a relevant approach to improving the efficiency of skills at all stages: i) in the world of technology (initial stage), it helps for the ideation and research processes (Chesbrough and Tucci, 2020) and in the reduction of uncertainties (Hinz and Eisenbart, 2019); ii) in the world of transition from technology to product and business (intermediate stage), it contributes in the structuration of business model projects (de Faria, Santos and Zaidan, 2021; Chesbrough and Tucci, 2020; Hinz and Eisenbart, 2019; Mansoori, Karlsson and Lundqvist, 2019) and to facilitate the learning process among entrepreneurs (Mansoori, Karlsson and Lundqvist, 2019) and; iii) in the world of business (final stage), the LS practices contribute with some activities of the technology transfer processes, experimentation and adjustments to the market (Chesbrough and Tucci, 2020; Omelyanenko *et al*., 2018).

The LS practices contribute to a significant adjustment of technological ideas, minimizes research time, contributes to design and development, and facilitates contact with consumers, allowing the testing of technological ideas (Omelyanenko *et al.*, 2018). Furthermore, lean practices contribute mainly to the initial stages of radical innovations and pivoting as a mechanism to maintain a moderate level of risk associated with product and business development (Yoo, Huang and Arifoglu, 2016).

Table 1 explains the five LS practices that were identified in the literature review: i) Business Model Canvas, ii) Validation Board, iii) Minimum Viable Product, iv) Empathy Map and v) Value Proposition Canvas.

Table 1: LS practices concepts

PRACTICE	CONCEPT	AUTHOR
Business Model Canvas (BMC)	It is a visual map of the company, divided into nine elements that helps with visualization, conception, and experimentation of business models. It describes an objective and logic of how an organization creates, delivers, and captures value.	Hidayat, Hendrix and Hidayat (2018); Marin *et al* . (2017); Fulga *et al* . (2016); Marin *et al.* (2015); Osterwalder and Pigneur (2010)
Validation Board (VB)	It is a tool to test customer viability, of the problem, and the adequacy of solutions for each customer segment. It allows to test the assumptions of a business.	Peralta *et al.* (2020); Ries (2012)
Minimum Viable Product (MVP)	It seeks to create a prototype, with the lowest possible investment, for testing and ensuring that the business is able (or not) to enter the market, thereby clarifying points to be adjusted and strengthened, and eventually, a decision of whether to proceed.	Maludin *et al* . (2021); Zimmermann *et al.* (2021); Gbadegeshin (2018); Blank, Dorf (2012); Ries (2012)
Empathy Map (EM)	It provides to capture the insights of customers and try to find new solutions to old issues, or rediscover old solutions to new issues.	Staniec and Pilawa (2020); Osterwalder and Pigneur (2010)
Value Proposition Canvas (VPC)	It helps outline customer segments and the value proposition and contributes to structure the way that the product or service connect directly to customer desires.	Puurtinen and Pohjola (2021); Päivi and Helena, (2020); Tzavidas, Enevoldsen and Xydis (2020); Fechtelpeter, Kuehn and Dumitrescu (2018); Blank, Dorf (2012); Ries (2012); Cooper, Vlaskovits (2010); Osterwalder and Pigneur (2010)

Source: Based on literature review.

It is observed that these practices contribute to the development of technology, product and business, as they focus on structuring the value proposition and validating the client segment (De Faria, Santos and Zaidan, 2021; Hinz and Eisenbart, 2019). The LS practices encourage interaction between team members, allows the exchange of information, improves organizational knowledge, and allows them to manage resources effectively while generating value (Toro-Jarrin *et al*., 2016).

Specifically, for TBPP processes, the BMC is used in the exploration of knowledge-based opportunities, in the technical validation of knowledge-based opportunities, in the commercialization of Research and Development

results and in the visualization of business strategies (Hidayat, Hendrix and Hidayat, 2018; Marin *et al.,* 2017; Fulga *et al.,* 2016; Marin *et al.,* 2015). The VB is used to assist entrepreneurs in implementing the LS process, and to present a product to consumers and test its acceptance (Peralta *et al.*, 2020). The MVP allows examining the functionality of the technology and its main business and commercialization potentials, in view of the benefits for the customer and the user (Maludin *et al.*, 2021; Zimmermann *et al.,* 2021; Gbadegeshin, 2018). The EM allows to define the problem and specify the goals and benefits of solving the problem (Staniec and Pilawa, 2020). And the VPC allows to create a systematic and strategic vision of the project, translating and mapping intangible value propositions into desirable offers, to later be prototyped and shared with partners and users with the intention of modeling and co-creation (Puurtinen and Pohjola, 2021; Päivi and Helena, 2020; Tzavidas, Enevoldsen and Xydis, 2020; Fechtelpeter, Kuehn and Dumitrescu, 2018).

3. Methodology

The methodological approach used in this paper was a case study, as it allows an understanding of the real world, acquiring knowledge to draw conclusions (Yin, 2008). For the selection of the units of analysis, nine technology projects of the Innovation Incentive Program (IIP) were explored, developed at the Federal University of Ouro Preto (Universidade Federal de Ouro Preto, UFOP) (Brazil). These nine projects (Table 2) were selected by the university committee and by government institutions to participate in the IIP program and to promote innovation. The program in its 16th edition aims to foster innovation in the academic environment.

Table 2: Characterization of the studied projects

Projects	Knowledge	Application
Case 1	Pharmaceuticals	Male infertility in case of low count and / or motility of sperm.
Case 2	Mechanical and organic chemistry	Manufacture of organic electronic devices, conductive tracks, resistors, capacitors, and inductors plans, and then diodes, transistors and OLEDs.
Case 3	Mobile and cloud computing	Document management and cloud storage.
Case 4	Applied Mechanics	Detection of fractures in sleepers made of steel.
Case 5	Computer and Cytology	External quality monitoring for cytopathology of tipoII.
Case 6	Food and Chemical	Quality Monitoring and deterioration of real-time meat.
Case 7	Clean Energy	Economic and sustainable energy generation.
Case 8	Food and Chemical	Intelligent packaging with natural preservatives.
Case 9	Blockbuster Games - Technology and Innovation	Social inclusion of visually impaired people through assistive technology in the gaming market.

For data collection (Table 3), the case study involved some sources of evidence (Yin, 2008), such as questionnaires, semi-structured interviews, online meetings, consultation of documents, in addition to direct observation, which allowed follow the implementation of LS practices during a period of six months. This data collection allowed an intimate connection with the empirical reality, providing the validation of the theory. The implementation conducted by the project teams was carried out based on templates created in electronic spreadsheets containing the standard theoretical structure of LS practices. For that, 18 people were interviewed, two representatives of each project. The interviews were conducted based on 11 questions to find out which practices have the greatest potential to contribute to each stage.

Table 3: Research techniques used to data collection

Research Technique	People Involved	Application Detail	Time spent collecting data (for all projects)
Semi structured interview	Researchers-entrepreneurs, project fellows, program coordinator, program consultants	Semi-structured interview initially held for 30 minutes with each project leader.	270 minutos
		For the interview eleven questions was used and the average duration of the interview was 90 minutes	2.100 minutes
Document Analysis	SECTES representatives and program consultants	Analysis of documents prepared for the projects and technical Reporting Program Analysis (435 pages)	2.160 minutes
Meeting via video conference	Researchers-entrepreneurs, master's degree student, graduation student	36 meetings (each involving a researcher/master's degree student with a graduation student - an average duration of 90 minutes over 6 months)	19.440 minutes

For data analysis, the interviews were transcribed. The analysis of the information collected by the different sources of evidence used, allowed a triangulation of the data (Yin, 2008), allowing to identify the existence of patterns, similarities and divergences in each of the technological projects. From these collected data, a table was structured that presents the different LS practices used in each case, in the different phases of the TBPP subprocesses. Although the research deals with nine cases, there was no attempt to create generalizable models in the context of technological projects from public universities, but to understand, in depth, the challenges and limitations involved in the process of generating technological businesses

4. Data presentation

From the interviews with the researchers-entrepreneurs, it was possible to identify the practices that contributed in specific stages of the three subprocesses of the TBPP. In percentage terms, it was identified the frequency with which the teams of the 9 projects used the practices to operationalize each stage of the TBPP (Table 4).

Table 4: Relation between process and LS practices

		Technological Business Planning Process (TBPP)										
		Technology world (INITIAL)			World of transition (INTERMEDIATE)				World of business (FINAL)			
Technological Planning Process (TPP)	LS Practices	Research phase	Technology phase	Freq.	Laboratory phase	Pre-commercial phase		Freq.	Pre-commercial phase	Commercial phase		Freq.	General Freq.
	Business Model Canvas	7	3	55,56	2			0,00				0,00	28,00
	Validation Board		3	16,67	7			0,00				0,00	
	Minimum Viable Product	7	3	55,56	1			0,00				0,00	
	Empathy Map		1	5,56	1	9		50,00	9	4		72,22	
	Value Propostion Canvas			0,00	7	4		22,22	4	4		44,44	
	TPP Frequence	31,11	22,22	**26,67**	40,00	28,89		**34,44**	28,89	17,78		**23,33**	
Technology Transfer Planning Process (TTPP)	LS Practices	Research phase	Technology phase	Freq.	Identification of patenting possibilities phase	Patenting phase	Phase of prospecting and presentation to the market	Freq.	Negotiation phase: established or nascent company	Transfer formalization phase	Phase of transferred product performance verification	Freq.	General Freq.
	Business Model Canvas	7	3	55,56	7	3		37,04				0,00	21,39
	Validation Board		3	16,67		9		33,33				0,00	
	Minimum Viable Product	7	3	55,56	7	3		37,04				0,00	
	Empathy Map		1	5,56			3	11,11	9			33,33	
	Value Propostion Canvas			0,00			3	11,11	9			33,33	
	TTPP Frequence	31,11	22,22	**26,67**	31,11	33,33	13,33	**25,93**	40,00	0,00	0,00	**13,33**	
Business Planning Process (BPP)	LS Practices	Research phase	Opportunities identification phase	Freq.	Opportunities identification phase	Opportunity structuring phase		Freq.	Prototype company phase	Nascent Technology Based Company (NtTBC) phase	New Technology Based Company (NwtBC) phase	Freq.	General Freq.
	Business Model Canvas	7	7	77,78	7	1		44,44	2			7,41	22,96
	Validation Board			0,00		9		50,00				0,00	
	Minimum Viable Product	7	7	77,78	7	1		44,44	2			7,41	
	Empathy Map			0,00				0,00	9			33,33	
	Value Propostion Canvas			0,00		1		5,56	9			33,33	
	BPP Frequence	31,11	31,11	**31,11**	31,11	26,67		**28,89**	48,89	0,00	0,00	**16,30**	
	General Frequence	28,15			29,21				16,94				

Analyzing Table 4, we have:

a) Among the TBPP subprocesses (Technology Planning Process – TPP; Technology Transfer Planning Process – TTPP; Business Planning Process - BPP), the TPP was the one in which the researchers-entrepreneurs most used the LS practices. The TPP presents 225 possibilities for using the LS practices (9 cases* 5 phases of the TPP*5 practices=225 possibilities). Of this total, 63 possibilities were explored, which results in a 28% frequency of use of LS practices. This demonstrates that the LS practices served as a basis for the development of academic innovations. In second place is BPP (22.96%) and, finally, TTPP (21.39%). The results show that despite the contribution of LS practices being more concentrated in the TPP, they also help researchers-entrepreneurs and their teams to convert their technological projects into business models with market potential. In addition, it is observed that LS practices are still incipient for the transfer process, demonstrating that universities have many opportunities to explore the use of LS practices in this context. The researchers-entrepreneurs claim that the university needs to develop policies and strategies that can favor transfer processes, which cannot be achieved only with the use of lean practices.

b) Analyzing the combined use of practices, it was observed that they were more used in the intermediate stage (World of Transition) (29.21%) and in the initial stage (Technology World) (28.15%). Considering that in the intermediate stage there are 315 possibilities for using the LS practices (9 cases*5 practices*7 phases=315 possibilities), it is observed that 92 possibilities were fulfilled, that is, 29.21%. Similarly, for the initial stage, of the 270 possibilities, 76 were fulfilled, which corresponds to 28.15%. The LS practices showed low utilization at the final stage, with only 16.94% of the possibilities fulfilled.

c) Comparing the three stages (initial, intermediate, final) and the three subprocesses (TTP, TTPP, BPP), it was observed that the researchers-entrepreneurs judge that the LS practices became more useful in the intermediate stage, especially for the TPP subprocess, which resulted in 34.44%.

To evaluate the LS practice that most contributed to the operationalization of the processes, table 5 was prepared.

Table 5: Relation between Process *versus* LS Practices

LS Pratices	Technology world	World of transition	World of business
Business Model Canvas (BMC)	62,96	31,75	2,78
Validation Board (VB)	11,11	39,68	0,00
Minimum Viable Product (MVP)	62,96	30,16	2,78
Empathy Map (EM)	3,70	20,63	43,06
Value Propostion Canvas (VPC)	0,00	23,81	36,11

Analyzing table 5, it appears that the most used practice was the BMC and MVP with 62.96% applied to the initial stage, followed by the EM practice to the final stage (43.06%). For the intermediate stage, the most used practice was the Validation board (39.68%).

5. Results and discussion

From the application of LS practices in the nine technological projects, it was possible to identify the contributions of the LS practices to the different stages of the TBPP (initial, intermediate, final). As a result, four research findings were identified.

Finding 1 - The practices contributed mainly to the* TPP *subprocess* and *to the intermediate stage of the TBPP

As demonstrated in the fragments of interviews in cases 3 and 7, it can be seen that at the beginning of the technology development, those involved have little knowledge about the product, business and market. In this way, the practices help to reduce the uncertainties related to technological development, especially in the incorporation of technology into a commercial product.

> *[...] "We could not see the various possibilities of applying our technology to the customer… At the beginning, we did not have much information, which generated great anxiety in the team. From what was analysed using these tools, we reviewed everything we had discussed, and ended up making adjustments that allowed us to go a few steps further." (Case 3).*

> *[...] "I can say that the practices helped me and my team to evaluate the characteristics of the technology compared to other technologies in the market,-which contributed to the elaboration of strategies for managing what we are developing in the face of new technologies." (Case 7).*

Finding 2 - Among all practices, BMC and MVP were considered the most important to operationalize TBPP

The Business Model Canvas mainly contributed to define the target market and select the most appropriate technological solution configuration to serve it. As the interview fragment of case 4 shows, this was enough to guide the development of the technology, carry out laboratory tests and ensure the functionality and applicability of the prioritized solution.

> *"We realized that we had good technology in our hands, however it was not clear which attributes we should focus on to serve the consumer market… With LS practices, especially Canvas, we started to work with more selectivity of information, evaluating not only a market, but several possibilities of application of the technology." (Case 4).*

The MVP represents an opportunity to validate the technology and the product and assist in the elaboration of market strategies, helping to minimize technological failures and structuring the business. Respondents in case 8 stated:

> *[...] "MVP provided rapid product validation. We tested it quickly and made the necessary adjustments, eliminating a few reworks." (Case 8).*

Finding 3 - Besides the practices contributing to improve the performance of the development process, they also contributed significantly to the knowledge management of the projects team

From the systematization of information about technology, product and market, the practices were useful to reduce uncertainties and improve the performance of the TBPP, allowing the improvement of communication and exchange of knowledge between those involved. As stated by the interviewee in case 5:

> *"[...] the process guides us, and the tool made clear the path to identifying the latent needs of each client and, with that, we gain time during the development." (Case 5).*

About knowledge management, LS practices played an important role in organizing information, explicitation, sharing and generating new knowledge within the team. They favored the improvement of the flow of information and the learning process among those involved. As shown in the interview fragment of case 7, the application of practices provided greater team integration and contributed to a discussion of the problems experienced throughout the processes.

> *"[...] I think the main contribution of the practices was to create an environment so that the involved in the project could discuss, exchange information... We increased the interactions between us... Now the information is documented, that is good." (Case 7).*

Finding 4 - The combined implementation of the practices highlighted the benefits for TBPP

In order for researchers-entrepreneurs to develop their innovations, to promote commercial products, it was important to integrate lean practices set. In the view of the interviewees, they contributed to the different phases of the TBPP and, together, allowed the product to get closer to the market. The result of this practices set was the definition of the business model and the specification of the product to meet the needs of the market, as shown in the report of case 3:

> *"So, we began to think more strongly about technology's appeal to the market and realized that we had wasted time in the beginning because of a lack of business direction or guidance. To achieve consistent results for the business it is necessary the combined use of several resources, but always through methods that allow us to minimize risks" [...] (Case 3).*

6. Implications, limitations, and conclusions

To identify the LS practices most used by researchers-entrepreneurs in the different stages of the Technological Business Planning Process, a qualitative approach was carried out through case study. It was observed that the TPP was the subprocess in which the entrepreneurial researchers most used LS practices, obtaining 28% of the possibilities. It was observed that the practices were more used in the intermediate stage (World of Transition) (29.21%). Among the practices analyzed, BMC and MVP were the most used practices, obtaining 62.96% of the possibilities, and their use was more concentrated at the initial stage (Technology World) of the TBPP. BMC contributing to the exploration of opportunities (Hidayat, Hendrix and Hidayat, 2018; Marin et al., 2017) and the MVP for product validation (Maludin et al., 2021; Zimmermann et al., 2021). It was noticed that the practices also contributed significantly to the knowledge management of the projects team corroborating the studies by Mansoori, Karlsson and Lundqvist (2019). In addition the combined implementation of the practices highlighted the benefits for TBPP. In the initial phase of TBPP, the entrepreneurial team is focused on the development of technology, when information is diffuse and with little knowledge about product, process and market configurations. So, there was greater applicability of LS practices in the intermediate phase of TBPP, in order to help the incorporation of technology into a commercial product and, consequently, define the business model of the projects (de Faria, Santos and Zaidan, 2021). The practices contributed mainly to technological and business planning and, to a lesser extent, to the technology transfer process. The researchers-entrepreneurs report that the university still needs to define policies and strategies for the transfer offices to support the technology transfer process, corroborating the studies by Ravi and Janodia (2022) and Boguszewicz-Kreft *et al.* (2021). It was observed that the implementation of practices not only contributes to gather and structure product, business and market information, but also generate, store and share important knowledge among the members of the entrepreneurial team (Bandera, Passerini and Bartolacci, 2020). Finally, the combined use of LS practices enhances the benefits for the TBPP, integrating the information, which corroborates the studies by Blank and Dorf (2012), Ries (2012) and Cooper and Vlaskovits (2010). As a limitation of this study, it was not analyzed whether LS practices influence the operational performance of teams and the delivery of results during the TBPP, from a quantitative perspective. Another limitation is that only nine cases were analyzed in the academic environment, whose resources were limited when analyzing the market perspectives. As opportunities for future work, it is suggested to explore a sample that includes the generation of technological businesses in other business contexts such as business accelerators, technology parks or involving cross country studies.

Acknowledgements

We would like to thank the Federal University of Ouro Preto (UFOP/ Brazil) (www.ufop.br), Foundation for Research Support of the State of Minas Gerais (FAPEMIG), Coordination for the Improvement of Higher

Education Personnel (CAPES) and National Council for Scientific and Technological Development (CNPq), for the support and funding during the development of the research.

References

Aguiar, R.B.D., Silva, D.S., Caten, C.S.T. and Silva, L.C.P. (2019) "Lean mentorship: Fitting external support to entrepreneur needs over the startup development", *Production*, Vol 29.

Ajamian, G.M. and Koen, P.A. (2002) "Technology Stage-Gate™: a structured process for managing high-risk new technology projects", *The PDMA toolbook for new product development*, Vol 1, pp 267-295.

Araújo, M., Reis, L. and Morais, I. (2021) "Innovation Strategies for Adaptation of Organizations in a VUCA World", *Proceedings of the 16th European Conference on Innovation and Entrepreneurship (ECIE)*, Vol 2, pp. 1245–1253. doi: 10.34190/EIE.21.162.

Bandera, C., Passerini, K. and Bartolacci, M.R. (2020) "Connecting Knowledge Management and Entrepreneurship: Processes and Technology", *Knowledge Management, Innovation, and Entrepreneurship in a Changing World*, pp 31-45.

Blank, S. and Dorf, B. (2012) *The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company*, K & S Ranch, Pescadero.

Boguszewicz-Kreft, M., Arvanitis, A., Karatzas, K., Antonelli, G. and Simonetti, B. (2021) "Technology Transfer Steps Towards the Commercialization of Research Results for Universities", *WSB Journal of Business and Finance*, Vol 55, No. 1, pp 26–39.

Boh, W.F, De- Haan, U. and Strom, R. (2016) "University technology transfer through entrepreneurship: faculty and students in spinoffs", *The Journal of Technology Transfer*, Vol 41, No. 4, pp 661-669.

Borseman, M., Tanev, S., Weiss, M. and Rasmussen, E. S. (2016) "Lost in the canvases: Managing uncertainty in lean global startups", SPIM Innovation Symposium, The International Society for Professional Innovation Management (ISPIM), March, p 1.

Chesbrough, H. and Tucci, C. L. (2020) "The Interplay between Open Innovation and Lean Startup, or, Why Large Companies are not Large Versions of Startups", *Strategic Management Review*, Vol 1, pp. 277–303.

Cooper, R.G. (2008) "Perspective: The stage-gate® idea-to-launch process—update, what's new, and nexgen systems", *Journal of product innovation management*, Vol 25, No. 3, pp 213-232.

Cooper, B. and Vlaskovits, P. (2010) *The entrepreneur's guide to customer development: a" cheat sheet" to The Four Steps to the Epiphany*, Newport Beach, CA: Cooper-Vlaskovits, p 103.

De Faria, V. F., Santos, V. P. and Zaidan, F. H. (2021) "The Business Model Innovation and Lean Startup Process Supporting Startup Sustainability", *Procedia Computer Science*, Vol 181, pp 93-101.

Diánez-González, J. P., Camelo-Ordaz, C. and Fernández-Alles, M. (2021) "Drivers and implications of entrepreneurial orientation for academic spin-offs", *International Entrepreneurship and Management Journal*, Vol 17, No. 2, pp 1007–1035.

Fasi, M. A. (2022) "An Overview on patenting trends and technology commercialization practices in the university Technology Transfer Offices in USA and China", *World Patent Information. Elsevier Ltd*, Vol 68, February, p 102097.

Fechtelpeter, C., Kuehn, A. and Dumitrescu, R. (2018) "Supporting the planning phase of SME-tailored technology transfer projects", *Towards Sustainable Technologies and Innovation - Proceedings of the 27th Annual Conference of the International Association for Management of Technology*, IAMOT 2018, (April 2018), pp. 0–20.

Fernandes, J. M., Reis, L. P. and Di Serio, L. C (2017) "Planejamento de negócios tecnológicos: um estudo de posicionamento de mercado e cadeia de valor", *RAM. Revista de Administração Mackenzie*, Vol 18, No. 3, pp 70-116.

Fulga, S. *et al*. (2016) "Business Models for increasing technological transfer effectiveness", *Annals of the Academy of Romanian Scientists Series on Engineering Sciences*, Vol 8, No. 1, pp. 17–26.

Galli, B. J. (2019) "Reflection of literature on using lean innovation models for Start-Up ventures", *Journal of Modern Project Management*, Vol 7, No. 3, pp. 6–18. doi: 10.19255/JMPM02101.

Gbadegeshin, S. A. (2018) "Lean Commercialization: A New Framework for Commercializing High Technologies", *Technology Innovation Management Review*, Vol 8, No. 9, pp. 50–64.

Harms, R. and Schwery, M. (2020) "Lean Startup: Operationalizing Lean Startup Capability and testing its performance implications", *Journal of Small Business Management*. Routledge, Vol 58, No. 1, pp 200–223.

Hidayat, A., Hendrix, T. and Hidayat, M. (2018) "Implementing Business Model Canvas for Cibinong Science and Technology Park", *Jurnal Bisnis dan Manajemen,* Vol 18, No. 1, pp. 47–58. doi: 10.24198/jbm.v19i1.159.

Hinz, A. and Eisenbart, B. (2019) "Connecting the Dots: Effectuation and Lean Startup", *Core.Ac.Uk*, August, pp 7–9. Available at: https://core.ac.uk/download/pdf/324148449.pdf

Lakiza, V. and Deschamps, I. (2019) "How to develop an impactful action research program: Insights and lessons from a case study", *Technology Innovation Management Review,* Vol 9, No. 5.

Leitão, J., Pereira, D. and Gonçalves, Â. (2022) "Business Incubators, Accelerators, and Performance of Technology-Based Ventures: A Systematic Literature Review", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol 8, No. 1, pp 46.

Majdouline, I., El Baz, J. and Jebli, F. (2022) "Revisiting technological entrepreneurship research: An updated bibliometric analysis of the state of art", *Technological Forecasting and Social Change*, pp 121589.

Maludin, S. *et al.* (2021) "Reassembling Technology Transfer in Indonesia", *International Journal of the Analytic Hierarchy Process*, Vol 13, No. 3, pp. 437–457. doi: 10.13033/IJAHP.V13I3.846.

Mansoori, Y., Karlsson, T. and Lundqvist, M. (2019) "The influence of the lean startup methodology on entrepreneur-coach relationships in the context of a startup accelerator", *Technovation*. Elsevier Ltd, Vol 84–85, pp. 37–47. doi: 10.1016/j.technovation.2019.03.001.

Marin, A. *et al*. (2015) "Business models and competitive advantage for technology transfer entities", *Romanian Review Precision Mechanics*, Optics and Mechatronics, Vol 48, pp. 103–109.

Marin, A. *et al*. (2017) "Business modeling process for university's technology transfer offices", *Proceedings of the International Conference on Business Excellence*, Vol 11, No. 1, pp. 1033–1049. doi: 10.1515/picbe-2017-0107.

Omelyanenko, V. *et al.* (2018) "Technology transfer management culture (education-based approach)", *Problems and Perspectives in Management*, Vol 16, No. 3, pp. 454–463. doi: 10.21511/ppm.16(3).2018.36.

Osterwalder, A. and Pigneur, Y. (2010) *Business model generation: a handbook for visionaries, game changers, and challengers*, Nova Jersey: John Wiley and Sons, Inc, Vol 1, pp 276.

Päivi, A. and Helena, A. (2020) "Creating value propositions and service offering for the underground labs and their network : Part 2 : Creation and reflection".

Peralta, C. B. da L. *et al*. (2020) "A framework proposition to identify customer value through lean practices", *Journal of Manufacturing Technology Management*, Vol 31, No. 4, pp. 725–747. doi: 10.1108/JMTM-06-2019-0209.

Puurtinen, H. and Pohjola, P. (2021) "Multi-Stakeholder Service Model Creation to Improve the Efficiency of Research and Innovation Infrastructures", pp. 61–71.

Ravi, R. and Janodia, M.D. (2022) "Factors Affecting Technology Transfer and Commercialization of University Research in India: a Cross-sectional Study"*, Journal of the Knowledge Economy.* Springer US, Vol 13, No. 1, pp 787–803.

Reis, L.P., Cheng, L.C., Ladeira, M.B. and Fernandes, J.M. (2014) "Processo de Planejamento de Negócio (PPNeg): Complementando o Processo de Planejamento Tecnológico (PPTec) para a Geração de Empresas de Base Tecnológica (EBT) de Origem Acadêmica (OA)", *RAI – Revista de Administração e Inovação*, São Paulo, Vol 11, No. 4, pp 07-32.

Reis, L. P., Fernandes, J. M. and Armellini, F. (2021) "Leveraging a Process-Oriented Perspective on Frugal Innovation Through the Linkage of Lean Product Development (LPD) Practices and Waste", *International Journal of Innovation and Technology Management*, Vol 18, No. 07, p 2130004.

Reis, L. P., Fernandes, J. M., Barreto, E. J., Lima, M. V. V. and Armellini, F. (2021) "Impact Assessment of Lean Product Development and Lean Startup Methodology on Information Technology Startups Performance", *International Journal of Innovation and Technology Management (IJITM),* Vol 18, No. 06, pp 1-24.

Ries, E. (2012) *A Startup Enxuta: como as empresas que utilizam a inovação continuam para criar empresas extremamente bem-sucedidas*, São Paulo: Lua de Papel*,* pp 274.

Siegel, D.S., Waldman, D.A., Atwater, L.E. and Link, A.N. (2004) "Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies", *Journal of engineering and technology management*, Vol 21, No. 1-2, pp 115-142.

Staniec, I. and Pilawa, J. (2020) "The use of design thinking in the creation of academic incubators", *Journal of Economics and Management*, Vol 41, No. 3, pp. 105–127. doi: 10.22367/jem.2020.41.06.

Still, K. and Satell, G. (2017) *Accelerating Research Innovation by Adopting the Lean Startup Paradigm Kaisa Still*, Vol 7, No. 5, pp 32–43. *Available at: www.timreview.ca.*

Takata, M., Nakagawa, K., Yoshida, M., Matsuyuki, T., Matsuhashi, T., Kato, K. and Stevens, A. J. (2022) "Nurturing entrepreneurs: How do technology transfer professionals bridge the Valley of Death in Japan?", *Technovation. Elsevier Ltd*, Vol 109, p 102161.

Taouaf, I., Attou, O.E., El Ganich, S. and Arouch, M. (2021) "The Technology Transfer Office (TTO): Toward a Viable Model for Universities in Morocco", *Cuadernos de Gestión*, Vol 21, No. 2, pp 97–107.

Toro-Jarrin, M.A., Ponce-Jaramillo, I. E. and Güemes-Castorena, D. (2016) "Methodology for the of building process integration of Business Model Canvas and Technological Roadmap", *Technological Forecasting and Social Change*, Vol 110, pp 213-225.

Tzavidas, E., Enevoldsen, P. and Xydis, G. (2020) "A University-industry knowledge transfer online education approach via a cloud-based database global solution", *Smart Learning Environments*, Vol 7, No. 1. doi: 10.1186/s40561-020-00128-5.

Vohora, A., Wright, M. and Lockett, A. (2004) "Critical junctures in the development of university high-tech spinout companies'", *Research Policy*, Vol 33, No. 1, pp 147–175.

Zimmermann, V. *et al*. (2021) "Minimum Viable Products in Mechatronic System Engineering: Approach for Early and Continuous Validation", pp. 0–11.

Yin, R. K. (2008) "Case Study Research-Design and Methods", 4th edition, *Sage Publications*, London, 240 pp.

Yoo, O., Huang, T. and Arifoglu, K.A. (2016) "Theoretical Analysis of the Lean Start-Up Agile Product Development Process", *Anual Conference POMS*, Orlando, May.

Wulandari, A.D. and Subriadi, A.P. (2021) "Preparing the Startup Ecosystem for Building a New Startup Business During Pandemic: A Systematic Literature Review", *International Journal of Electronic Commerce Studies*, Vol 13, No. 1, pp 137–160.

Managing Knowledge and Identity across the Boundary of Academic and Commercial Science

Kent Rondeau[1], Justin Dillon[2], Nasser Mansour[3] and Jason Daniels[4]
[1]Alberta School of Business, University of Alberta, Edmonton, Canada
[2]College of Social Sciences & International Studies, University of Exeter, UK
[3]College of Education, Qatar University, Qatar
[4]School of Public Health, University of Alberta, Edmonton, Canada
kent.rondeau@ualberta.ca
j.s.dillon@exeter.ac.uk
n.mansour@qu.edu.qa
jason.daniels@ualberta.ca

Abstract: In the last few decades, institutions of higher learning are being transformed from ivory towers to become engines of regional and national economic development and 'knowledge businesses' increasingly focused on producing commercial products for private industry. The role of academics is rapidly shifting as many in the professoriate are becoming 'captured' by an ethos of commercialization as they rush to bring the product of their research to the marketplace. Critics of the entrepreneurial paradigm see academics as promoters as well as victims of commercialisation who internalize the pursuit of profit and value of money under the academic capitalist knowledge regime. While some academic researchers have enthusiastically embraced the transformation in the relationship between science and business, and between the academy and industry, many remain firmly committed to academic science, disinterested in pursuing commercial opportunities. Yet, others choose a middle ground and straddle the academic and commercial boundary. The purpose of this paper is to illustrate the role of identity to influence how academic scientists manage the boundary between the world of academic science and commercial science. Drawing from a large sample of Canadian university academic researchers in the applied sciences (n=379), four distinct categories of academic scientists are identified: Type I: Traditional academics who view the realm of academic science and commercial science as distinct and choose to position themselves strictly as academic scientists; Type II: Pragmatic academic hybrids who view academic and commercial science as distinct but decide to strategically pursue industrial links to acquire resources that support their research; Type III: Collaborative academic hybrids who believe in the paramountcy of academic and industry collaborations for the advancement of science; and Type IV: Academic entrepreneurs who abide in the fundamental importance of academic-industry links for application and for commercial exploitation. Results suggest that our researcher categories are further differentiated with respect to the strength of their collaborations with industry, their program of research, the extent of their industry experience, the degree of financial support they receive from industry, the size of their research laboratory, and by their scientific publications and the number of patents and licenses they hold from their research.

Keywords: faculty-industry engagement, academic-industry ideology, research identity

1. Introduction

Academic entrepreneurialism in institutions of higher learning is everywhere in vogue. Universities are being transformed from ivory towers to engines of regional and national economic development and 'knowledge businesses' increasingly focused on producing commercialisable product for private industry (Stein, 2004). The role of academics in universities is shifting. There is a growing concern that the professoriate is becoming captured by an ethos of commercialisation. Critics of the entrepreneurial paradigm see academics as promotors as well as victims of commercialisation who internalize the pursuit of profit and value of money under the academic capitalist knowledge regime (Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004). While some academic researchers have enthusiastically embraced the transformation in the relationship between science and business, and between the academy and industry, many others remain disinterested and disengaged (Novotny, 2017). For those who choose to adopt this new role, not enough is known about existing patterns of relationship that academic scientists have with industry and their potential to reshape career trajectories in the pursuit of entrepreneurial opportunity (Audretsch & Kayalar-Erdem, 2005).

Institutional support and pressure for university-based scientists to engage with industry and business stakeholders have enabled and motivated academics to embrace an entrepreneurial identity (Guo, Restubog, Cui, Zou, & Choi, 2019). Academic entrepreneurs participating in commercialisation activities develop dual identities—those of a scholar and entrepreneur, and without effective role integration may incur identity confusion, inconsistency, and conflict as they impose opposing attitudinal and behavioral demands (Jain,

George, & Maltarich, 2009). Academic entrepreneurs carry multiple professional demands that are embedded in a hybrid career involving the original identity of an academic doing scholarly work and a newly acquired one as an entrepreneur involved in business venturing. Social identity theory provides a theoretical base to understand how individuals align their behaviors with social groups from which they craft their identity (Turner & Oakes, 1986). Rooted in social psychological theory, social identity theory explains a variety of group processes, including intergroup relations, the process of professionalizing, and generalized identity work in organizations and community ecosystems (Hogg, Terry & White, 1995; Zou, Li, Guo & Guo, 2019).

For most scientists employed at institutions of higher learning, taking the leap into the world of commercialisation represents a profound challenge. It can involve altering the set of activities that constitute a scientists' normal workload and entails addressing conflicting pressures, demands, and values that originate from competing normative cultures of the academic and business worlds. During a long period of training and socialization, research scientists are immersed in a normative system that Merton (1968) has identified as constituting the 'ethos of science.' Four facets that comprise this ethos include; *universalism* which asserts that scientific observation and measurement should be verifiable and independent of observer; *communism* (communalism) implying that scientists share their work with their community for the advancement of knowledge; *disinterestedness* which purports that scientists should have no emotional or financial attachments to the outcomes of their work, and *organized skepticism* which refers to the need for scientists to have no interest in a specific outcome and to suspend judgements about their findings until all facts have been assembled. Individuals trained in the career path for a traditional university scientist undergo a unique set of experiences that relate to the inculcation of these norms that over time become inextricably intertwined with their role identity as research scientists. For academics, participation in commercialisation activity involves the evaluation of the demands of an entrepreneurial role identity that may require them to initiate attempts to reconcile the new role with their existing one as academic scientist. This identity transformation is not an easy task as these specific value-based orientations entail role identity propositions that are generally regarded as appositional. As Merton (1968, p. 273) has observed "the communism [communalism] of the scientific ethos is abstractly incompatible with the definition of 'private property' in capitalist societies." The Mertonian belief in skepticism is in stark contrast with the entrepreneurial norm of optimism, while the scientists' notion of disinterestedness exists at odds with the entrepreneurial ideal of passion for a prescribed outcome. In contrast to the scientific ethos, "the entrepreneurial orientation typically requires an intense single mindedness of effort, a short-term focus, and an emphasis on execution with products and profits representing the key outcomes" (Jain, George, & Maltarich, 2009, pp. 924).

Given these incompatibilities, understanding the kinds of 'identity work' that university scientists engage in when they get involved in commercialisation represents a fertile field for further investigation. Personal and social identity is strongly conditioned by forces and factors that animate human motivation. Drawing on the work of Stephan and Levin (1992), Alice Lam (2010) links personal identity formation with characterizations of the evolving relationship between scientists' value orientations and their commercial engagements and associated personal motivations. She contends that those with traditional beliefs about the separation of science from commerce are more likely to be extrinsically motivated, using commercialization merely as a means to obtain resources in support of their quest for the 'ribbon' (peer recognition and reputation), which constitutes the normative social reward in academic science, and from which other extrinsic rewards may be derived. In contrast, those identifying with entrepreneurial norms tend to be motivated by the pragmatic 'puzzle-solving' (intrinsic satisfaction) features of commercial research as well as being motivated by financial rewards (the so-called 'gold').

Lam (2011) suggests that commercial engagement can be either a 'controlled' or an 'autonomous' activity depending on the degree to which scientists have internalized the values associated with it. When scientists adhere to traditional Mertonian norms of basis science they will perceive commercialisation to be at odds with their personal values and goals, and they likely will be 'a motivated' to engage in this behavior. Nevertheless, some may take part in commercial activity as a result of 'introjection' usually manifested as a desire to secure additional resources in furtherance of their research without having to actually embrace commercial values. Traditional academic scientists can be placed on the extrinsic end of the motivational continuum and may use commercialization as a means to obtain specialised resources in support of their pursuit of the ribbon. At the other end are entrepreneurial scientists who are motivated primarily by the quest for 'gold' and 'puzzle.' Between these polar opposites, are hybrid positions where scientists hold an ambivalent attitude toward science and its relationship with commercialisation. Academic scientists who choose to enter the realm of

commercialisable science, often find themselves torn between the traditional norms or Mertonian ideals of basic science and the reality of an encroaching market ethos. While some may choose to resolve the tension by making choices between these dichotomous alternatives where they choose one and forego the other, others may attempt to reconcile these differences by re-negotiating their roles at the intersection (boundaries) of these two domains.

Early writers in the sociology of science have spoken about the ambivalence of scientists and the frequent deviation of their actual behavior from Mertonian norms and their willingness to explore new social identities in their search of scientific truth. Gieryn (1983) coined the term 'boundary work' to denote the active agency of scientists to continually test norms while drawing and redrawing the boundaries of their work. As a means of protecting their professional autonomy, scientists labour hard to establish the boundary between the production of knowledge and its exploitation. However, the boundary becomes increasingly blurred when scientists seek to secure additional resources and public support for scientific research. According to Lam (2011, p. 1356), "this ambiguity is a source of internal tension, as well as giving scientists much opportunity for choice and variation. The contemporary transformation in the relationship between science and business has brought the sociological ambivalence of science to the forefront and opened up opportunities for individual action."

Drawing on earlier work that attempts to categorize those who engage in science, Lam (2010) uses this framework to identify four types of research scientists. Type I traditional academics are characterized by a strong belief that academia and industry should be distinct and that the appropriate role for academic scientists is to shun commercial modes of engagement and to hold suspicions of those who do so. The type I traditionalist believes in a limited form of engagement with industry, while seeking to maintain their academic role and engage in boundary work characterized as 'boundary separation.' Like type I traditionalists, type II pragmatic academics believe that academia and industry should be distinct, but recognize the need to collaborate with industry in a targeted way. While securing industrial resources in furtherance of their research as well as field placements for graduate students are strong motivators, type II hybrids chose to establish distinct collaborative linkages with industry, protecting their dominant academic identity while experiencing some cognitive dissonance as they attempt to reconcile their roles. Type II pragmatists will accommodate industry and engage in 'boundary testing' behaviors, but remain strongly identified with their academic roles. On the other end of the spectrum are type IV academic entrepreneurs who believe in the fundamental importance of science-business collaboration. These research scientists have fully developed, strong commercial ties with firms, and demonstrate a continuous engagement with commercial activity. These research academics have a fused identity and engage in what Lam (2010) terms 'boundary inclusion' activities. Finally, type III collaborative hybrids believe in the fundamental importance of science-business collaboration but recognize the need to maintain categorical distinctions while negotiating shifting borders. This type of scientist retains a focal academic identity while choosing to pursue commercial opportunities at will, but not all of its associated meanings. For the most part, type III collaborative hybrids will experience lower levels of cognitive dissonance than type II pragmatists and type III collaborators because they have made greater progress in integrating the entrepreneurial role into their academic identity. The type of research that an academic engages may also assist in this transformation, whereby academic scientists doing more applied science may find it easier to negotiate boundaries, while academic scientists doing more basic, theoretical science may have fewer reasons to do so. Academic scientists working in research fields that are closer to the marketplace have more incentives to engage in boundary spanning behaviour than do scientists whose research product has weaker commercial application (Colyvas & Powell, 2006; Mendoza, 2009). Academic scientists that have established strong forms of engagement with private industry may be more likely to pursue research commercialisation in that they are in position to better exploit the social capital they have acquired through these relationships (Perkmann, Tartari, et. al., 2013). Research productivity may also be impacted by how academic scientists set and manage their relationships with industry. Traditional forms of academic productivity remain the peer-reviewed publication, yet those who cross boundaries to engage in research commercialisation also generate patents, sponsored commercial products, and engage in new venture business start-ups. Resources provided by industry can facilitate the direct or indirect production of all forms of academic productivity, increasing the overall size of the research program (Gulbrandsen & Smeby, 2005). Nevertheless, heavy involvement with industry can produce threats to faculty autonomy and independence, including faculty conflicts of interest and commitment (Tartari & Breschi, 2012).

1.1 Research questions

The framework proposed by Lam (2010; 2011) provides an ideal one for investigating the cognitive frames by which academic scientists negotiate the boundaries between academic and commercial science. A hybrid career broadens the opportunities for academics but can also bring new challenges associated with a role transition. Managing the multiple identities associated with a hybrid career is key to the successful development of a career as an academic research scientist. A research agenda can be surfaced which has the following questions requiring further elaboration:

- 1. Can academic scientists be characterized on the basis of research orientation and on the basis of their degree of identification with the traditional values of academic science or with the values of commercial science?
- 2. In what ways is the general research orientation of academic scientists predictive of the relationships, engagements, and experiences they have with private industry?
- 3. How do normative academic and commercial values of academic scientists relate to their research productivity?

2. Methodology

Data for this study was collected by means of an online questionnaire sent to three thousand nine hundred sixty-two (3962) full-time and continuing academic faculty members in Canadian university-based schools of engineering and applied science. The study population included faculty employed at twenty-eight (28) top-ranked, research-oriented institutions with a diverse and rich array of research programs represented. Institutional review board (IRB) approval for the study was secured from the University of Exeter (UK). The questionnaire and letter of introduction was sent to identified faculty members, with five follow-up reminders over a three-week period given to those who did not respond to earlier requests for participation. Data was collected in October 2022. In total, 379 completed questionnaires were returned and constituted the study sample. After subtracting those in the population that were refused, demitted, or returned as undeliverable (88 persons), an effective response rate of 9.8 percent was achieved. Study validity was investigated for generalizability of results by comparing the academic rank of members from the study population (3962 persons) against the reported academic rank of respondents indicating that those holding the designation of assistant professor may be slightly under-represented while those with the rank of full professor may be slightly over-represented in the study sample. Study validity was further investigated by examining differences in key demographic indicators between early and later respondents (assuming that late responders are more like non-responders than early responders to the request for participation), indicating that our study sample contains more individuals who are slightly older and of senior academic rank.

2.1 Study variables

The dependent variable in our analysis is a construct of ten commonly-expressed channels of industry engagement and collaboration. Academic-industry collaborations range from more informal, diffusive relationships with industry (informal networking with industry; involvement with industry advisory boards; and the placement of students with industry) to more formal, prescribed relationships (university-based and industry-sponsored research centers; collaborative research with industry partners; and contract-based research with industry). Subjects were asked to estimate their degree of involvement with each form of academic-industry engagement and university-industry engagement where 1=no involvement to 4=extensive involvement. An industry engagement scale was constructed of these ten channels and produced a Cronbach alpha of .80 for our study sample, indicating an acceptable level of internal reliability for this measure.

2.1.1 Independent variables

We are interested in examining the relationship of individual-level faculty characteristics to academic-industry engagement. We hypothesize that three key academic faculty predictors are associated with the strength and magnitude of faculty engagement with industry: previous faculty employment with private industry, holding an industry-sponsored research chair, and the percentage of total research funds coming from industry sources. To assess faculty-industry experience, subjects were asked about their full-time industry work experience. To assess industry-faculty research support, respondents were asked if they presently hold, or have previously held, an industry-sponsored research chair. To assess their financial involvement with industry, subjects were asked to estimate the percentage of their total research funds presently coming from

industry. The number of graduate students under supervision was a proxy measure for the size of the academic research laboratory.

The type of research being conducted can be characterized using a framework provided by Stokes (1997). A research typology can be produced that characterizes research as a consequence of knowledge creation on the basis of whether it advances theory or if it advances practice. For purpose of distinction, basic research is considered to advance theory but not practice (Bohr's Quadrant). Applied research advances practice but not theory (Edison's Quadrant). User-based research advances both theory as well as practice (Pasteur's Quadrant). Study respondents were asked to allocate 15 points on the basis of how they perceived their program of research according to the categories of 'basic', 'applied', and 'user-based'. It should be noted that these allocations reflect researcher subjective assessments and not any kind of objective determination.

2.1.2 Control variables

Two faculty-level variables were controlled in our analysis: academic rank and gender. Individuals who hold more senior academic rank may be expected to have developed more social capital with industry. They are also more likely to have more research publications and hold more patents derived from their research over the lifetime of their careers. Women are found to be significantly under-represented in senior academic ranks in the applied sciences and, as a consequence, more likely to have had fewer opportunities to develop extensive ties with industry, have fewer life-time publications, and hold fewer patents from their research.

2.2 Data analysis

Data was analyzed and study questions addressed using SPSS (Version 28.0)™. Descriptive statistics show the overall characteristics of the study sample. Study data is displayed according to academic rank (assistant, associate, and full professor), and by gender. Academic scientists can be categorised according their values and attitudes concerning the proper role of academic and commercial science.

3. Results

Table 1 includes the general characteristics of study sample as reported on the basis of faculty rank (assistant, associate, and full professor) and gender. Women make up about 22 percent of the roster of assistant professors but comprise only six percent of full professors. On average, assistant professors report 34 publications and 1.22 patents, while full professors have 160 scientific publications and hold 3.54 patents.

Table 1: General characteristics of Study Respondents[a]

	Assistant Professor	**Associate Professor**	**Full Professor**	**Male**	**Female**
Number of respondents (n)	51	92	231	310	56
Age of respondents (years)	40.2	48.0	57.9	54.3	46.9
Gender (Female)	0.22	0.11	0.06	----	----
Employment status (# respondents)					
Contractual (non-tenure track)	6	2	1	7	1
Non-tenured (tenure track)	43	5	2	33	16
Tenured	2	84	224	265	39
Professional and research achievement					
Professional engineer designation (P.Eng)	0.49	0.78	0.81	0.78	0.63
Industry-sponsored Research Chair holder	0.02	0.07	0.17	0.14	0.05
Research funds coming from industry[b]	0.21	0.37	0.36	0.34	0.34
Full-time industry work experience (years)	4.88	4.67	5.85	5.52	4.50
Graduate students under supervision	6.11	7.53	7.57	7.37	7.75
Weighted Research Orientation[c]					
Basic-research orientation	0.16	0.18	0.17	0.18	0.14
User-based research orientation	0.49	0.50	0.49	0.48	0.52
Applied research orientation	0.35	0.32	0.34	0.34	0.34
Research Productivity					
Total career peer-reviewed publications	33.8	63.1	160.7	130.5	68.1
Total career patents/licenses	1.22	1.99	3.54	3.10	1.39

[a]Numbers may not sum because of missing data
[b]As a proportion of total research funds received
[c]Research orientation as proportional weight (sum to 1.00)

Academic faculty can be characterized on the basis of their declared identity with respect to their alignment with academic versus market (entrepreneurial) values. Drawing on the framework provided by Lam (2010; 2011), it is possible to characterize academic faculty on the basis of four basic identity categories: traditional academic, pragmatic academic hybrid, collaborative academic hybrid, and entrepreneurial academic. Table 2 reports on the research orientations of study respondents.

Table 2: Academic-Industry ideology

Academic Researcher Ideology: Select one that best describes your professional beliefs.	**Frequency**	**Valid Percent**	**Cumulative Percent**
Traditional Academic I believe that academics and industry should be distinct. I pursue success strictly in the academic area.	21	5.6	5.6
Pragmatic Academic Hybrid I believe that academics and industry should be distinct. I pursue industrial links to acquire resources that support my academic research.	75	19.9	25.5
Collaborative Academic Hybrid I believe in the fundamental importance of academic-industry collaboration. I pursue industrial links for scientific advancement.	190	50.6	76.1
Entrepreneurial Academic I believe in the fundamental importance of academic-industry links for application and commercial exploitation.	90	23.9	100.0
Total	376	100.0	100.0

Many academic faculty in the applied sciences have established extensive networks of engagement with private industry. Academic-industry networks reflect industry social capital and enable academics to more easily cross academic-industry boundaries. These linkages provide a basis for understanding how academic faculty are able to more easily assume industry collaborative and entrepreneurial norms that are antithetical to traditional Mertonian academic norms. Academic scientists were asked to identify the strength of their collaborations with ten (10) faculty-industry channels of engagement, indicating a 1=no significant involvement to 4=extensive involvement for each channel of engagement. Table C reports on academic-industry engagement channels.

Table 3: Academic-Industry engagement channels

***Academic Researcher-Industry Engagement Channels*:** Degree of your involvement with industry channel (1=none to 4=extensive)	**Mean**	**Std Dev.**	**Range**
Informal networking with industry	3.01	.85	1 - 4
Industry governing boards or industry advisory committees	2.06	1.04	1 - 4
Industry-sponsored research projects for my students	3.21	.90	1 - 4
Executive and continuing education, industrial training programs	1.83	.98	1 - 4
Collaborative research with industry partners	3.27	.87	1 - 4
University-based research centers and institutes	2.84	1.05	1 - 4
Industrial research parks	1.43	.79	1 - 4
New venture business incubators	1.62	.91	1 - 4
Consulting for industry	2.29	1.04	1 - 4
Contractual research for industry	2.39	1.07	1 - 4
Academic-Industry engagement scale (10-items; alpha=0.80)	2.37	.56	1.00 – 3.91

After categorizing respondents into one of four researcher identities, we can show how researcher ideology relates with respect to associated researcher characteristics, forms of academic-industry engagement, research program orientation, as well as research productivity (scientific publications and research patents). Table 4 reports on the researcher profiles of the four identity/ideology categories.

Table 4: Academic researcher profiles

	Type I Traditional Academic (n=21)	**Type II Pragmatic Academic Hybrid (n=75)**	**Type III Collaborative Academic Hybrid (n=190)**	**Type IV Entrepreneurial Academic (n=90)**
Faculty rank[a]	2.55	2.47	2.45	2.53
Faculty gender (female)	.048	.181	.178	.103
Industry-sponsored research chair	.000	.067	.149	.156
Research funds coming from industry	.066	.279	.376	.367
Years of industry work experience	4.21	4.28	5.43	6.70
Graduate students under supervision	4.45	6.21	8.27	6.97
Faculty-industry engagement scale	1.69	2.18	2.44	2.64
Weighted Research Orientation				
Basic research orientation	.375	.229	.153	.113
Applied research orientation	.143	.290	.337	.423
Research productivity				
Total career peer-review publications	134.7	107.0	123.2	117.2
Total career patents/licenses held	1.35	1.99	2.67	4.20

[a]Assistant professor=1; Associate professor=2; Full professor=3

4. Discussion

With respect to our study questions, we are able to characterize academic scientists on the basis of our four identity categories. Generally speaking, the four profiles are not distinguished by either faculty rank or faculty gender. The first two identity categories (traditional and pragmatic hybrid) maintain the insolubility of academic and commercial norms. Type I traditional academics report the lowest level of industry experience and receive less than seven percent of their research funds from industry sources. Compared with other academic scientists, they have developed the weakest faculty-industry collaborations. Examining their overall research orientation, traditional academics are more likely to characterize their research as theoretical and less likely to engage in applied research. Compared with their colleagues, these academics have highly productive research programs inasmuch as they have more peer-reviewed research publications, congruent with the traditional reward system (the ribbon) offered in the academy. Consistent with their focus on basic research, type I traditional academics report holding the fewest number of research-based patents and licenses.

Pragmatic academic hybrids identify more strongly with academic values, but engage with industry in an instrumental fashion, in part to acquire the financial and material resources that aid in their research. While faculty in this category report low levels of industry work experience, they receive almost 28 percent of their research funds from industry sources, a four-fold increase over traditional academic researchers. Type II pragmatic hybrids have larger research programs than traditional academics, as measured by the number of research students under their supervision. By diversifying the base of the research funding to include industrial sources, research scientists may be able to expand their program of research. The general research orientation of pragmatic academic hybrids is characterized as less basic but is more applied than traditional academics. While the number of scientific publications of pragmatic academic hybrids is less than traditional academics, pragmatic hybrids hold more commercial patents/licenses.

The last two identity categories (collaborative academic hybrid and entrepreneurial academic) speak about the integration of academic and commercial research norms. Our largest category is the collaborative academic hybrid where academics report high faculty-industry engagement scores. Compared with other categories, type III collaborative academic hybrids receive the largest proportion of their research funds from industrial sources and report having the largest overall research programs (as measured by the number of graduate students under supervision). Collaborative hybrid academics also report having more industry experience, while about 15 percent report holding or have held an industry-sponsored research chair. They also report holding more commercial patents and licenses than either the traditional or pragmatic academics.

Our fourth researcher identity profile is labelled the entrepreneurial academic and comprises about 24 percent of our sample population. Academic entrepreneurs are able to cross the academic-industry boundary with

considerable ease. Lam (2011) contends academics in this category will demonstrate the least amount of cognitive dissonance as they have been able to successfully resolve the value-based conflicts inherent in academic and commercial science while crafting a new research identity. Faculty who characterize themselves as falling into this category are much more likely to be male, have extensive work experience in industry, and have acquired the greatest amount of industry social capital as measured by their overall strength and diversity of faculty-industry engagements. Not surprisingly, they are least likely to engage in basic or theoretical research and much more likely to characterize their research as applied. Compared with faculty in any other identify category, academic entrepreneurs hold the greatest number of career patents and licenses.

4.1 Limitations

The results reported in this study are somewhat exploratory in nature. There are a number of limitations that require further investigation. Data collected are from full-time, continuing academics employed in schools of engineering and applied sciences in Canadian research-based universities. Findings may not be generalizable to other jurisdictions or to post-secondary settings where research is of lesser importance. Second, the study suffers from mono-method bias in which respondents report on their own perceptions (Doty & Glick, 1998). Single respondent bias limits our ability to validate findings because of the potential of self-serving bias. Third, our identity categories were created through a single-item forced choice method which may be an entirely inadequate way of capturing more complex notions of research ideology and identity. It is also important to be aware of the difference between what respondents say they believe (what they espouse) and what subjects actually do (what they enact). By using categorical distinctions, there is a loss of statistical power. Indeed, a second choice was asked of respondents which when combined with their first choice would allow for the construction of a non-categorical, continuous variable. However, this data was not reported in this paper because of the ease and simplicity of using categorical distinctions as a means of exploring the concepts of ideology and identity would be lost. Finally, our operationalization of academic-industry engagement and its scale construction is somewhat problematic. There are many ways (channels) by which academic faculty can and do engage with industry with no universal agreement about what channels represent true industry engagement and which channels are more ornamental. A benefit of our measure is that it attempts to assess engagement embeddedness capturing not only the many forms of engagement but also measures the degree of strength of each engagement channel. Further exploration should be conducted to identify which specific channels of industry engagement are associated with academic research scientists' attitudes and beliefs with respect to the appropriate relationship between academic science and commercial science, and between the academy and business.

4.2 Conclusion

This study has provided evidence that academic researchers in the applied sciences can be differentiated on the basis of their research ideology and identity. Using a framework developed by Lam (2010; 2011), our sample of academic faculty employed in schools of engineering and applied sciences in Canadian research-based universities can be categorized as type I traditional academics who strictly pursue academic science while eschewing commercial engagements; type II pragmatic academics who choose to follow traditional norms of Mertonian science while engaging with industry to acquire additional resources in the pursuit of academic science; type III collaborative academic hybrids who believe in the association of academic and commercial science for the benefit of society; and type IV academic entrepreneurs who believe in the fundamental importance of academic-industry links for application and commercial exploitation. This framework provides a useful way of distinguishing academic research scientists on the basis of their industry engagements and associations, the size and orientation of their program of research, as well as their level of productivity as academic scientists (peer-reviewed publications) and as commercial scientists (patents/licenses held).

References

Audretsch, D.B., and Kayalar-Erdem, D. (2005). Determinants of scientist entrepreneurship: an integrative research agenda. In S.A. Alvarez, R. Agarwal, & O. Sorenson, *Handbook of entrepreneurship research*, pp. 97-118, Springer, Boston.

Colyvas, J.A., and Powell, W.W. (2006). "Roads to institutionalization: The remaking of boundaries between public and private science", *Research in Organizational Behavior*, Vol. 27, No. 6, pp 305–353.

Deci, E.L., and Ryan, R.M. (2000). "The 'what' and 'why' of goal pursuits: human needs and the self-determination behavior", *Psychological Inquiry*, Vol. 11, No. 4, pp 227-268.

D'Este. P., and Perkmann, M. (2011). "Why do academics engage with industry? The entrepreneurial university and individual motivations", *Journal of Technology Transfer*, Vol. 6, No. 3, pp. 316-339.

Doty, D.H., and Glick, W.H. (1998). "Does common method variance really bias results?" *Organization Research Methods*, Vol. 1, No. 4, pp 374-406.

Gieryn, T. (1983). "Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists", *American Sociological Review*, Vol. 48, No. 6, pp. 781-795.

Gulbrandsen, M., and Smeby, J.C. (2005). "Industry funding and university professors research performance", *Research Policy*, Vol. 34, No. 6, pp. 932-950.

Guo, F., Restubog, S.L.D., Cui, L., Zou, B. and Choi, Y. (2019). "What determines the entrepreneurial success of academics? Navigating multiple social identities in the hybrid career of academic entrepreneurs", *Journal of Vocational Behavior*, Vol. 112, No. 2, pp. 241-254.

Hogg, M.A., Terry, D.J., and White, K.M. (1995). "A tale of two theories: a critical comparison of identity theory with social identity theory", *Social Psychology Quarterly*, Vol. 58, No. 4, pp. 255-269.

Jain, S., George, G., and Maltarich, M. (2009). "Academics or entrepreneurs? Investigating role identify modification of university scientists involved in commercialization activity", *Research Policy*, Vol. 38, No. 6, pp. 922-935.

Lam, A. (2010). "From 'ivory tower' traditionalists to 'entrepreneurial scientists'? Academic scientists in fuzzy university-industry boundaries", *Social Studies of Science*, Vo. 40, No. 2, pp. 307-340.

Lam, A. (2011). "What motivates academic scientists to engage in research commercialization: 'gold', 'ribbon', or 'puzzle'?" *Research Policy*, Vol 40, No. 10, pp. 1354-1368.

Mendoza, P. (2009). "Academic capitalism in the Pasteur's Quadrant", *Journal of Higher and Further Education*, Vol. 33, No. 3, pp. 301-311.

Merton, R.K. (1968). *Social Theory and Social Structure*, The Free Press, New York.

Novotny, A. (2017). "The heterogeneity of the academic profession: the effect of occupational variables on university scientists' participation in research commercialization", *Minerva*, Vol. 55, No. 4, pp. 485-508.

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Brostrom, A., D'Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S., Kitson, M., Llerena, P., Lissoni, F., Salter, A., and Sobrero, M. (2013). "Academic engagement and commercialisation: A review of the literature on university–industry relations", *Research Policy*, Vol. 42, No. 2, pp. 423-442.

Ryan, R.M., and Deci, E.L. (2000). "Intrinsic and extrinsic motivations: classic definitions and new directions", *Contemporary Educational Psychology*, Vol. 25, No. 1, pp. 54-67.

Slaughter, S., and Leslie, L.L. (1997). *Academic Capitalism. Politics, Policies and the Entrepreneurial University*, The Johns Hopkins University Press, Baltimore.

Slaughter, S., and Rhoades, G. (2004). *Academic Capitalism and the New Economy. Markets, State and Higher Education*, The Johns Hopkins University Press, Baltimore.

Stein, D.G., Ed. (2004). Buying In or Selling Out? The Commercialization of the American Research University, Rutgers University Press, New Brunswick, New Jersey.

Stephan, P.E., and Levin, S.G. (1992). *Striking the Mother Lode in Science: The Importance of Age, Place, and Time*, Oxford University Press, New York.

Stokes, D.E. (1997). *Pasteur's Quadrant -- Basic Science and Technological Innovation*, Brookings Institution Press, Washington.

Tartari, V., and Breschi, S. (2012). "Set them free: Scientists' evaluations of the benefits and costs of university-industry research collaboration", *Industrial and Corporate Change*, Vol. 21, pp. 1117-1147.

Turner, J., and Oakes, P. (1986). "The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence", *British Journal of Social Psychology*, Vol. 25, No. 3, pp. 237–252.

Zou, B., Li, Y., Guo, J., and Guo, F. (2019). "Antecedents and outcomes of entrepreneurial identification: The moderating effect of role orientation", *Science and Public Policy*, Vol. 46, No. 4, pp. 541-551.

From Six Learner Personas of Teampreneurship to a Learner-Led and Co-Creative Entrepreneurial Model?

Juha Ruuska
JAMK University of Applied Sciences, Jyväskylä, Finland
juha.ruuska@jamk.fi

Abstract: In the context of entrepreneurship education, design thinking and service design, I will present six learner personas, that I have discovered during my design-ethnographic PhD research in Tiimiakatemia, that is a special entrepreneurship degree programme in JAMK University of Applied Sciences, Jyväskylä, Finland. Programme is known by its team ideology and communal and learning-by-doing learning culture. Six learner personas here are equivalents to *user persona*, to present typical/ archetypal users (students) of an educational program or service. Learner personas are also a way to represent cultural understanding and insight collected through an extensive ethnograpical study between 2016-2020, that has also included ethnographic interviews and projective, participatory and visual methods, such as Lego Serious Play. In my paper, based on the needs, challenges, learning strategies and insight from ethnographic research and the six learner personas, I will further develop and present an idea of learner-led, open, communal, co-creative and integrative entrepreneurial education model that could serve HEIs in developing their own entrepreneurial pedagogy.

Keywords: applied ethnography, learner personas, entrepreneurship education model, LOCCI-model, higher-education

1. Introduction: The case of Tiimiakatemia

I started my 8,5 year personal learning journey of Tiimiakatemia (Team Academy) as a "Team Coach" in August 2012. Officially, in my pay slip I was employed as a senior lecturer, but many central artefacts in the community had been relabeled: teachers were "team coaches", students were "team entrepreneurs" and courses were absent, replaced by a community of 150 teampreneurs, that were organized in team companies (co-operatives). Team companies were set-up by learners in the first weeks of their 3,5 year bachelor studies, without a business plan and previous experience about entrepreneurship. Established originally in 1993 in Jyväskylä, Finland, Tiimiakatemia was started as an experiment in the midst of the reform of the Finnish higher education, that created a dual university model, striving for educating nearer-to-working-life professionals than the traditional universities focusing on academic research. When I started my learning journey, there were 7 team coaches with an annual intake of 40 students.

The programme is a unique construction of "team entrepreneurship education" (Degree Programme in Entrepreneurship), and culturally it grew isolated from the other university as a "special unit of entrepreneurship", created originally by a lecturer in marketing, who titled himself the "head coach". The community appears intensive, and the "teampreneurs are" often enthusiastic about Tiimiakatemia and their own teams. The cultural identity was then not constructed towards entrepreneurship in general, but especially "teampreneurship" and towards Tiimiakatemia community, which was constructed as a separate brand and/or learning organization (Senge, 1990/2006). The program has still its own "leading thoughts" with a mission to "create bold teampreneurs", and learn teampreneurship with the help of their team company and customers. Since 1993, every teampreneurs' given goal has been to make a world-around-trip with the funds made during the program.

The communal aspect seem to support most of the high-school graduated learners in the beginning, as their inexperience, insecureness and cultural attitude is open, but diverse interpretations, identities and goals towards entrepreneurship cause disharmonies later in the process. This is the point where Tiimiakatemia's sometimes one-eyed team ideology pose a challenge for each learner, as its culture potentially interprets individuals from the point of view of a corporate high-performance team. Tiimiakatemia way of thinking of teams were picked up from the rising business culture of the 1990's, and self-help team literature (Katzenbach et al 1993; Lencioni 2002). Community culture and its pedagogy was affected by (in addition of Senges ideas of the Learning Organization) by pragmatism (learning-by-doing), experiential learning (Kolb 1984), the ideas on corporate learning (Nonaka & Takeuchi 1995) and sometimes could be referred or understood to as a community of practice (Wenger 1996; Lave & Wenger 1991).

The short introduction here is for the reader to better understand the concept and the history of Tiimiakatemia, but it doesn't tell you the whole picture. Writing a story about the "whole picture" was my goal after I started

my ethnographical research (Geertz 1973; Van Maanen 2011) in 2016 as a member of the community, and still after I have left the community in the end of 2020. The research has included big and rich set of different qualitative, ethnographical data (research diary, documents, theme interviews and visual Lego Serious Play participatory workshops) including autoethnographical writing (Ellis 2004). This article is connected but separate representation based on that data. The goal of this article is to present some central results of the research, the six learning personas and further develop and present an idea of learner-led, open, communal, creative, constructive and integrative entrepreneurial education model that could serve HEIs in developing their entrepreneurial pedagogy. The idea is to take out a holistic real-life case from Finnish entrepreneurial education and develop and present a generic idea that could be used in developing entrepreneurial educational and pedagogical concepts. The article is presenting a case of processual pedagogy and effectuation (Sarasvathy 2008), that has been suggested by Mäkimurto-Koivumaa and Puhakka (2013). This paper's theoretical framework is multidisciplinary, but still its home is in the applied critical and multidisciplinary cultural studies and social constructionism (see Alasuutari 1996; Hoggart 1958; Grossberg 1992; Berger & Luckmann 1966), that integrates ideas from service design thinking and user-centric design (Brown 2008; Mager 2009; Miettinen 2011;Vargo & Lusch 2004) integrating also educational, organizational and entrepreneurship research.

This aims to be a critical article. That is why Tiimiakatemia is not presented here as an ideal model for entrepreneurship education, but it is a real phenomenon in entrepreneurship education that has achieved international recognition that you can study, and it has produced interesting and good results and very promising impact (see Ruuska and Krawczyk 2013) we can learn from (see Vettraino & Urzelai 2021;2022a;2022b;2022c). Still, It is a cultural construction of its time, that produce special communal identity, special culturally differentiated, closed signification of entrepreneurship. It also contains ideological pitfalls and risks, that are to be avoided when trying to construct an ideal model.

Culture clock of Tiimiakatemia is presented in Figure 1. It represents the communal learning practices. It helps to understand processual the holistic learning culture and the circles represent annual, monthly, weekly and daily practices that the learners and the coaches reproduce every day. Through the interpretation of the figure, it can be seen, that the practices and the language are aiming to construct somewhat similar to company organization, not a conventional educational institution. The learners have their own office spaces in the shared open office, that they pay rent for and they arrange meetings with their own clients, without visible control or permission from the teachers. The coaches are still available for consultation. The contact hours (equivalent of teaching) with the coaches are held in bi-weekly 4-hour dialogue training sessions, that are most precious and meaningful communal practice also for sharing communal knowledge, also that is essential for the team identity and practice building.

When we think of a stereotypical start-up incubator culture, event or entrepreneurial community, we think of cultural identity of a hero serial entrepreneur, that is represented also in media production by Richard Branson and Elon Musk (both carry a name for teampreneur community prizes in Tiimiakatemia). According to Hyrkäs (2016), start-up culture is based on canonized model stories of Silicon valley technology companies like Google, Apple and Amazon and their founders. The story constructs on visionary, revolutionary entrepreneur with society-changing idea and working with high-performance team with great risk and reward.

These potential superstar identities carry the promise and meaning for young entrepreneurs for identification and ideology in western culture. Still, although these cultural identity models are affecting also the young beginner teampreneurs, empirical findings show that the local identity map in Tiimiakatemia is more diverse than the typical stereotypes. Tiimiakatemia also uses stories of their own, much down-to-earth, funny stories of fail and success of the alumni, that usually are self-employed entrepreneurs, usually providing services in marketing, sales or real estate.

The diverse identity "battle" at communal level is presented in figure 2, that shows the cultural positions as team identities – the learners can construct their team more as a team of teampreneurs (engouraged by the community values, as *the self*) or construct their team more as team of individuals (not supported by the community values (*the other*). In these areas continuous dialogue, negotiations and significations are made on *who we are*. By "cultural self", the dominant cultural position is meant, and by signifying something as "the other", is excluding those from the community ideals (Foucault 1972;1980; Hall 1992; Said 1985).

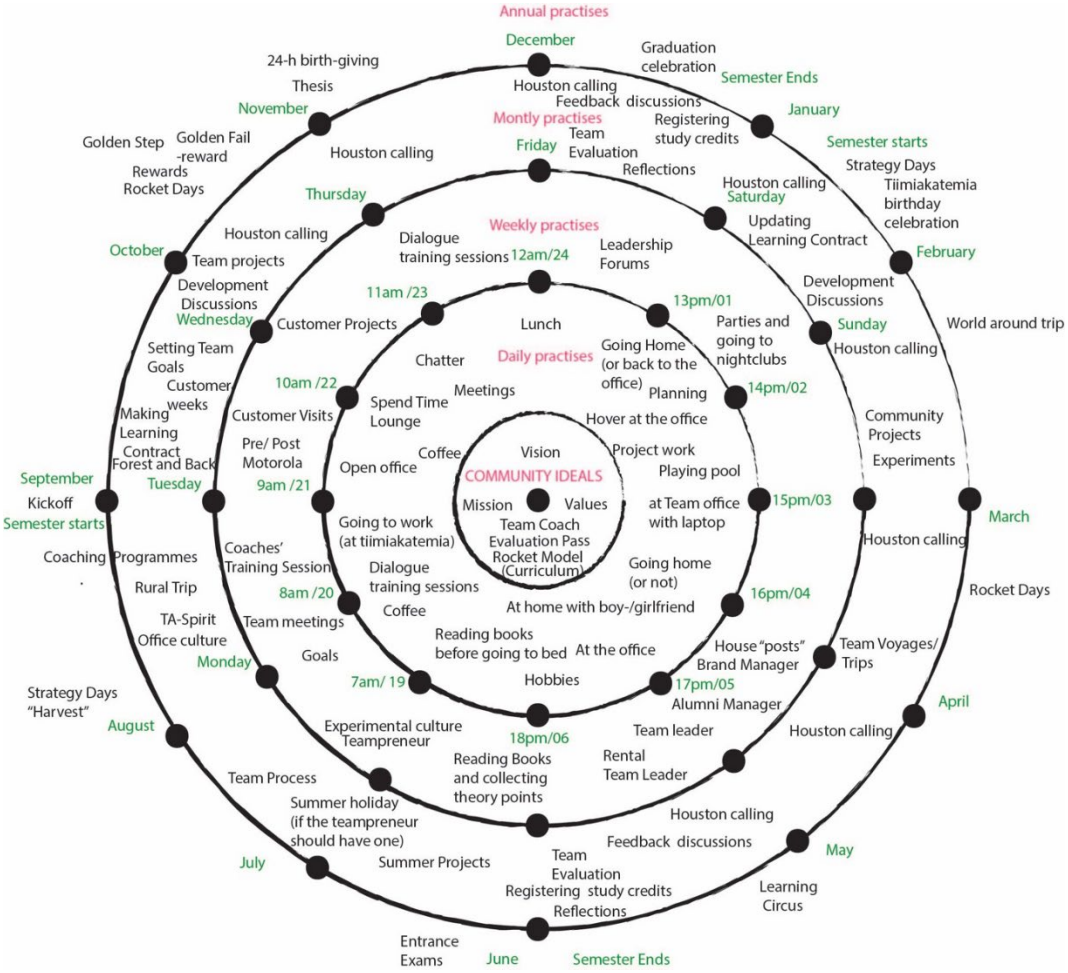


Figure 1: Culture Clock of Tiimiakatemia – representation of communal learning practises and ideals (adapted from Ruuska 2021;2022)

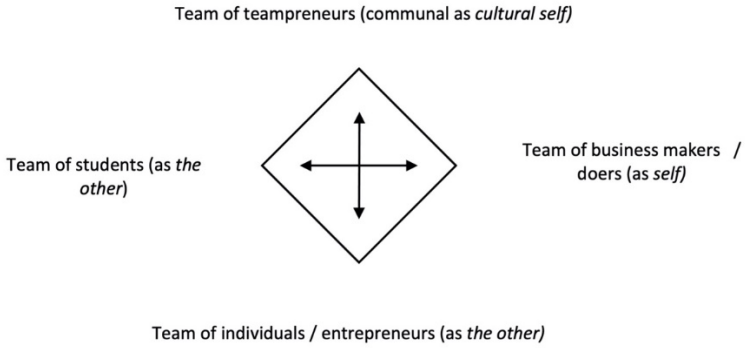


Figure 2: Team identity map (Ruuska 2021, 2022)

The cultural mission of the community is hence aiming for coaching high-performance teams and practical business makers, not individual entrepreneurs and not definitely students. In general level this was, and still is causing some kind of culture shock, as the Finnish educational culture is constructed towards individuality (see cultural dimensions Hofstede 2010) and student identity work, and that concern also the freshmen, who start studying at Tiimiakatemia. This leads these *diverse beginners* to a five-stage team process, that after the *adaptation phase* (1) start *evaluating and questioning* (2) the team process from an individual point-of-view (Ruuska 2021;2022). The next, third phase is called both a *team/individual construction/deconstruction* phase (3) where the learners are potentially caught in a sort of inclusion/ exclusion game, where the team dynamic concentrates on "whos in the team vs. who is not in the team" with the community values and coaches supporting team and communal ideology – "*Team goals are more important than individual goals*". This is

potentially problematic process from the point of view of individual competence development and public education's basic mission, as everyone should have an equal (legal) right to learn despite the relationship to other students. The fourth phase, *construction and specialization* (4), focuses more on self-actualization and specialization individually and in small 2-3 person groups, where also the business ideas get further experimented and developed and the professional identities are shaped further in practise. Stage five is *graduation (5)* phase, which concentrates on formal graduation (academic thesis work) and dissolvement of the team and close down of the learning platform, co-owned co-operative. The teams and individuals are ready to embark on their world-around-trip or to the working life.

2. Six learner personas

I hereby present the six learning personas (Figure 3), that have been identified through ethnographical research and qualitative, inductive analysis. Learner personas are equivalents to *user persona*, to present typical/ archetypal users (students) of the degree program (Guðjónsdóttir, 2010; Holtzblatt et al., 2005).

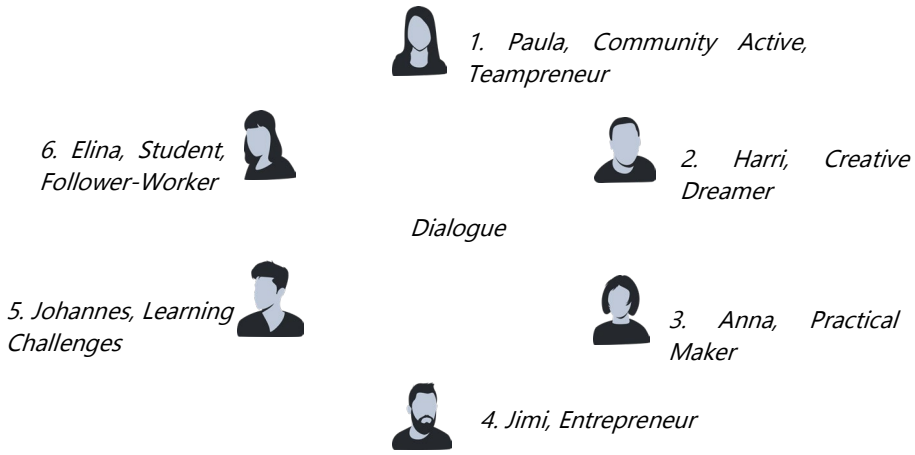


Figure 3: Six learner personas (Ruuska 2021, 2022)

Table 1: Thematic analysis of the learning personas (Ruuska 2021; 2022)

Name	Meaningful	Learning Goal	Strategy (How to achieve Goal)	Strenghts	Challenge/Risk
Paula, Community Active	Sense of belonging, teamwork	Team formation, team entrepreneurship	Work as a team (in the beginning), focused small group (later)	Social, communication and leadership skills	Strategic learning skills, understanding diversity, burnout
Harri, Creative Dreamer	Self-actualisation (of dreams)	Becoming yourself, learning, graduation	Focusing on "becoming yourself" - project	Creativity, curiosity, strong inner drive, focused	Strategic learning skills, too challenging goals, lack of support
Anna, Practical Maker	Practical work and learning-by - doing	Develop competence (specialisation), graduation	Working, learning-by-doing and focusing on projects	Focusing and commitment on personal interests/practical project work	Academic learning skills, strategic learning skills, communal team learning
Jimi, Entrepreneur	Achieving entrepreneurial and financial goals	Entrepreneurship, serial entrepreneurship	Experimentation in practise	Ability to put ideas into practice and get results	Communal/ team learning, exclusion, dropout

Name	Meaningful	Learning Goal	Strategy (How to achieve Goal)	Strenghts	Challenge/Risk
Johannes, Learning Challenges	Wellbeing, being appreciated/ accepted, finding interesting project, graduation	Challenges in setting and reaching goals, finding interesting project, Graduation	Be a part of projects, study as defined/instructed	Committed in the beginning of the process	Strategic learning skills, academic/practical learning, burnout, exclusion, dropout
Elina, Student-follower-worker	Sense of belonging, student-life, studying successfully	Graduation, grades, academic theory, university/master studies	Studying successfully, work as instructed	Academic learning skills, self-directive in given context, social	Strategic learning skills, practical learning, setting meaningful goals

Paula, Harri, Anna, Jimi, Johannes and Elina represent different learners that have different learning goals, orientation, actitivity and values, and do not represent natural personalities nor identities, but archetypal cultural learning identities in a given entrepreneurial context. This means that anyone of the actual learners might take different positions of different personas or characteristics during their learning experience. In the end learner personas have to be understood as design tools, that help understanding and illustrating different learners' behaviour and needs. The personas help creating ideas, concepts for new learning concepts in applicable areas, in this case entrepreneurial education in higher education institutions.

These six personas are analyzed thematically in Table 1, that describes persona diversification in more detailed way. Through the analysis it is easy to imagine the challenges in creating a high-performance team, ideological community or unified company without major challenges, as part of the students are not aware of the community ideals and team ideology when starting their studies. In Tiimiakatemia this has caused dropouts, exclusion and challenges in creating quality team goals and projects, and this also affecting the learning results of the different individuals. These disharmonies could though, be resolved by team members with using inclusive (not exclusive) and open dialogue.

Still, there are remarkable benefits in the communal cultural practises, that also support the individual learning and development, and also there are remarkable strenghts gained for giving individual freedom to learners and in the interpretation of *ownership of the learning*. I call them *me-techniques and we-techniques;* independently learner-designed and facilitated team training sessions, community retreats and trips and especially the idea of individual *ownership of learning*, supported a learning tool and a *me-technique* like the learning contract, that seem to produce a great deal of commitment, intimacy to construct and strenghten *pure* internal relationships (Giddens 1991) and social capital between the team and community members. Foucault would call these governing *technologies of the self* (Foucault 1988), which represent an ideal subject and the self-reflexive practices of the modern, neoliberal subject, whose entrepreneurial self-identity is free but fully responsible of his/hers own life plans and actions (Foucault 2008; Giddens1991,75-76;87-98; Rose 1996,60). From the community point of view the practises seem to produce strong communal identity, that also produce relatively active alumni network, that also play a part of being the customers (and later employers) for the freshmen (*(penguins).*

3. Developing design drivers for the learner personas

In this chapter I will define the design drivers using the thematic analysis presented in the last chapter and present an analysis leading to an entrepreneurial model constructed from and informed by the learning personas, that represent 6 different views to entrepreneurial education. By design drivers I mean the value that should be taken into account and included, when designing future learning concepts. The common factor between these personas is interest towards entrepreneurship. Based on the empirical data backing the persona creation it is evident, that all personas are all eager to construct entrepreneurial identity and activities: learn and explore about entrepreneurship, become entrepreneurial and *become* entrepreneurs, but the goals, activity orientation and the potential of the personas differ.

When we analyze the different personas, we can find different challenges (and risks). These challenges are then included when creating the five design drivers:

Table 2: Developing design drivers

Challenge	Description	Design Driver
Strategic learning	Setting personally suitable quality (especially long-term) goals and achieving or working towards them is challenging, the learning is not progressing as fast as it could/should	Constructive & Creative learning, integrative learning, Communality
Lack of meaningfulness	When learner is experiencing lack of meaningfulness, activity and creativity is narrowed to completing tasks required	Learner-led learning, Constructive & Creative learning
Lack of understanding diversity	Focusing on team process and too strict interpretation of it causes continuous inclusion / exclusion game in the team that is potentially unethical, includes misuse of power and is holding back individual learning processes	Culturally open, learner-led learning
Lack of support	Learners experience lack of support in the community	Communal practices, culturally open
Academic or practical learning	Most learners struggling with integration of academic and practical learning	Integrative learning

Creating design drivers by using only challenges is not enough. Also other (positive/supporting) qualities of personas have to be included: what is meaningful for the persona, learning goals, the *habitus* or way of learning - and different activity orientations or special competences are here taken into account when creating the design drivers.

- 1.Learner -led

It seems that the individual *ownership of learning* in Tiimiakatemia is essential ingredient and a starting point of producing creative agency, meaningfulness and commitment and positive feedback towards the community. In Tiimiakatemia learning culture (that is a long-term programme), there are open learning tools, like the "learning contract" that are designed for constructing the history, present and the future of the learner, and produce agency and meaningfulness for and by the learner. By this I don't mean a traditional personal study plan. This all means radical ownership of learning, where the learner is not just only responsible of his/her own learning but is free to set learning goals individually, not restricted by the curriculum or course structure (only communal structure: values, norms and 6ractices restrict the learner). This is a radical stand, but possible to design in an entrepreneurial setting.

- 2.(Culturally) Open

Entrepreneurial education should act and think openly and not only include all its members, but be open to the world and multidiciplinarity. This design driver is lead from the challenges of the exclusive insider team & communal culture (inclusion/ exclusion game of "us and them") and the need to include and approve diverse learners (6 personas). Openness is also an attitude towards others and important value in learning. If the communication and knowledge is not culturally open for exchange, transformation, new ideas and thoughts, the risk for maintaining the status-quo predicts the reactive, protective community of regression and anxiety.

- 3.Communal

Entrepreneurial education should nurture openly holistic (e.g. 6ultidisciplinary), inclusive communal model that is flexible, participatory and supportive for the diverse learner personas in different levels (individual, group, community). In the group level, flexible and open learning teams/groups formation should be supported. In the community level, different community events for sharing knowledge should be supported and structure for community-led projects should be arranged. The setup of the open organization should seek open-ended, flexible but repetitive communal models, practices and rituals, which support long-term and holistic learning processes, learner-led and communal development of ideas, experiments, projects and relationship/network building. The communality should support the creation of multidisciplinary competences, connections and cross-communal and cross-cultural practices.

- 4.Creative & Constructive

Entrepreneurial education should support the development of creative agency and processual pedagogy, where building something meaningful and novel is a learning goal. This process aims to (co)create artefacts of tangible

or intangible knowledge, projects and receiving (learning) results for all learner personas. The creative activities here are interlinked with communal support and group/team creation, openness, and to be able to set and pursue independently set learning goals. By the term *creative* here, I mean supporting individuals' capability to act or think innovatively (Giddens 1991, 41), which is linked both to effectual and causal entrepreneurial thinking (see Mäk Mäkimurto-Koivumaa, S. & Puhakka, V, 2013). By supporting constructive and creative activity, customized support for learners is needed. These individual processes should be supported and strengthened by the peer community, the coaching, facilitative and mentoring models and other supporting cultural (e.g. multidisciplinary) or technological structure.

- 5.Integrative

Entrepreneurial education should integrate practical, theoretical/academic and experiental activity to a holistic, learner-led process and long-term -program (e.g. 3,5 years). This means not just learning-by-doing, but exploring (researching), experimenting and reflecting during the real-life projects, where there is space, time and support for learning. In Tiimiakatemia, running real business with similar peers, without any experience often results of projects (e.g. subcontracted phone sales projects), that produce little special competences. On the other hand, by running your own business is the only way to institutionally *become* an entrepreneur and experience entrepreneurship in practise.

4. Conclusions: LOCCI model for entrepreneurial education

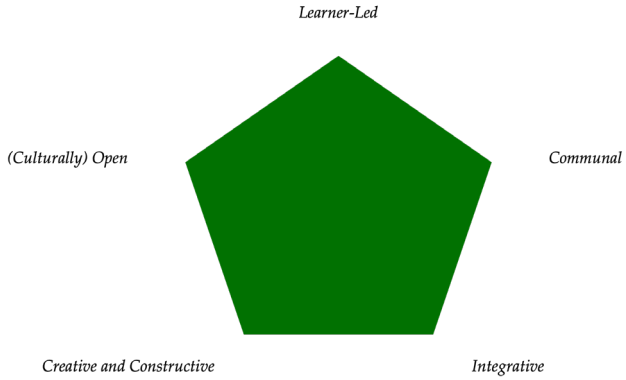


Figure 4: LOCCI model for entrepreneurship education

In figure 4, design drivers are here presented as the LOCCI model for entrepreneurship education. The drivers defined in the last chapter can act as values for entrepreneurial degree programmes and hence produce identity work and holistic compentence development (21st century skills and beyond) for different learner personas. I argue, that these personas are applicable in more generic level, despite the empirical case study presented here. This is because the learner personas presented here are generic enough, that cover individual, communal, creative, practical, academic and learning challenge cultural dimensions and hence are applicable in general level. In practise, this model can be used to create an education program and start developing learner-led and open, competence-based curriculum, that enables the learners to start integrative, creative and constructive learning activity, where the goal is to become co-creative entrepreneurs with working with their peer learners, customers and teachers, whose role is transforming from controlling teacher to facilitator, mentor, coach, consultant, tutor and advisor. With so many historically constructed pedagogicical roles existing, it is important to awcknowledge, that the teachers' role is essential in supporting every learner's identity work. As this is easy to say in one sentence, the challenge for these new programs in higher education are paradoxically cultural, as the pedagogies applied have seem to connect their historically constructed teacher-centric, academic practises or in the case of Tiimiakatemia, to practice- and team-centered. The Tiimiakatemia example shows, that the creation of quite similar entrepreneurial learning community is possible, and it is already adapted in higher education all over the world (see Vettraino & Urzelai 2021;2022a;2022b;2022c).

Further development, design drivers and *30 entrepreneurial actor positions for the learner personas* (value potential) are presented in Table 3. Through the matrix, based on design drivers, you may find different actor positions, potentials and entrepreneurial value that is possible if diverse needs and interests are supported by the entrepreneurial learning culture or learning environment. It can be then argued, that they can represent and fit also a wider entrepreneurial learner (student) population.

I understand the limitations of the paper and the preliminary contextualization of the LOCCI-model, and further research is needed in conducting systematic literary review and comparative research to evaluate the connections, similarities and differences to existing entrepreneurial education models and impacts that have been previously introduced (see Fayolle et al, 2008; Fiet, 2000; Gibb, 1993; Krueger et al,1993; Kuratko, 2005;

Nabi et al, 2017; Thrane et al, 2016). Still, the demand for more long-term programs, pedagogical evaluation and community creation (and creation of ecosystems; Spigel, 2017) is evident, that concentrate to integrate

the theoretical (supply-model) into practical, experiental experimentation and action (demand and competence -models) to create tangible impact (Nabi et al, 2017; Béchard and Grégoire, 2005). The purpose of this paper though, has been introductory and practical; to use a case, and informed developmental framework (applied ethnography /service design thinking) in formation of a cultural and partly pedagocical model for further discussion and experimentation to create working and sustainable degree programs for entrepreneurship education in higher education.

Table 3. Design drivers and 30 entrepreneurial actor positions for the learning personas (value potential)

Design/ value Driver **Learning persona activity and value potential**	**Learner-led learning**	**Communal practises**	**(Culturally) Open**	**Creative & Constructive learning**	**Integrative learning (practical, theoretical & emotional knowledge)**
Paula, Community Active	Work and learn together, fulfill the need to belong to a community	Develop sustainable, respectful and collective learning practices for all	Develop culturally open attitude and practices	Work together as a team towards meaningful, constructive goals	Learn entrepreneurship in a personal, collective and a strategic way, combining theory and practice
Harri, Creative Dreamer	Create individual and long term goals, work towards individual self-actualisation	Have support when working towards individual goals, get feedback to learn, increase of self-knowledge	Have support of diverse ideas, inclusion of individuality and diverse goals	Construct creative projects of self-actualisation and experience project results personally, concretely and tangibly	Experience personal dreams to come reality
Anna, Practical Maker	Have support for learning by doing and work for realizing tangible results	Work together in projects, Have support and get feedback	Working, learning-by-doing and focusing on projects	Focusing on personal interests/practical project work & see results	Integrating practical work succesfully into academic knowledge
Jimi, Entrepreneur	Have support for reaching individual entrepreneurial and financial goals	Developing and sparring ideas together, finding team members, creating networks, sharing risks	Have support and help to develop his/her ideas	Put ideas into practice, see and get entrepreneurial results	Integrating practical, entrepreneurial work succesfully with academic knowledge

Design/ value Driver Learning persona activity and value potential	Learner-led learning	Communal practises	(Culturally) Open	Creative & Constructive learning	Integrative learning (practical, theoretical & emotional knowledge)
Johannes, Learning Challenges	Have expert support in setting meaningful, suitable goals and achieving them, get constant feedback to learn	Have communal support, to be included in suitable projects, get constant peer feedback to learn	To feel included and appriciated	Working towards meaningful, clear and suitable goals	Have support when integrating suitable practical work into academic knowledge
Elina, Student-follower-worker	Have support to learn, graduate and belong to a safe student community	Have support when working towards individual goals, get peer feedback to learn	To have "licence to learn", to feel included and appreciated	Working towards meaningful goals	Integrating practical work succesfully into academic knowledge

References

Alasuutari, P. (1996) *Kulttuurintutkimus ja kulturalismi.* Teoksessa Kupiainen Jari & Sevänen Erkki (toim.). *Kulttuurintutkimus. Johdanto*. *Cultural studies and Culturalism.* In Kupiainen Jari & Sevänen Erkki (ed.) *Cultural studies, introduction*. Helsinki, SKS, pp. 32-50.

Béchard,J. P., and Grégoire, D. 2005. *Understanding teaching models in entrepreneurship for higher education*. In Kyrö, P. and Carrier C. (Ed.), The dynamics of learning entrepreneurship in a cross-cultural university context, 104–134. Tampere, Finland: Faculty of Education, University of Tampere.

Berger, L. P. & Luckmann T. (1994/1966) *Todellisuuden sosiaalinen rakentuminen. Tiedonsosiologinen tutkielma.* Suomentanut ja toimittanut Vesa Raiskila. Original work, *The Social Construction of Reality* (1966) Helsinki, Gaudeamus.

Brown, T. (2008, June) *Design Thinking.* Harvard Business Review. [online] https://readings.design/PDF/Tim%20Brown,%20Design%20Thinking.pdf

Ellis, Carolyn (2004) *The Ethnographic I. A Methodological Novel About Autoethnography*, Altamira Press.

Fayolle, A. and Gailly, B. (2008) "From craft to science, teaching models and learning processes in entrepreneurship education", Journal of European Industrial Training, Vol. 21, No. 7, pp.569–593.

Fiet, J.O. (2000) "The pedagogical side of entrepreneurship theory", Journal of Business Venturing, Vol. 16, No. 2, pp.101–117.

Fornäs Johan (1995) *Cultural Theory and Late Modernity,* Sage.

Foucault, M. (1972) *The Archeology of Knowledge*, London, Tavistock.

Foucault, M. (1980) *Power/Knowledge,* Brighten, Harvester.

Foucault, M. (1988) *Technologies of the Self. Technologies of the Self: A Seminar with Michel Foucault*, M. H. Luther, H. Gutman & P. H. Hutton (ed.), Amherst, The University of Massachusetts Press, 16–49.

Foucault, M. (2008) *The Birth of Biopolitics. Lectures at the College of France 1978-1979*, Houndmills & New York, Palgrave MacMillan.

Geertz, Clifford (1973) *The Interpretation of Cultures*, Basic Books.

Gibb, A. (1993) "The enterprise culture and education: understanding enterprise education and its links with small business, entrepreneurship and wider educational goals", International Small Business Journal, Vol. 3, No. 11, pp.11–34.

Giddens, Anthony (1991) *Modernity and Self-Identity,* Oxford, Polity Press.

Grossberg, L. et al. (ed.)(1992) *Cultural Studies,* New York, Routledge.

Guðjónsdóttir, R. (2010) *Personas and scenarios in use*, [online] www.researchgate.net/publication/282326654_Personas_and_scenarios_in_use, , Stockholm: Doctoral Thesis, Kungliga Tekniska Högskolan, Human-Computer Interaction.

Hall, S. (1992) *The West and the Rest: Discourse and Power*. In S. Hall & B. Gieben (Eds.), *Formations of modernity* (pp. 275–332). Polity Press & Open University.

Hofstede, G.H, Hofstede, G.J, & Minkov M. (2010) *Cultures and Organizations - Software of the Mind: Intercultural Cooperation and Its Importance for Survival*. McGrawHill.

Holtzblatt et al. (2005) *Rapid contextual design: A how-to guide to key techniques for user-centred design*. Morgan Kaufmann Publishers/ Elsevier.

Hyrkäs A. (2016) *Startup Complexity. Tracing the Conceptual Shift Behind Disruptive Entrepreneurship*, Department of Social Research, Faculty of Social Sciences University of Helsinki, Academic dissertation.

Katzenbach, J., & Smith, D. (1993). *The Wisdom of Teams: Creating the High-performance Organisation*. Harper Business Essentials.

Kolb, D. A. (1984) *Experiential learning : experience as the source of learning.*

Krueger, N.F. and Carsrud, A.L. (1993) "Entrepreneurial intentions: Applying the theory of planned behavior", Entrepreneurship & Regional Development, Vol. 5, No. 4, pp.315–330.

Kuratko, D.F. (2005) "The emergence of entrepreneurship education: development, trends and challenges", Entrepreneurship Theory and Practice, Vol. 29, No. 5, pp.577–597.

Lave, J. & Wenger E. (1991) *Situated Learning. Legitimate Peripheral Participation*. Cambridge, Cambridge University Press.-

Lencioni, Patrick (2002). *Five Dysfunctions of a Team. A Leadership Fabel,* John Wiley & Sons.

Mager, B. (2009) *Service Design as an Emerging Field,* In Miettinen S. & Koivisto M. (ed.) *Designing Services with Innovative Methods.* Helsinki, University of Art and Design, pp.28-43

Miettinen, S. (Ed.) (2011) *Palvelumuotoilu. Uusia menetelmiä käyttäjätiedon hankintaan ja hyödyntämiseen*. *Service design: New methods for collecting and developing user data,* Helsinki, Teknologiateollisuus.

Mäkimurto-Koivumaa, S. & Puhakka, V. (2013) "Effectuation and causation in entrepreneurship education", International Journal of Entrepreneurial Venturing 5(1).

Nabi, G. Liñán, F, and Fayolle, A. (2017). The Impact of Entrepreneurship Education in Higher Education:

A Systematic Review and Research Agenda" Academy of Management Learning & Education, 2017, Vol. 16, No. 2, 277–299.

Nonaka I. and Takeuchi H. 1995. *The Knowledge-Creating Company*, *How Japanese Companies Create the Dynamics of Innovation*. New York and Oxford: Oxford University Press.

Rose, N. (1996) *Inventing Our Selves. Psychology, power and personhood*, London, Cambridge University Press.

Ruuska, J., & Krawczyk, P. (2013). *Team Academy As a Learning Living Lab*. In Proceedings of University Industry Conference, Amsterdam, Netherlands.

Ruuska, J. (2021) *Tiimiakatemia Learning Culture, Design-Ethnographical Findings From Tiimiakatemia*, In Vettraino E & Berrbizne U. (ed.) *Team Academy and Entrepreneurship Education*, Routledge.

Ruuska, J. (2022). *Yhteisöllisen yrittäjyyden oppimiskulttuuri: Muotoiluetnografinen tutkimus (kesken):* Väitöstutkimus: Nykykulttuurin tutkimus, Jyväskylän yliopisto (in Finnish*). Communal learning culture of team entrepreneurship: Design- ethnographical research of Tiimiakatemia* (in progress), Doctoral Thesis, Contemporary Culture, University of Jyväskylä, Finland.

Said, E. W. (1985) *Orientalism: Western Concepts of the Orient,* Harmondsworth, Penguin.

Sarasvathy, S.D. (2008) *Effectuation, Elements of Entrepreneurial Expertise*, Edward Elgar, Cheltenham.

Senge, P. (2006/1990). *The fifth discipline*. Random House.

Spigel, B. 2017. "The Relational Organization of Entrepreneurial Ecosystems. Entrepreneurship Theory and Practice", 41(1): 49-72.

Thrane, C. and Blenker P. et. al. (2016) "The promise of entrepreneurship education: Reconceptualizing the individual–opportunity nexus as a conceptual framework for entrepreneurship education", International Small Business Journal 2016, Vol. 34(7), pp.905–924.

Van Maanen, J. (2011/1988) *Tales of the Field. On Writing Ethnography,* The University of Chicago Press, 2nd Edition.

Vargo S.L. & Lusch R.F. (2004) "Evolving to a New Dominant Logic for Marketing*",* Journal of Marketing, Vol. 68 , pp 1–17.

Wenger, E. (1998) *Communities of Practice. Learning, meaning, and identity*, Cambridge University Press.

Vettraino E. & Berrbizne U. (ed.) (2021) *Team Academy and Entrepreneurship Education*, New York: Routledge.

Vettraino E & Berrbizne U. (ed.) (2022b) *Team Academy Diverse Settings*, New York: Routledge.

Vettraino E & Berrbizne U. (ed.) (2022c) *Team Academy Leadership and Teams*, New York: Routledge.

Vettraino E & Berrbizne U. (ed.) (2022d) *Team Academy in Practise*, New York: Routledge.

Financial Innovation for Financial Inclusion: Mapping Potential Access to Finance

Egidijus Rybakovas and Gerda Zigiene
Kaunas University of Technology, Lithuania
egidijus.rybakovas@ktu.lt
gerda.zigiene@ktu.lt

Abstract. The importance of access to finance as a significant problem for business development is considered one of the measures representing the level of financial inclusion. Developing financial innovations, such as crowdfunding, mobile payments, AI-based credit scoring systems, and even blockchain technologies has an immense potential to increase financial inclusion, increase access to finance for individuals and businesses, enabling the unscored or unbanked population to become active members of financial markets. Studies have shown the positive impact of financial technology on individuals' financial inclusion and access to finance, but the development of the Fintech phenomenon does not itself imply improved access to finance for businesses. The spread and adoption of Fintech are taken as evidence of financial innovation This research aims to explore the expected interaction between financial innovation and financial inclusion in selected European countries. The data from the Global Fintech Ranking and Survey on the access to finance of enterprises (SAFE) is used in this study, examining them by comparing countries by their Fintech rankings and respective rank position obtained by measuring the importance of access to finance as a problem in business development. The analysis of 29 European countries indicates that theoretically defined expectations are met in most cases: access to finance is not an important problem for the companies from the countries that are ranked higher in the Fintech rating report. But part of the sampled countries deviates from this trend. These findings indicate that besides financial innovation other factors also may determine the financial inclusion of the companies.

Keywords: financial innovation, financial inclusion, access to finance

1. Introduction

In this paper, we analyse possible ties between financial innovation and financial inclusion. Let us start with the terminology of both. In recent years, financial innovation, incorporating technology into financial solutions has been a hot topic in the business and academic world. *Fintech* is defined as an interdisciplinary subject that integrates finance, technology management and innovation management (Leong, 2018). The term FinTech is commonly used by many researchers to mean "financial technology" abbreviation (Agarwal & Zhang, 2020; Chen et al., 2019; Goldstein et al., 2019; Sangwan et al., 2019). The Fintech sector, deploying financial innovations, plays an important role in the global economy and prosperity, including its impact on financial inclusion.

Financial inclusion means the ability of access to financial products and services for individuals and businesses to meet their needs (World Bank, n.d.) The relationship between Financial Innovation (FINN) and Financial Inclusion (FINC) is well known and widely explored. It was concluded, that “Financial innovation is a major driver of financial inclusion” (Yawe & Prabhu, 2015). Often the problem is observed and explored at the individual/household level and is mostly related to payment services (Hollanders, 2020; Hughes, 2021; Joia & Cordeiro, 2021; Yawe & Prabhu, 2015), transaction accounts (Hollanders, 2020), developing infrastructure and links between poverty rates, racial makeup, and rates of Fintech (Arner et al., 2019; Friedline et al., 2020) or even philanthropic financing of poor individuals and communities (Gabor & Brooks, 2017).

However, there is limited research on the FINN implication for firms' FINC, especially focusing on Small and Medium Enterprises (SMEs). Business companies, especially SMEs, could also experience financial exclusion, evidenced by limited access to finance. Thus, in this article, research will be focused particularly on the impact of FINN development on the FINC of firms.

The pieces of evidence of FINN in business include crowdfunding platforms, mobile payments, artificial intelligence-based credit scoring systems, and blockchain technologies. Most of these innovations fall under the Fintech category, which is considered here in this research as an appropriate proxy for FINN.

FINC, on the other side, is associated with the indicator reporting access to finance as a significant problem in business development.

Several research pieces have been conducted to analyse the impact of FINN on greater FINC and access to finance in developing countries. Finkelstein-Shapiro et al. (2022) have built a model with a traditional banking system and endogenous Fintech intermediary creation and have found that greater Fintech entry delivers positive long-term effects on aggregate output and consumption. However, the potential of the rapid development of the Fintech industry to increase the FINC of companies and their ability to attract financing has not yet been properly explored.

This article builds upon recent scholarship on Fintech, FINN, and FINC by (i) discussing conceptually the expected positive relationship between FINN and FINC, which is observed through indicators of Fintech developments and business experience in terms of access to finance; (ii) contending that increased Fintech development not necessarily by itself influences financial inclusion and sustainable access to finance; and (iii) arguing that, as new financial technologies evolve, we should not overlook the actual impacts and effects estimating the potential benefits of innovations. The research aims to explore FINN-FINC relationships in selected European countries. The methodological approach to classifying countries in terms of differentiating levels of FINN and FINC is provided as a conceptual outcome from the review of existing relevant literature.

2. Relevant literature review

The emergence of FINN fostered in turn the attention of scholars towards the phenomena of the ability to stimulate FINC by the employment of financial technologies. Financial inclusion is the precarious link amidst enhanced economic opportunity and improved economic results. FINC is indicated by United Nations (UN) as an enabler of seven of seventeen UN Sustainable development goals (SDGs): SDG1, on eradicating poverty; SDG 2 on ending hunger, achieving food security and promoting sustainable agriculture; SDG 3 on profiting health and well-being; SDG 5 on achieving gender equality and economic empowerment of women; SDG 8 on promoting economic growth and jobs; SDG 9 on supporting industry, innovation, and infrastructure; and SDG 10 on reducing inequality (*Financial Inclusion and the SDGs - UN Capital Development Fund (UNCDF)*, n.d.). There is scientific evidence that FINC can support inclusive economic growth (Finkelstein-Shapiro et al., 2022; Friedline et al., 2020; Hollanders, 2020; Hughes, 2021; Joia & Cordeiro, 2021; Yawe & Prabhu, 2015).

The first studies linking the impact of financial technology on FINC were carried out when the intensive development of the sector yielded positive results in light of the disruptive effects of Fintech. In the areas where people did not have access to financial services or current accounts, Fintech companies replaced traditional financial institutions by offering access to financial services through Internet access and mobile device. It is not surprising, therefore, that the first effects of Fintech on financial inclusion were observed among individuals and included payment services (World Bank, n.d.; Yawe & Prabhu, 2015), which in turn attracted the attention of researchers to explore Fintech as a stimulator of financial inclusion. FINC via payments was analysed from various angles. Payments, as the first wave of financial inclusion of individuals and households, was researched by Hollanders (2020), Hughes (2021), Joia and Cordeiro (2021), and Yawe and Prabhu (2015).

Other researchers pointed out the possibility of lending through Fintech solutions in areas underserved by traditional financial institutions (Buchak et al., 2018; Fuster et al., 2019; Jagtiani & Lemieux, 2018; Wójcik, 2021). More aspects of FINN for FINC, such as developing infrastructure and links between poverty rates, racial issues, and impact investment in poor communities have been studied by several authors (Arner et al., 2019; Bartlett et al., 2022; Friedline et al., 2020; Gabor & Brooks, 2017). Although some experts still define FINC as "…broader access to and usage of financial services, in particular, payment services" (Hollanders, 2020), there are much more financial inclusion aspects besides payments and the scope covers business too, as defined by the World Bank: "Financial inclusion means the ability of access to financial products and services for individuals and businesses to meet their needs" (World Bank, n.d.). Word Bank's definition broadens the concept from individuals to businesses and points out financial products and services that might vary from a current account to individuals, to artificial intelligence solutions for easing the creditworthiness estimation, thus access to finance for SMEs. SDGs, connected to financial inclusion, as listed above, also bring attention to various areas of the impact of financial inclusion.

In terms of the impact of Fintech sector development on SME businesses, the range of Fintech services is expanding to include not only mobile payments but crowd financing (Kim & De Moor, 2017; Serwaah, 2021), artificial intelligence solutions for more accurate SME credit assessments (Bughin et al., 2017, 2019; Rybakovas & Žigienė, 2021; Taylor, 2018; Westermann, 2018; Zhang et al., 2018; Žigienė et al., 2019), the impact of platform

economies (Langley & Leyshon, 2021) on financing, and more. The application of individual technologies helps SMEs to overcome the barrier of access to finance for business development, thus the potential of increasing business financial inclusion. Although the coherent studies on the overall impact of FINN on FINC covering business are hard to find, research suggests Fintech targets the underdeveloped banking and finance area, and firms with low access to finance. Academic research reveals the crowdfunding potential to overcome traditional financial institutions' barriers for young businesses. The employment of artificial intelligence in improving the credit scoring accuracy of SMEs helps to turn SMEs from unscored and unbanked to scored and banked.

Overall, however, there is still a lack of consistent research to confirm the link between the development of the Fintech sector and the financial inclusion of companies. Especially if we are talking about different countries where the speed and the scope of Fintech development differs. So we question whether the country's development of the Fintech sector can accelerate firms' access to finance and, in turn, financial inclusion.

3. Method and data

The actual relationships and interactions between FINN and FINC at the country level are explored and mapped on the conceptual framework shown in Figure 1. The background for this approach is gained from a relevant literature review, which indicates that FINN-FINC interactions occur at the individual level while firm-level analysis remains underexplored and thus needs attention. Since the firm-level microdata describing both sides of the model is not available, the empirical analysis is done at the country level, combining separate data sources to measure FINN and FINC.

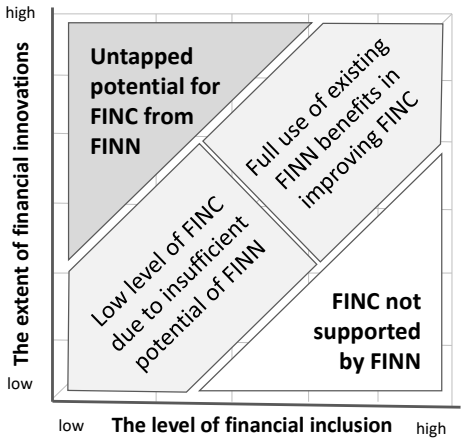


Figure 1: The conceptual approach to mapping the use of benefits from FINN to improve FINC

The top-left off-diagonal segment of the map positions countries where the FINN level is high, but it is not reflected in the respective FINC level, which indicates that FINN potential is untapped. The two segments along the diagonal represent theoretically explained expectations of the positive FINN effect on FINC; increasing the level of FINN expands FINC, while insufficiency of FINN results in a low level of FINC. Finally, the bottom-right off-diagonal segment of the map positions countries where FINC is relatively high, but this is supported by some other unexplained factors, as the FINN level is low.

The empirical data based position of the country in the conceptual framework (Figure 1) could work as a policy development guide. The reasons and factors that prevent benefiting from FINN should be uncovered in the countries with untapped potential for FINC from FINN. While new horizons explaining mechanisms of higher FINC might be discovered in countries showing relatively high FINC which is not supported by FINN.

The empirical research aims to explore the above-discussed expectation in selected European countries. The spread and adoption of Fintech are taken as evidence of FINN. The perception of access to finance as a significant problem for business development is one of the measures representing the FINC level.

Such operationalisation is validated by the common definition of FINC, which refers to “easy access to and use of financial services from the formal financial institutions in a timely, adequate, affordable manner (Nguyen, 2020)”. It should be pointed out that FINC as “a multidimensional concept cannot be accurately captured by individual indicators” (Nguyen, 2020), which means that this research leaves wide space for other attempts

based on another approach to the operationalisation of the FINN and FINC concepts. The decision to simplify and limit the research design to only two basic indicators is reasoned by the aim to study FINN-FINC interactions at the firm level, which still lacks research and empirical data-based evidence.

To explore the FINN-FINC relationship, we will use data from the Global Fintech Ranking (Findexable, 2021) and Survey on the Access to Finance of Enterprises – SAFE (European Central Bank, 2021) in this study, examining them by comparing countries by their Fintech rankings and respective rank position obtained by measuring the perception of access to finance as a problem in business development. The comparison of selected countries' rankings based on Fintech developments and access to finance measures is employed as a research method.

Fintech index (Findexable, 2021) only uses quantifiable data to determine ranked country scores. The ranking is based on the three main indicators: 1) the quantity of privately owned Fintech companies, 2) the quality of those companies (which is assessed by the web presence of the company, monthly visits, customer base, valuation, presence of major industry gatherings, Fintech events, as well as a ratio to the population of the country to assess the scale of the ecosystem), 3) the local business environment (which is referred to the World Bank's Doing Business Report). The rank position of the country is considered an indicator of FINN. A higher position in the ranking (smaller rank number) indicates advances in financial innovation.

The SAFE provides information on the latest developments in the financial situation of enterprises, and documents trends in the need for and availability of external financing. The survey is conducted twice a year: once by the European Central Bank covering euro area countries and once in cooperation with the European Commission covering all European Union (EU) countries plus some neighboring countries (European Central Bank, 2021).

The research takes September-October 2021 (wave 25) survey data. The actual indicator to measure the overall FINC level of business in a country is the survey question: "How important have the access to finance problems been for your enterprise in the past six months (please answer on a scale of 1-10, where 1 means not it is not at all important and 10 means it is extremely important)?". The countries' ranking was done based on the average value of the country sample. The distribution on country averages covers 2.8 – 7.0 values range. A higher position in the ranking (smaller rank position number) indicates lower importance of the problem of access to finance.

More than 13 thousand firms are included in the sample of the 25th SAFE wave (European Central Bank, 2021). Different country sample sizes vary in the range of 90 (Luxembourg) and 1400 (Italy) and correspond to the country size. The overall sample structure by firm size is as follows: 45% are represented by 1-9 employees firms, 30% – 10-49 employees firms, and 25% – 50-249 employees firms. In terms of the main activity of the enterprise, 17% represent industry, 11% – construction, 24% – trade, and 48% – services. In terms of ownership, the majority of sampled enterprises are owned by one owner only, that is respondent or another natural person (42%) or by family or entrepreneurs – more than one owner (38%). Among the remaining: 2% are owned by public shareholders (enterprise is listed on the stock market), and 18% are other enterprises and business associates (European Central Bank, 2021). Each country's sample deviates from this overall structure to maintain the representativeness of the country's enterprise population.

The mapping of observed countries based on the two above described indicators is done aiming to uncover the not- and over-exploited potential of FINC here represented as the problem of access to finance. The estimation of insufficiency in exploiting the potential access to finance and its over-exploitation is done according to the country's Fintech ranking. The generalised and conceptually reasoned rule is that a higher Fintech ranking should be associated with the respectively lower average evaluation of access to finance as the important problem for the business (which is evidence of the higher overall FINC in the country).

The sample of 29 European countries matched between two selected data sources (European Central Bank, 2021; Findexable, 2021). Since the 2021 Fintech index covers 36 European countries, the rank positions based on the FINN measure of some countries were slightly changed to match the total number of rankings based on two different data sources.

4. Findings

The analysis of 29 European countries indicates that theoretically reasoned expectations are met in most cases (Figure 2): companies from the countries, that are ranked higher in Fintech rating, report to the SAFE survey that accesses to finance is not an important problem and vice versa. But greater or lesser deviations from this trend also are present. Some of the outliers are particularly noticeable.

The companies from the United Kingdom, Germany, Estonia, Ireland, Lithuania, and Spain (e.i. countries that are ranked relatively high in Fintech rating) experience access to finance as a more important problem to the business than expected. Portugal, Bulgaria, and Turkey also fall into this category; representing the bottom part of the Fintech ranking (Figure 2). Lithuania and Spain are two especially noticeable cases among those that deviate to the more prominent problem of accessing finance than it could be expected according to the level of FINN, which here is represented by Fintech ranging.

Slovakia, Croatia, Czechia, Slovenia, and Hungary (representing south-eastern Europe) are a few examples of countries where access to finance is considered a less important problem to the business than expected based on their Fintech ranking. Finland and Denmark also fall into this category; these two countries are highly ranked in Fintech rating. These findings indicate that besides FINN other factors also might determine the FINC of the companies.

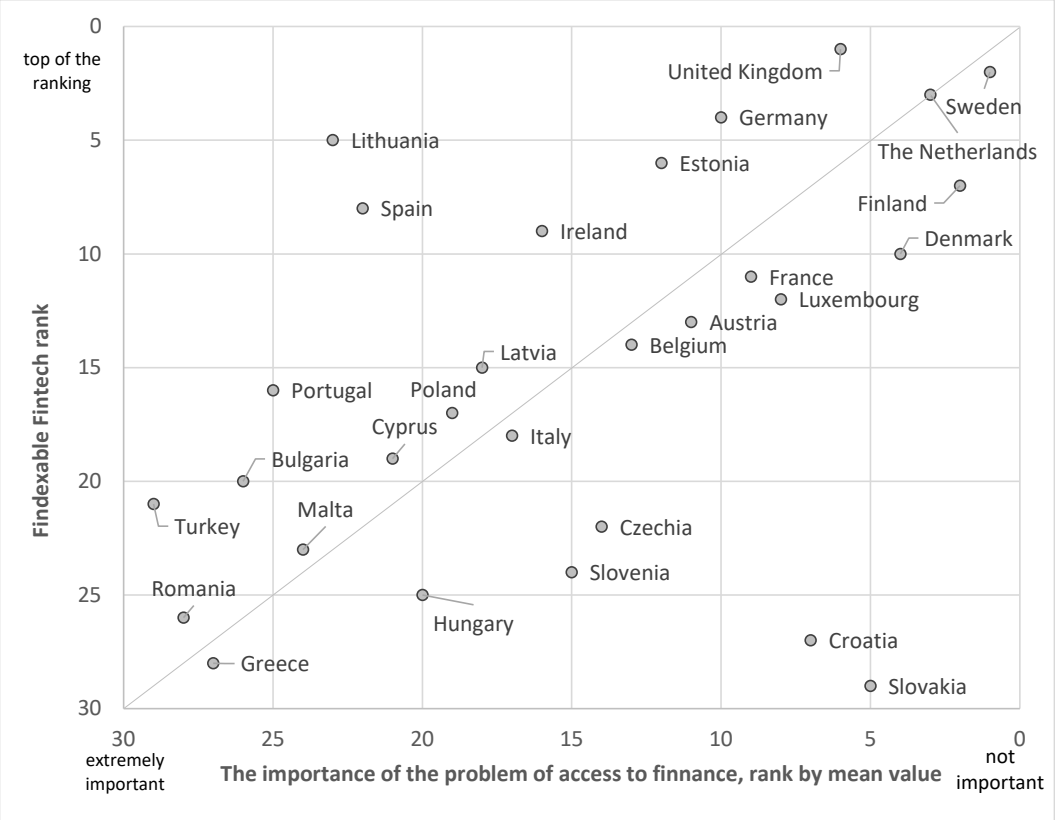


Figure 2: The comparison of Fintech index (Findexable, 2021) and importance of the access to finance as a problem for business (European Central Bank, 2021) ranks

These findings indicate that FINC in general or indicated by potential access to finance is associated with FINN and might be mapped accordingly. The above-mentioned outlier cases do not break the rule. They may represent special cases that illustrate either faster Fintech developments that benefits are not yet fully utilised by businesses (as in the cases of Spain and Lithuania) or indicate that not necessary FINN is the most important factor and reason for FINC as the south-eastern European region countries show. For example: "The development of Lithuania's Fintech sector has been exceptional in the last decade, growing almost fivefold in seven years […]. Lithuania has cemented its leadership as the EU's biggest and most vibrant Fintech hub" (Invest Lithuania, 2021). Very similar advances are also reported in Spain (Ernst & Young, 2021).

Both directions of deviations from the explained mainstream are valuable for further research and theory developments.

5. Conclusions

The majority of research on a link between FINN and FINC is focused on individuals or households, exploring payment services, infrastructure, and connections between poverty rates, racial makeup, and rates of Fintech or even philanthropic financing. Although the positive link between FINN and FINC at the individual or community level is already well established, there is limited research on the Fintech implication for firms' FINC, especially focusing on SMEs. Another area of research that also shows positive results is the interaction between individual financial technologies (payments, crowdfunding, AI) and access to finance for SMEs, thus shoving the potential of a positive link between the overall country's Fintech development and SMEs financial inclusion.

The study of FINN-FINC interaction in selected European countries let us classify the observed countries and indicate clear differentiation patterns. Distinct four groups of countries are identified. The majority of observed European countries are classified according to a theoretically reasoned explanation which says that higher levels of FINN should result in higher levels of FINC. The outlier countries were classified as representing the local context where the potential for FINC from FINN is untapped or FINC might be supported by other not FINN related factors. The south-eastern region of Europe unites the latter group of countries, while the common characteristics of the former group represented by Spain and Lithuania are not that evident. Though these two countries are poisoned as hubs and Fintech leaders, some wider comparative research is needed to find out the reasons that result in limited access to finance despite the high FINN level. It is concluded that the main focus and attention in this field of research should be paid to these outlier cases. In-depth case studies would be valuable in explaining the reasons which resulted from these unexpected deviations.

As the aim of this study was to see the link between the development of the Fintech sector and financial inclusion, and the results suggest that in some countries this link is more pronounced than in others, further research could also include a wider range of factors. In this way, other still uncovered factors that promote financial inclusion through the development of Fintech in some countries could be applied in others.

References

Agarwal, S., & Zhang, J. (2020). FinTech, Lending and Payment Innovation: A Review. *Asia-Pacific Journal of Financial Studies*, *49*(3), 353–367. https://doi.org/10.1111/ajfs.12294

Arner, D. W., Buckley, R. P., Zetzsche, D. A., & Veidt, R. (2019). *Sustainability, FinTech and Financial Inclusion* (SSRN Scholarly Paper ID 3387359). Social Science Research Network. https://doi.org/10.2139/ssrn.3387359

Bartlett, R., Morse, A., Stanton, R., & Wallace, N. (2022). Consumer-lending discrimination in the FinTech Era. *Journal of Financial Economics*, *143*(1), 30–56. https://doi.org/10.1016/j.jfineco.2021.05.047

Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2018). Fintech, regulatory arbitrage, and the rise of shadow banks. *Journal of Financial Economics*, *130*(3), 453–483. https://doi.org/10.1016/j.jfineco.2018.03.011

Bughin, J., McCarthy, B., & Chui, M. (2017, August 28). A Survey of 3,000 Executives Reveals How Businesses Succeed with AI. *Harvard Business Review*. https://hbr.org/2017/08/a-survey-of-3000-executives-reveals-how-businesses-succeed-with-ai

Bughin, J., Seong, J., Manyika, J., Hämäläinen, L., Windhagen, E., & Hazan, E. (2019). *Notes from the AI frontier: Tackling Europe's gap in digital and AI*. McKinsey Global Institute. https://www.mckinsey.com/~/media/mckinsey/featured%20insights/artificial%20intelligence/tackling%20europes%20gap%20in%20digital%20and%20ai/mgi-tackling-europes-gap-in-digital-and-ai-feb-2019-vf.ashx

Chen, M. A., Wu, Q., & Yang, B. (2019). How Valuable Is FinTech Innovation? *The Review of Financial Studies*, *32*(5), 2062–2106. https://doi.org/10.1093/rfs/hhy130

Ernst & Young. (2021). *Spanish Fintech Ecosystem*. https://assets.ey.com/content/dam/ey-sites/ey-com/es_es/topics/financial-services/ey-spanish-fintech-ecosystem-v9.pdf?download

European Central Bank. (2021, November 24). *Survey on the access to finance of enterprises (SAFE)*. European Central Bank. https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html

Financial Inclusion and the SDGs—UN Capital Development Fund (UNCDF). (n.d.). Retrieved April 12, 2022, from https://www.uncdf.org/financial-inclusion-and-the-sdgs

Findexable. (2021). *The Global Fintech Index: Global Fintech Rankings Report. Bridging the Gap.* Findexable Limited, The Global Fintech index. https://findexable.com/gfi-live/

Finkelstein-Shapiro, A., Mandelman, F. S., & Nuguer, V. (2022). *Fintech Entry, Firm Financial Inclusion, and Macroeconomic Dynamics in Emerging Economies*. Inter-American Development Bank. https://doi.org/10.18235/0003918

Friedline, T., Naraharisetti, S., & Weaver, A. (2020). Digital Redlining: Poor Rural Communities' Access to Fintech and Implications for Financial Inclusion. *Journal of Poverty*, *24*(5–6), 517–541. https://doi.org/10.1080/10875549.2019.1695162

Fuster, A., Plosser, M., Schnabl, P., & Vickery, J. (2019). The Role of Technology in Mortgage Lending. *The Review of Financial Studies*, *32*(5), 1854–1899. https://doi.org/10.1093/rfs/hhz018

Gabor, D., & Brooks, S. (2017). The digital revolution in financial inclusion: International development in the fintech era. *New Political Economy*, *22*(4), 423–436. https://doi.org/10.1080/13563467.2017.1259298

Goldstein, I., Jiang, W., & Karolyi, G. A. (2019). To FinTech and Beyond. *The Review of Financial Studies*, *32*(5), 1647–1661. https://doi.org/10.1093/rfs/hhz025

Hollanders, M. (2020). FinTech and financial inclusion: Opportunities and challenges. *Journal of Payments Strategy & Systems*, *14*(4), 315–325.

Hughes, H. (2021). The Complex Implications of Fintech for Financial Inclusion. *Law & Contemporary Problems*, *84*(1), 115–128.

Invest Lithuania. (2021). *The Fintech Landscape in Lithuania: 2021—2022 Report*. https://investlithuania.com/report/fintech-report-2021-2022/

Jagtiani, J., & Lemieux, C. (2018). Do fintech lenders penetrate areas that are underserved by traditional banks? *Journal of Economics and Business*, *100*, 43–54. https://doi.org/10.1016/j.jeconbus.2018.03.001

Joia, L. A., & Cordeiro, J. P. V. (2021). Unlocking the Potential of Fintechs for Financial Inclusion: A Delphi-Based Approach. *Sustainability*, *13*(21), 11675. https://doi.org/10.3390/su132111675

Kim, H., & De Moor, L. (2017). The Case of Crowdfunding in Financial Inclusion: A Survey. *Strategic Change*, *26*(2), 193–212. https://doi.org/10.1002/jsc.2120

Langley, P., & Leyshon, A. (2021). The Platform Political Economy of FinTech: Reintermediation, Consolidation and Capitalisation. *New Political Economy*, *26*(3), 376–388. https://doi.org/10.1080/13563467.2020.1766432

Leong, K. (2018). FinTech (Financial Technology): What is It and How to Use Technologies to Create Business Value in Fintech Way? *International Journal of Innovation, Management and Technology*, 74–78. https://doi.org/10.18178/ijimt.2018.9.2.791

Nguyen, T. T. H. (2020). Measuring financial inclusion: A composite FI index for the developing countries. *Journal of Economics and Development*, *23*(1), 77–99. https://doi.org/10.1108/JED-03-2020-0027

Rybakovas, E., & Žigienė, G. (2021). Is Artificial Intelligence a Magic Pill Enhancing SMEs Access to Finance? *2021 IEEE International Conference on Technology and Entrepreneurship (ICTE)*, 1–6. https://doi.org/10.1109/ICTE51655.2021.9584833

Sangwan, V., Harshita, Prakash, P., & Singh, S. (2019). Financial technology: A review of extant literature. *Studies in Economics and Finance*, *37*(1), 71–88. https://doi.org/10.1108/SEF-07-2019-0270

Serwaah, P. (2021). Crowdfunding, gender and the promise of financial democracy: A systematic review. *International Journal of Gender and Entrepreneurship*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/IJGE-07-2021-0115

Taylor, P. (2018). *The Robots Are Coming To Corporate Finance*. Forbes Technology Council. https://www.forbes.com/sites/forbestechcouncil/2018/05/01/the-robots-are-coming-to-corporate-finance/#8959bae56b6e

Westermann, C. (2018). *Opportunities and Risks of Artificial Intelligence in the Financial Services Industry*. PwC Switzerland. https://www.pwc.ch/en/insights/fs/opportunities-and-risks-of-artificial-intelligence-in-the-financial-services-industry.html

Wójcik, D. (2021). Financial geography II: The impacts of FinTech – Financial sector and centres, regulation and stability, inclusion and governance. *Progress in Human Geography*, *45*(4), 878–889. https://doi.org/10.1177/0309132520959825

World Bank. (n.d.). *Financial inclusion* [Text/HTML]. World Bank. Retrieved April 12, 2022, from https://www.worldbank.org/en/topic/financialinclusion/overview

Yawe, B., & Prabhu, J. (2015). Innovation and financial inclusion: A review of the literature. *Journal of Payments Strategy & Systems*, *9*(3), 215–228.

Zhang, Q., Wang, J., Lu, A., Wang, S., & Ma, J. (2018). An improved SMO algorithm for financial credit risk assessment – Evidence from China's banking. *Neurocomputing*, *272*, 314–325. https://doi.org/10.1016/j.neucom.2017.07.002

Žigienė, G., Rybakovas, E., & Alzbutas, R. (2019). Artificial Intelligence Based Commercial Risk Management Framework for SMEs. *Sustainability*, *11*(16), 4501. https://doi.org/10.3390/su11164501

The Risk Attitude and the Motivation to Online Purchase

Arik Sadeh[1] and Cristina Feniser[2]
[1]HIT Holon Institute of Technology
[2]Technical University of Cluj Napoca, Romania
sadeh@hit.ac.il
cristina.feniser@mis.utclu.ro

Abstract: The e-commerce and virtual stores are sources of innovative economic ideas and initiation of entrepreneurial business. This research deals with the motivation of potential buyers to conduct a purchase in virtual stores concerning their risk aversions in several dimensions, including entrepreneurial risk aversion. The study is based on a survey of 104 responders exposed to technology working in the hi-tech industry. We used the structural equation modeling approach to conduct the statistical analysis. The relationships between risk aversion, the reliability of the products, the stores, and the motivation to purchase are modeled in one set of equations. The study's findings can help entrepreneurs how to market products that may be perceived as not reliable.

Keywords: online purchase intention, risk aversion, trust of online shops, perceived security

1. Introduction

1.1 Rational

The goal of the study is to examine the relationship between consumer confidence in online shops' websites and the consumer's level of willingness to take risks and make an online purchase. Despite the many possibilities of the Internet being a significant fac tor for global consumption, there is an assumption that several factors lower customers' confidence in the Internet environment and reduce the willingness to purchase.

Consumers want to be sure that they will be able to earn more than lose when making an online purchase. Still, in the purchase process, they are exposed to many risks, including the risk of losing time, money, and privacy by revealing personal details. The consumer desires to reduce these risks to enjoy the many advantages of online purchases, including a broader range of products, convenience, timesaving, and money.

Due to the accelerated development of technology, the entry of newer means of communication and trade than in the past, and the result of purchasing options, it is important to confirm the direct relationship between potential customers' trust in websites and willingness to take risks and, accordingly, to make an online purchase. Therefore, give practical recommendations regarding parameters that increase customers' trust in websites to increase the likelihood of making a sale online.

The relationship between the level of reliability perceived by the customer and the correctness of making the purchase

In the literature, it has been found that trust is an important factor in decision-making in implementing e-commerce. It is also a characteristic that is defined in most social and economic interactions in conditions of uncertainty. Therefore, every interaction requires an element of trust and the interactions in an unsafe e-commerce environment (Adam et. Al, 2008).

Consumer confidence in an online environment where there is no interaction between people is defined as a rational selection process in which the consumer is required to trust the retailer and make a move in which circumstances make the consumer vulnerable to the retailer (Jarvenpaa and Tractinsky1999). Therefore, online shopping requires higher levels of trust than traditional shopping.

Online transactions and internet interactions are not only characterized by uncertainty but also by anonymity, lack of control, and the potential for spying on the part of suppliers. Therefore, the creation of a trust is a critical element in e-commerce. In the face of these risks, the consumer is looking for ways to minimize the perceived risk, and one of the ways to do so is by creating trust, where trust serves as a mechanism that reduces the complexity of human behavior in situations in which the individual is required to deal with

uncertainty (Petrovic et al., 2003). Therefore, for a consumer to make a purchase online, firstly, he needs to trust and trust the retailer since the lack of trust is one of the main reasons consumers do not purchase online.

The relationship between the perceived risk level by the customer and the willingness to make the purchase

The uncertainty inherent in the online environment has brought the risk to an inevitable element of e-commerce. Since there is a difficulty in assessing the risk in real terms, the literature refers to this in terms of perceived risk, defined as consumers' fear of losing their desire to make an online purchase. The willingness of consumers to make an online purchase is contingent on the level of risk perceived by the site. Given the uncertainty in e-commerce, the perceived risk will reduce customers' willingness to make online transactions (Sadeh et. al, 2006)

The principle of risk has been known and studied in the field of economics since the 1920s in the context of turning physical damage or undesirable effects into personal benefits. Risk is a random variable with a known probability, which is related to situations with the ability to choose in which the player can choose between two or more alternatives while choosing the best alternative (Giesler2004).

The ability to choose is the basis of the economy since by allocating the limited resources that consumers have, the correct distribution of resources is chosen to select the best alternative. There are different types of risk, including financial loss, performance risks, physical risks, risk of loss of time, psychological risks, and social risks (Flanagin et. al. 2014).

In-depth studies in the field of risk perceived by consumers confirm that the perceived risk in the eyes of consumers is a central factor in their purchase behavior and assessment (Laroche et al.,2004). According to Bauer (1960), the perceived risk has two characteristics: uncertainty (in obtaining an undesirable result) and the impact and the importance of losing that result.

From the literature, it can be concluded that both consumers who do not make purchases online, and consumers who purchase online are affected by the perceived risk when making a purchase, but at different levels. Consumers who do not purchase online are significantly affected by the perceived risk and therefore avoid purchasing online, with the main barrier being the issue of security. On the other hand, consumers who purchase online make purchases despite the perceived risk, Given the great importance of their convenience and variety from the Internet provider.

When the risk perceived by the consumer is lower than the benefit obtained from the product, the risk has a minimal impact on the consumer's purchasing behavior, so that in the end, the consumer ignores the risk. On the other hand, when the perceived risk is high, it may cause the consumer to postpone the purchase or avoid it altogether (Chunningham et al., 2005).

The relationship between the love of risk and the willingness to make an online purchase

Online purchasing offers an opportunity to meet the needs of the risk lover in a less risky way and in more beneficial ways.

By the current definition, the term "sensation seeking" is a term from the field of behavioral science used to evaluate behavioral traits expressed in the pursuit or aversion to risks. "It is a trait characterized by the search for different, strange and complex experiences, and the willingness to take physical, social, legal, or economic risk in them for the sake of the experience" (Zuckerman, 1994).

Different forms of risk love manifest themselves in the way of thinking, the senses, social interaction, and dangerous sports activities (Zuckerman, 1994). At the same time, people have different needs for excitement, risk, the need for change, and adventure. Furthermore, studies show that love of risk varies according to socio-demographic variables. Therefore significant differences can be seen in risk love based on age, gender, race, and education levels (Lopez-Bonilla, 2008).

Previous studies have found that there is a direct positive correlation between the love of risk and risk-taking behavior. At the same time, the love of risk is not linked solely to behaviors that go against social norms and

negative behaviors. However, there is a relationship between the love of risk and leisure, consumer behavior, and behavior on trips. (Lopez- Bonilla, 2008).

Love of risk in the marketing field is attributed as a principle relative to the explained tendencies of consumers (Sadeh and Dvir, 2020). These tendencies are understood from three categories, including curiosity-driven behavior, the search for diversity and diversity, and the risk perceived by the consumer (Lopez-Bonilla, 2008). Grande (2005) argues that consumers are looking for variety to break a routine.

It should be noted that online consumers who take a risk when making an online purchase are attributed as low-level risk lovers.

Summary of the literature review

Trust and risk are mutually linked. Trust is "a social lubricant that allows consumers to transact with retailers that are not part of the consumer's direct network (Jarvenpaa & Tractinsky, 1999). Trust in e-commerce facilitates the perception of the risk involved in making an online transaction in the eyes of the consumer. The higher the risk perceived by the consumer; the higher levels of trust are needed to carry out the execution of the transaction. At the same time, when a website is perceived as unreliable or risky, consumers with a love of risk will tend to make the purchase despite the perceived risk.

2. Methodology

Target Population

The sampling framework will be among a population that has a credit card and an Internet connection.

The research paradigm

The study is a quantitative study with the aim of generalizing to all populations, with pre-defined hypotheses, and based on previous studies. The study is based on the distribution of questionnaires and uses statistical analysis software, the SPSS, to analyze the results. In conclusion, it can be said that this is detailed and structured research based on a quantitative approach.

Sample

The target population is residents of the State of Israel over 18 who have access to the Internet and have credit cards. Since a market survey is being conducted, predicting the level of credibility of the website perceived by customers to generalize from the sample to the entire population in the field of social sciences, we will require a level of significance of 5% with a sampling error of 10%. The target population is enormous. Therefore, the sample size determined is 100.

Selection of subjects

Questionnaires were distributed to high-tech companies and academic institutions.

Study Method

As part of quantitative research, the research method is a survey by a closed questionnaire, using an online system for conducting surveys and conducting research (QuestChain). So we have a platform for creating surveys (e-survey) in personal or group viral distribution, enabling the export of data to Excel.

Data Collection Tools

Over two months, about 250 questionnaires were distributed, of which about 180 were answered, including 104 questionnaires fully.

The questionnaire was distributed to several high-tech companies. And among students from Technological Faculties in Israel.

The subjects received an e-mail with a short explanation and a link to the QuestChain website to complete the questionnaire.

The research population is directly and indirectly exposed to technology. Therefore, it would be worth mentioning that the results of this study highlight more on this population than all buyers.

Data analysis

We used the statistical data analysis software, the SPSS, to analyze the data.

We tested for significant correlations among relevant variables. Using the student t-test for non-dependent samples, we examined the differences between risk-loving and risk-averse subjects.

Reliability and validity

Alpha Cronbach was calculated for the position test questions and found to be worth 0.833. However, Cronbach Alpha was not calculated for the Zuckerman questionnaire because a validated available questionnaire was used for this study. Nor was Cronbach alpha calculated for the socioeconomic questions.

3. Findings

Responders who make purchases online do so due to the attractiveness of prices (90.4%), in light of the ability to compare prices (92.5%), since purchases can be made 24 hours a day (90.4%) due to the speed of the process (93.5%), since other surfers can get reviews (90.3%), due to comfort (94.6%) and in order to get out of the routine (9.4%).

In order to reduce the perceived risk from the online purchase 51.9% of the consultants consult with friends before making the purchase, 15.4% send a letter to the supplier requesting a commitment to reliability, 63.5% seek general information about the site, 62.5% read reviews and opinions of other surfers.

Online secure purchasing

There was a significant positive relationship among responders who believe an online purchase is secure. This is as opposed to making purchases online due to the attractiveness of prices, the ability to compare prices, the possibility to make a purchase 24 hours a day, and preference for purchase. In addition, on the Internet, the possibility of obtaining opinions from other surfers is higher due to the speed of making the purchase.

Online purchase and price attractiveness

Responders who purchase online due to price attractiveness were found to have a strong positive relationship with online shopping due to the ability to compare prices ($p = 0$, $r = 0.788$), make purchases 24 hours a day ($p = 0$, $r = 0.573$). In light of the agility of the process ($p = 0$, $r = 0.513$), the convenience of purchase ($p = 0$, $r = 0.661$), and due to the ability to get reviews from other surfers ($p = 0$, $r = 0.495$).

Buyers who purchase online due to the attractiveness of the prices were found to have a positive connection to making a purchase even if the site is not recognized at all ($p = 0.001$, $r = 0.345$). Moreover, even if the site is not secure, it has negative reviews from other surfers, with no obligation to maintain personal information, and even if there is a certain probability that he will not receive the product ($p <0.039$, $r> 0.219$).

These subjects do not consider the risk of monetary loss to be a real risk ($p = 0.01$, $R = -0.267$).

Online purchase and price comparison

Subjects who purchase online due to the ability to compare prices were found to have a strong positive relationship with online shopping in light of the possibility of making purchases 24 hours a day ($p = 0$, $r = 0.752$), due to process agility ($p = 0$, $R = 0.561$), convenience of purchase ($p = 0$, $r = 0.683$) , and due to the ability to obtain reviews from other surfers ($p = 0$, $R = 0.683$).

The purchase will be made even if the site is not recognized at all (p = 0.004, R = 0.306), and even if there is a certain probability that he will not receive the product (p = 0.049, r = 0.209).

These responders were found to have a significant positive association with TAS risk-taking (p = 0.05, r = 0.202)., and the convenience of the purchase (p = 0, r> 0.45).

Moreover, a test taker who believes that an online purchase is safe will purchase a product online even if there are negative reviews from other surfers on the site (p = 0.009, r = 0.272) and will make the purchase even in case there is no commitment to maintain the responder's personal details (p = 0.002, r = 0.319), and even if there is a certain probability that he will not receive the product (p = 0, r = 0.435).

At the same time, the believer was tested that buying online is safe and is found to prefer buying online and not in a retail store, given that the purchase price is the same (p = 0, r = 0.372). He will also purchase online even if the site is not known to him (p = 0, r = 0.459).

Moreover, a significant negative relationship was found with the risk of loss of time (p = 0.011, r = -0.264), loss of money (p = 0, r = -0.509) , and disclosure of personal details (p = 0.002, r = -0.323) . That is, a subject who believes that an online purchase is safe does not find the three risks in which, the risk of losing time, money, and exposure of personal information, as risks that could frustrate the purchase online.

The relevance of online shopping has increased since the COVID=19 pandemic; it would be interesting to extend this research to compare the conduct of e-commerce buyers after the pandemic period. Do people trust more or maybe less the e-shops?

4. Conclusions

A description of the findings found consistency among the subjects in the area of trust in the Internet. Making online purchases is perceived as reliable by the subjects. Moreover, an examination of correlations found that subjects who believe that online purchasing is safe will purchase on an unfamiliar site that is not secure, that does not commit to maintaining personal information, and despite negative reviews from other surfers. Even when the subjects were asked whether they would purchase if there were a certain probability that they would not receive the product, most answered in the affirmative.

In contrast, in the student t-test for independent samples, a significant difference was found between risk lovers and risk-averse individuals against their will to make online purchases. Risk lovers make purchases online, unlike those who dislike risk and do not make online purchases. In addition, a significant difference was found between risk-loving and risk-averse subjects in the perception of the Internet as reliable for online purchases.

Subjects with low-risk love scores do not believe online purchases are reliable. Furthermore, a significant difference was found between risk lovers and those who dislike the risk of purchasing on an unfamiliar site and purchasing on a site where there is a probability of not receiving the purchased product. Subjects with a low score in the love of risk will not buy on an unfamiliar site if there is a certain probability of not receiving the purchased product.

The contribution and the added value of this study ן‌s in exposing that risk-loving subjects believe that online purchases are safe and will make the purchase even in cases where we would not expect them to purchase. This purchase is despite parameters that express unreliability (unfamiliar site, unsecured site, lack of commitment to maintain personal information, good negative reviews for not receiving the purchased product). In contrast, risk-averse respondents do not believe that online purchases are reliable and will behave as expected in cases where unreliability parameters are encountered and will not make an online purchase.

This size of the sample, while it is sufficient, should be increased in future research to get more reliable and significant results. We suggest exploring the opportunities in e-commerce and the attitude of buyers to opportunities rather than only for risk.

References

Adam, A. M. A. Aderet, A. Sadeh (2008) Do Ethics Matter to E-Consumers?J. of Internet Commerce, 6(2), pp 19-34

Chunningham, Lawrence, F., Gerlach, James, H., Harper, Michael D., Young, Clifford, E. (2005). Assessing Perceived Risk of Consumers in Internet airline Reservations Services [Electronic version]. *International Journal of Services Industry Management*, Vol. 16, No. 4, pp 357-372.

Flanagin, A.J., Metzger, M.J., Pure, A. Markov & E. Hartsell (2014). Mitigating risk in ecommerce transactions: perceptions of information credibility and the role of user-generated ratings in product quality and purchase intention. Electronic Commerce Research 14, 1–23

Giesler, M. (2004). Consumer Risk: Cultural Risk, Collective Risk and the Social Construction of Risk Reduction.

Jarvenpaa, L. S., Tractinsky, N. (1999). Consumer Trust in an Internet Store: A Cross-Cultural validation [Electronic version]. *Journal of Computer-Mediated Communication,* Vol. 5, No. 2.

Laroche, Michael. McDougall, Gordon H.G. Bergeron, Jasmin. Yang, Zhiyong. (2004). Exploring How Intangibility Affects Perceived Risk.

Lopez- Bonilla, J., Lopez- Bonilla, L. (2008) . Sensation seeking and e-shoppers [Electronic version]. *Electronic Commerce Research,* Vol 8. No.3 pp.143-154.

Petrovic, O., Ksela, M., Fallenbock, M., Kittl C. (2003). *Trust in the Network Economy Vol. 2* [Electronic Version]. Wien: Springer-Verlag Wien New York.

Sadeh, A. A.M. Adam, A. Aderet (2006)_Methodological Considerations in Researching Ethics in E-Commerce E-COMM-LINE 2006, 7th Leonardo da Vinci European Conf. Bucharest, Romania, pp 18-19

Sadeh. A, and D. Dvir (2020) The Effect of Technological Risk, Market Uncertainty and the Level of Complexity on New Technology Ventures' Success. Int'l. J. of Innovation Management, 24(5), Zuckerman, Marvein. (1994). *Behavioral Expressions and biosocial Bases of Sensation Seeking* [Electronic Version]. Cambridge: Cambridge University Press

Identifying new Product Opportunities From Waste: Eliminating Waste in Tomato Production

Diana Salgado, Nicholas Ford and Christopher Simms
University of Portsmouth, UK
Diana.salgado@port.ac.uk
Nicholas.ford@port.ac.uk
Chris.simms@port.ac.uk

Abstract: The challenge of new product development (NPD) has seen a growth in literature on both idea generation and sustainability, but these two areas have not yet fully been integrated. The development of products from agricultural waste has particularly been overlooked, although the need to utilise sustainable materials and reuse waste is increasingly acknowledged. Our paper answers the question: *How can different sources of agricultural food waste be utilized to create new product opportunities?* We present a new framework for the identification and evaluation of NPD opportunities. This framework offers a new perspective to conceptualise different types of waste and identify their relative sensory, nutritional and functional properties. We present a case study of a UK tomato grower, using data gathered from interviews, attendance of meetings, observations and secondary data. Tomato production creates significant volumes of waste from unripe, imperfect, damaged and overripe fruits. Furthermore, processing tomatoes (for ketchup, passatas, juices, etc.) generates other kinds of waste such as seeds, skins and water. We show how firms can uncover new product opportunities through an analysis of each of these properties. For example, in tomato juice production around 5% of the raw material goes to waste since skins and seeds cannot be used. However, skins and seeds are nutritionally, sensorially and functionally useful and versatile. *Nutrition:* skins and seeds are rich in essential amino acids, minerals, fatty acids and lycopene, an antioxidant with several reported health benefits. *Sensory:* skin contains crystalline cellulose which can improve mouthfeel of food in low fat products, while seeds can increase hardness in flat breads. *Functional*: skins are partially permeable to liquids and gases, giving them potential for packaging and biodegradable tableware, while seed powder can be effective in removing organic dye molecules from coloured textile effluents. On the basis of our analysis we conclude that by examining the nutritional, sensory and functional characteristics of tomato waste, this can lead NPD managers to explore new alternatives in industries different from the original source of waste.

Keywords: tomato waste, NPD framework, identification of new products, product opportunity, nutritional, sensorial and functional properties of waste

1. Introduction

In 2006, the European Union's food industry was the cause of 22% of global warming (Castellani, Fusi and Sala, 2017). By 2015, the food industry had reached 34% of total man-made greenhouse gas (GHG) emissions globally with the highest contributions coming from agriculture and land-use change (Crippa *et al.*, 2021). It has been reported that food waste alone represents around 9% of the total GHG emissions in the food system (Crippa *et al.*, 2021). Some authors state that most of this food waste is still edible (Pearson, Minehan and Wakefield-Rann, 2013; Thyberg and Tonjes, 2016).

Good management of waste is essential to sustainable development (UNHSP, 2010; UNEP, 2012), and sustainable resource management calls for waste to be recycled (Bleischwitz and Bringezu, 2008; Papargyropolulou *et al.*, 2014). Food waste has a substantial economic, environmental and social impact (Evans, 2011; Papargyropolulou *et al.*, 2014), and reducing it is a priority challenge in global waste management (Defra, 2011; EPA, 2012; Papargyropolulou *et al.*, 2014). Critically this waste can also impact on agricultural producers, small holders, farmers and processors. This paper will focus on agricultural producers with small processing capacity. In this context, food waste produced between agricultural production and before reaching retail is normally referred to as food loss (HLPE, 2014). Food loss comprises a significant environmental issue due to the resource intensive nature of agricultural production and its significant carbon dioxide (CO_2) footprint. Furthermore, whilst lost food can be composted, this can result in significant methane (CH_4) and CO_2 emissions (Adhikari, Barrington and Martinez, 2006; Defra, 2011). The United Nations identified that 14% of the food produced is lost between harvest and retail (United Nations, 2021). Decreasing food loss offers the potential for significant reductions in emissions and therefore in environmental impact (Barrett and Scott, 2012).

Furthermore, better food waste management could also help to address the wider societal problems of insufficient food and material supplies for the population of the world, as well as the need to ensure the affordability of food for those in relative poverty. In the case of insufficient food, the United Nations World Food

Programme states that 957 million people do not have enough to eat (Laganda, 2021). The coexistence of food waste and hunger is a matter of concern to the food industry and policy makers alike. In the case of material supplies, as an example, 20% of the world's population lack adequate housing (Kuo, 2019). However, companies like The Urban Bio-loop have demonstrated that food waste can become a construction material. Thus, food waste management holds several opportunities to create both new food and products for other industries. This can reduce the environmental impact of growing food, reduce food shortages and potentially generate useful materials for other industries. Hence, the valorisation of waste forms an important subject for both academics and practitioners.

Recognition of the environmental problems faced by society has led to increasing scholarly attention to the circular economy (CE). However, to date the emphasis has been on technical cycles rather than biological cycles (as explained in the next section) (Sehnem *et al.*, 2019). In the biological cycle, nutrients refer to renewable materials, which can typically be regenerated through composting and anaerobic digestion (Ellen McArthur Foundation, 2013). The lack of research into the biological cycle may also reflect the small number of companies adopting CE practices and the difficulty in gaining access to them for data collection (Sehnem *et al.*, 2019).

Moreover, whilst a lot has been written on idea generation within the new product development (NPD) literature (e.g. Bossle et al., 2016), little has been written about idea generation in a sustainable NPD context. Indeed, the eco-innovation literature has tended to focus on broad managerial considerations within innovation management, and has thus overlooked the specific issues of valorising waste. The purpose of this study is to examine how lost food can be used to create new products. We address the following research question: *How can different sources of agricultural food waste be utilized to create new product opportunities?*

Our study presents a new approach to the identification and assessment of the new product opportunities presented by food loss. We illustrate this using a case study of a UK tomato producer. We analyse the different sources of product loss within production operations, and develop a novel method that provides a systematic approach to the identification of different opportunities to turn different sources of waste into product opportunities. Our case study analysis reveals the volumes of different types of tomato waste produced and their different sensory, nutritional and functional properties. We demonstrate how an analysis of each of these properties can help firms to uncover NPD opportunities. Thus, this paper contributes to the understanding of how to categorise food waste materials to identify their useful primary components which can be used in more complex products, typically with higher added value. In the long term, this contributes to environmental, economic and particularly societal development focused on the principle of circular economy.

2. Literature review

2.1 Tomato waste

Several researchers have investigated different uses of tomato waste in and outside of the food industry. Nutritionally, Riggi et.al. (2008) extracted carotenoids from tomato waste (Riggi and Avola, 2008); other researchers have found high levels of protein, fat and particularly fibre which processed food tends to lack (Nour *et al.*, 2018) and others have tried to incorporate tomato waste into different food products like bread, hamburgers or sausages with various different effects (Lu *et al.*, 2019). Outside the food industry, Ozbay et. al. (2016) compared the surface and structural properties of activated carbon produced from tomato paste waste, finding it to be a useful precursor to produce low-cost activated carbon (Ozbay and Yargic, 2016). Khiari et.al. (2019) explained how to recover energy from tomato waste via combustion (Khiari, Moussaoui and Jeguirim, 2019). Researchers agree that alternative uses of tomato waste can contribute to reducing environmental impacts. This is one of the main pillars of the circular economy principle.

2.2 Circular Economy

The concept of circular economy (CE) has been attributed to Pearce and Turner since 1989 (Geissdoerfer *et al.*, 2017). CE is the counterpart of a linear economy (LE). This means that while CE tries to maximise the use of resources and recirculate them and their waste in loop-like ways, LE extracts resources from nature, processes or uses them and then disposes of the residue. Both kinds of economies have their advantages and disadvantages. Among the advantages of CE are resource-use efficiency and innovation and the minimisation of space for waste disposal, this last being the main disadvantage in a LE. The disadvantages of CE are that some kinds of waste pollute the air during the reprocessing stages (e.g. for glass and plastic) which may require

another kind of technology to decrease or reprocess pollutants. The relative merits of CE and LE will depend on the material in question. MFor example, plastics require less energy to melt and transform into different products than glass. Therefore, for the reprocessing stages, plastic will be more desired than glass in a CE. However, with the recent problems of microplastics pollution, and given how far we are from a perfect CE, plastics are no longer considered a good option to use. In contrast, a LE will not have problems associated with fume waste from reprocessing materials.

CE has two basic cycles, the technical cycle and the biological cycle. The previous example of plastic and glass represents the technical cycle. However, in this paper we will focus on the biological cycle (BC) only. BC consists in returning the nutrients to the Earth via composting or anaerobic digestion so the land can regenerate and continue the cycle of growing more nutrients (Ellen McArthur Foundation, 2019). One part of CE corresponds to eco-innovation.

2.3 Eco-Innovation

There is a growing interest in the concept of eco-innovation (Bossle *et al.*, 2016). Eco-innovation is described as a novel method (production, service, business method, etc) to reduce the environmental risk, pollution or negative effects of using resources (Díaz-García, González-Moreno and Sáez-Martínez, 2015). This method requires more than individual technologies and artefacts and includes a system innovation referred to as "technological transition" (Ekins, 2010). Eco-innovation is encouraged by stakeholders interested in obtaining a competitive advantage like reducing costs or gaining a better reputation (Díaz-García, González-Moreno and Sáez-Martínez, 2015). In order to obtain those benefits, stakeholders need to rely on idea generation among other strategies.

2.4 Idea generation in a sustainable new product design/development context

The central pillar of product design is idea generation. A method for sustainable product design was showcased by Clark et.al. (2009) in the developing economies of Fiji, Costa Rica and Cambodia (Clark *et al.*, 2009). Chiu et.al. (2012) showed how software and other methods can help achieve sustainable product design (Chiu and Chu, 2012). Other authors have considered biomimicry as a foundation for environmentally sustainable product innovation (Kennedy and Marting, 2016) while others applied the eco-compass method in sustainable product development (Brzustewicz, 2016). However, not much has been written about idea generation in sustainable NPD in the agricultural sector. This paper attempts to explain how there are vast product opportunities in this sector and how, by using our framework, these opportunities can be discovered.

3. Methodology

This study forms part of a broader Knowledge Transfer Partnership (KTP) which has been running for more than two years investigating food waste and the development of innovative new food products that integrate and upgrade food produce that currently goes to waste. Collaborative research of this nature is considered an effective means of understanding managerial practices and issues (Adler, Shani and Styhre, 2003; Shani *et al.*, 2007).

Our data analysis followed the principles of naturalistic enquiry (Lincoln and Guba, 1985) and the process of constant comparison (Glaser, B. G., & Strauss, 1967). Interviews were recorded and transcribed and patterns in the data were identified using analytic induction. Specifically, the analysis process followed the four steps outlined by Green et al.(2007): data immersion; coding; identifying categories; and creating themes. Discussions during observations were analysed using a similar process, supported by reference to notes. To minimise subjectivity, multiple data sources were used in accordance with principles of 'triangulation' (Eisenhardt, 1989; Yin, 1994; Flick, 1998). Interviews were conducted with key managers within the company (Table 1) and data was gathered from internal presentations, documentation, and email communications.

Table 1: List of participants of survey for the analysis of food loss in the tomato grower company.

PARTICIPANT CODE	JOB TITLE
001	Managing Director
002	New Business Development Manager
003	KTP Associate
004	Logistics Manager
005	Compliance and Technical Manager

PARTICIPANT CODE	JOB TITLE
006	General Manager
007	Digital Marketing Assistant
008	Purchasing & Fruit Planner
009	Sales Account Manager
010	Development Kitchen Production Manager

The study employed an exploratory longitudinal case-study-based methodology, a strategy that is optimal when 'how' or 'why' questions are being addressed (Eisenhardt, 1989; Yin, 2003). A case study methodology was suitable as it involves intensive analysis to identify issues and generate insights (Bryman and Bell, 2003). In particular, focusing on a single case has been found to reveal interesting phenomena and provide significant findings (Siggelkow, 2007). The access to rich data afforded by the KTP made this a viable and valuable strategy. Furthermore, it is not uncommon in research studies to select a single case for practical reasons (Daymon and Holloway, 2002), particularly if a case has 'intrinsic value' (Stake, 1995) and offers a depth of information which may not be available if multiple cases were explored (Noke, Perrons and Hughes, 2008).

4. Results

In this section we present the sources, kinds and disposal methods of waste from growing tomatoes in the nursery through to transporting them to sell. We show the enablers and barriers for reducing or transforming waste and an example using our novel framework to find product opportunities.

4.1 Waste at the tomato grower

The tomato producer produces approximately 8 000 tons of tomatoes a year of which more than 700 tones go to waste. This means that around 9% of the total production goes to waste, mainly from the nursery and packhouse. Furthermore, processing tomatoes into juices and sauces adds an extra kind of waste in the form of peels/cuticle, seeds and small pieces that cannot be used for these kinds of products. Another unusual kind of waste is the water obtained via dehydration. At least 79% of the total weight of the tomato is water lost through dehydration. This water could be captured and used for human consumption or for other processes through the food production chain. One small source of waste comes from tomatoes that have been returned from market stalls every week because of insufficient demand. Most of these returned tomatoes and other products are reused in the kitchen so about 15% (20 to 30 kg) of the returned product (~200 kg/week) goes to waste. The key sources of waste are summarized in Table 2.

Table 2: Sources of food loss

Chain of production waste (nursery)	Operational waste (packhouse)	Processing waste (kitchen)	Logistics (transport and returned product)
Excess pollinated flowers: Non-ripened fruit (green)	Excess fruit from packaging operations	Seeds and Peels/cuticle from juices and sauces	Unsold product in markets
Ripe damaged/split fruit (e.g. manhandling)	Excess production of ripe fruit	Leftover from sauces	Damaged/rotten product during transport
Ripe fruit with rot	. Unsold due to ild splitting or softening	Water from dehydration	External courier manhandling product
Misshapen fruit	Unsold due to overripeness	Chopped pieces from semi-damaged tomatoes	Excess fruit as a result of imbalances in supply and demand
Blossom end rot, catfacing, cracking, fungi.	Oversize/undersize fruit (out of market specifications)	Rotten tomatoes (delays in processing or tomatoes arrived damaged)	
Bad handling practices	Bad handling practices		

About 6.0% of the total production is lost from the nursery, 3.0% is lost in the pack house, 5.5% is lost at the process level (in the kitchen) and 0.02% is lost in the logistics sector. This food loss ends up in the compost site of the tomato grower. The compost site processes annually more than 700 tonnes of tomato waste from the sources cited above. Moreover, each part of the tomato fruit has several routes of use and disposal (sTable 3).

Table 3. Current use/discard methods of each part of the tomato plant.

Item	Current use/discard methods
Whole ripe fruit	Raw Drying/smoking Preserving
Flesh	Pureeing Juicing Saucing
Green fruit, seeds, skins and defects	Composting
Water	Drainage
Stems and stalks	Composting

All that arrives at the compost site is mixed and therefore, it is difficult to differentiate what is edible from what is inedible. All that ends up at the compost site is eventually used to grow organic tomatoes.

The company required new solutions to remove excess stock under each of the above circumstances. For the company, this also held the potential for a significant environmental benefit. "*All the money and energy gone into creating the product, but it's a short shelf life product. So, we have to find a solution to it*", Participant 001.

4.2 Waste reduction barriers and enablers

4.2.1 Enablers

- Install new software to measure daily waste in the kitchen. Knowing the precise quantities and sources of waste can help recognise points of control.
- Develop new products. New products with tomatoes as main ingredient are in constant development in an attempt to reduce waste as much as possible. Some of these products have been launched within weeks of inventing them in order to minimise tomato loss through spoiling.
- Manufacture products for other companies.
- Donate tomatoes to charities and food banks.
- Process some tomatoes with unmarketable defects.

4.2.2 Barriers

- Rot occurs fast: tomatoes are highly perishable and lose quality. "Tomatoes have ten days of good quality and after that they stop being not that fresh. This is assuming they were treated appropriately", Participant 001. Also, "As they start to go off they start to redden, the flavour becomes affected and they shrink. They are fine for cooking. However, they have less water, less flavour and are less sweet. Overripe are better for cooking applications in general but the lycopene content decreases as the tomato darkens", Participant 003.
- Rot occurs particularly fast in varieties that are more susceptible. Varieties like the San Arrentino, Beef tomato and speciality tomatoes like green and white are the ones that represent more waste due to fast degradation. Also, large varieties tend to be more susceptible to fungal degradation than small varieties. "Once tomatoes get older they grow fungus very quickly and the flavour deteriorates, so we need to get them in the stage prior to this when they start to shrink. Also have to be aware of damage as they will grow fungus soon after any damage occurs. Window of opportunity", Participant 003. Constant check-ups of the product are needed since fungus can develop in tomatoes in the bottom of the boxes where rotting is more difficult to notice.
- Tomatoes become unmarketable: nursery. If not picked up on time, large varieties of tomato can grow beyond the acceptable size for the market while small varieties tend to split in the vine. Splitting happens due to variations of water content in the plant but it has been observed in piccolo tomatoes after being harvested. Unmarketable defects like blossom-end-rot, catfacing, cracking and others can also occur. For example, Beef tomatoes tend to present more blossom-end-rot than other varieties.
- Too many tomatoes per vine: excess pollinated flowers. For example, customers require six tomatoes per vine so if eight flowers were pollinated, two green tomatoes go to compost. "Green tomatoes cannot be left to ripen as they are [of] inferior [quality]", Participant 001.

5. Developing product opportunities

The new framework developed for characterising tomato loss has three stages: Nutritional, Sensorial and Functional. In this section we present one example of how the new framework can be applied to waste arising from the initial stage of growing tomatoes: green fruit arising from excess pollinated flowers.

5.1 Green fruit

5.1.1 Merits

Green tomatoes have several advantages. First, they are mainly composed by fibrous carbohydrates and water. The fibrous carbohydrate makes green tomatoes very sturdy, so transportation and storage are rarely a problem. Microbial degradation is slow. Second, they are edible after cooking. The main components of green/unripe tomatoes are water, fibre and chlorophyll. The latter is a widely used food supplement due to its antioxidant properties.

5.1.2 Challenges

One challenge of raw green/unripe tomatoes is the flavour. The peels and seeds have a very strong astringent and bitter flavour which leaves a strong aftertaste. This improves by cooking the tomatoes.

Another disadvantage is that people normally do not consume green/unripe tomatoes and soproducts derived from them could elicit disgust.

Table 4: Characteristics of the different parts of green tomatoes and potential product opportunities within three aspects. The final column gives examples of NPD opportunities arising from one or more of the parts listed

Aspect	Seeds	Flesh	Skin	Whole fruit	Potential product opportunities
Functional	Hard	Thick, bulky structure	Dense, impermeable, relatively strong	High cellulose content	Cellulose useful for insulation in buildings.
Sensory	Astringent and bitter	Astringent, acid, fresh aroma	Astringent, bitter, smooth	Astringent, juicy, acid, hard, fresh aroma	Use in home fresheners and other fragrances.
Nutritional	Lipids and proteins (Lu *et al.*, 2019)	Complex carbohydrates (Vogg *et al.*, 2004; Trebolazabala *et al.*, 2013).	Complex carbohydrates, waxes and potassium (Vogg *et al.*, 2004; Trebolazabala *et al.*, 2013; Lu *et al.*, 2019).	Complex carbohydrates, chlorophyll, less vitamin C than in red tomatoes (Dūma *et al.*, 2018).	Green tomato skin waxes to be used in citrus fruits to extend shelf-life. Vegan protein from tomato seeds. Extract insoluble fibres for supplements or as ingredient for low calorie foods.

Some of the challenges to utilising each source of waste involve the technological, economic and biological aspects of the company. Being relatively small, the company lacks technology and research infrastructure to explore the different uses of tomato waste in a circular economy context. This is mainly due to the costs of investment faced by the company. Also, the speed of decomposition of tomato waste requires it to be used immediately or stored at low temperatures. These challenges can be overcome by creating a strategy to collaborate with institutions with appropriate infrastructure and to develop the quality control practices of the company. This strategy needs to quantify the short and long term benefits of recirculating the tomato waste and to specify how to direct the different kinds of waste accurately.

6. Conclusion

Company stakeholders have recognised that the novel framework outlined here offers significant opportunities that have not been previously recognised. More widely, this framework can help producers to reduce food waste and food loss by characterising the different components of the waste and thus finding new product opportunities both within and beyond the food industry.

As stated by other authors, CE practises entail different challenges like unaffordable costs of developing technologies and purchasing equipment. These challenges can be overcome by associating the industry with universities and other institutions having the facilities and knowledge to help build up CE.

References

Adhikari, B., Barrington, S. and Martinez, J. (2006) 'Predicted growth of world urban food waste and methane production', *Waste Manag Res*, 24(5), pp. 421–33. doi:10.1177/0734242X06067767. PMID: 17121114.

Adler, N., Shani, A.B. and Styhre, A. (2003) *Collaborative research in organizations: Foundations for learning, change and theoretical development*. London: Sage.

Barrett, J. and Scott, K. (2012) 'Link between climate change mitigation and resource efficiency: A UK case study', *Global Environmental Change*, 22(1), pp. 299–307. doi:https://doi.org/10.1016/j.gloenvcha.2011.11.003.

Bleischwitz, R. and Bringezu, S. (2008) 'Global Governance for Sustainable Resource Management', *Minerals & Energy-Raw Materials Report*, 23:2, pp. 84–101. doi:10.1080/14041040802247278.

Bossle, M. *et al.* (2016) 'The drivers for adoption of eco-innovation', *Journal of Cleaner Production*, 113, pp. 861–872.

Bryman, D. and Bell, E. (2003) *Business Research Methods*. New York: Oxford University Press.

Brzustewicz, P. (2016) 'The Application of Eco-Compass Method in Sustainable Product Development.', *Scientiarum Polonorum Acta*, 15(1), pp. 5–14.

Castellani, V., Fusi, A. and Sala, S. (2017) *Consumer Footprint. Basket of Products indicator on Food*. doi:10.2760/555836.

Chiu, M.C. and Chu, C.H. (2012) 'Review of sustainable product design from life cycle perspectives', *International Journal of Precision Engineering and Manufacturing*, 13(7), pp. 1259–1272. doi:10.1007/s12541-012-0169-1.

Clark, G. *et al.* (2009) 'Design for sustainability: Current trends in sustainable product design and development', *Sustainability*, 1(3), pp. 409–424. doi:10.3390/su1030409.

Crippa, M. *et al.* (2021) 'Food systems are responsible for a third of global anthropogenic GHG emissions', *Nature Food*, 2(3), pp. 198–209. doi:10.1038/s43016-021-00225-9.

Daymon, C. and Holloway, I. (2002) *Qualitative research methods in Public Relations and Marketing Communications*. London: Routledge.

Defra (2011) *2011 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors*. London.

Díaz-García, C., González-Moreno, Á. and Sáez-Martínez, F.J. (2015) 'Eco-innovation: Insights from a literature review', *Innovation: Management, Policy and Practice*, 17(1), pp. 6–23. doi:10.1080/14479338.2015.1011060.

Dūma, M. *et al.* (2018) 'Bioactive compounds in tomatoes at different stages of maturity', *Proceedings of the Latvian Academy of Sciences, Section B: Natural, Exact, and Applied Sciences*, 72(2), pp. 85–90. doi:10.2478/prolas-2018-0014.

Eisenhardt, K. (1989) 'Building theories from case study research', *Academy of Management Review*, 14(4), pp. 532–550.

Ekins, P. (2010) 'Eco-innovation for environmental sustainability: Concepts, progress and policies', *International Economics and Economic Policy*, 7(2), pp. 267–290. doi:10.1007/s10368-010-0162-z.

Ellen McArthur Foundation (2013) *Towards the Circular Economy vol 1: an economic and business rationale for an accelerated transition*.

Ellen McArthur Foundation (2019) *Circular Economy Systems Diagram*, *The butterfly diagram: visualising the circular economy*. Available at: https://ellenmacarthurfoundation.org/circular-economy-diagram (Accessed: 12 April 2022).

EPA (2012) *Guidelines for Water Reuse*. Washington, D.C.

Evans, D. (2011) 'Blaming the consumer – once again: the social and material contexts of everyday food waste practices in some English households', *Critical Public Health*, 21:4, pp. 429–440. doi:10.1080/09581596.2011.608797.

Flick, U. (1998) *An Introduction to Qualitative Research*. London: Sage.

Geissdoerfer, M. *et al.* (2017) 'The Circular Economy – A new sustainability paradigm?', *Journal of Cleaner Production*, 143, pp. 757–768. doi:10.1016/j.jclepro.2016.12.048.

Glaser, B. G., & Strauss, A.L. (1967) *The Discovery of Grounded Theory*, *Chicago: Aline.*

Green, J. *et al.* (2007) 'Generating best evidence from qualitative research: the role of analysis.', *Australian and New Zealand Journal of Public Health*, 31(6), pp. 545–550. doi:10.1111/j.1753-6405.2007.00141.x.

HLPE (2014) 'Food losses and waste in the context of sustainable food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security', Rome. Available at: https://www.fao.org/3/i3901e/i3901e.pdf.

Kennedy, E.B. and Marting, T.A. (2016) 'Biomimicry: Streamlining the front end of innovation for environmentally sustainable products', *Research Technology Management*, 59(4), pp. 40–48. doi:10.1080/08956308.2016.1185342.

Khiari, B., Moussaoui, M. and Jeguirim, M. (2019) 'Tomato-processing by-product combustion: Thermal and kinetic analyses', *Materials*, 12(2), pp. 1–11. doi:10.3390/ma12040553.

Kuo, G. (2019) *Yet another emerging global crisis- Homelessness*, *The Millennium Alliance for Humanity and the Biosphere*.

Laganda, G. (2021) *2021 is going to be a bad year for world hunger*, *Food Systems Summit 2021*. Available at: https://un-food-systems.medium.com/2021-is-going-to-be-a-bad-year-for-world-hunger-6a7c43a294cf.

Lincoln, Y.S. and Guba, E.G. (1985) *Naturalistic Inquiry*. London: Sage.

Lu, Z. *et al.* (2019) 'Sustainable valorisation of tomato pomace: A comprehensive review', *Trends in Food Science and Technology*, 86(February), pp. 172–187. doi:10.1016/j.tifs.2019.02.020.

Noke, H., Perrons, R. and Hughes, M. (2008) 'Strategic alliances as an enabler for discontinuous innovation in slow clockspeed industries: evidence from the oil and gas industry', *R&D Management*, 38(2), pp. 129–139.

Nour, V. *et al.* (2018) 'Nutritional and bioactive compounds in dried tomato processing waste', *CYTA - Journal of Food*, 16(1), pp. 222–229. doi:10.1080/19476337.2017.1383514.

Ozbay, N. and Yargic, A.S. (2016) 'Comparison of Surface and Structural Properties of Carbonaceous Materials Prepared by Chemical Activation of Tomato Paste Waste: The Effects of Activator Type and Impregnation Ratio', *Journal of Applied Chemistry*, pp. 1–10. doi:10.1155/2016/8236238.

Papargyropolulou, E. *et al.* (2014) 'The food waste hierarchy as a framework of the managment of food surplus and food waste', *Journal of Cleaner Production*, 76, pp. 106–115.

Pearson, D., Minehan, M. and Wakefield-Rann, R. (2013) 'Food Waste in Australian Households: Why does it occur?', *Locale: The Australasian-Pacific Journal of Regional Food Studies*, 3, pp. 118–132.

Riggi, E. and Avola, G. (2008) 'Fresh tomato packinghouses waste as high added-value biosource', *Resources, Conservation and Recycling*, 53, pp. 96–106. doi:10.1016/j.resconrec.2008.09.005.

Sehnem, S. *et al.* (2019) 'Improving sustainable supply chains performance through operational excellence: circular economy approach', *Resources, Conservation & Recycling*, 149(May), pp. 236–248. doi:10.1016/j.resconrec.2019.05.021.

Shani, A.B. *et al.* (2007) *Handbook of Collaborative Management Research*. London: Sage.

Siggelkow, N. (2007) 'Persuasion with Case Studies', *Academy of Management Journal*, 50(1), pp. 20–24.

Stake, R. (1995) *The art of case research*. California: Sage.

Thyberg, K. and Tonjes, D. (2016) 'Drivers of Food Wastage and their Implications for Sustainable Policy Development', *Resources, Conservation and Recycling*, 106, pp. 110–123. Available at: https://commons.library.stonybrook.edu/techsoc-articles/11.

Trebolazabala, J. *et al.* (2013) 'Use of portable devices and confocal Raman spectrometers at different wavelength to obtain the spectral information of the main organic components in tomato (Solanum lycopersicum) fruits', *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*, 105, pp. 391–399. doi:10.1016/j.saa.2012.12.047.

UNEP (2012) *Annual Report 2011*. Rio de Janeiro.

UNHSP (2010) *Annual Report 2010*. Nairobi.

United Nations (2021) *Stop Food Loss and waste, for the people, for the panet*, *International Day of Awareness on Food Loss and Waste Reduction 29 September*. Available at: https://www.un.org/en/observances/end-food-waste-day.

Vogg, G. *et al.* (2004) 'Tomato fruit cuticular waxes and their effects on transpiration barrier properties: Functional characterization of a mutant deficient in a very-long-chain fatty acid β-ketoacyl-CoA synthase', *Journal of Experimental Botany*, 55(401), pp. 1401–1410. doi:10.1093/jxb/erh149.

Yin, R. (1994) *Case Study Research; Design and Methods*. California: Sage.

Yin, R. (2003) *Application of Case Study Research 2nd Edition*. California: Sage.

Context-Aware Entrepreneurship Education: Exploring the Educators Perspective

Juha Saukkonen[1] and Alexandros Kakouris[2]
[1]JAMK University of Applied Sciences, Finland
[2]University of Peloponnese, Greece
juha.saukkonen@jamk.fi

Abstract: The question that motivates the present study is whether entrepreneurship educators confront the context where entrepreneurship education is implemented. Recent studies indicate that homogenisation of entrepreneurial methods has occurred over time promoting a monolithic conception of innovation-driven start-ups, often technological, as a prototype for entrepreneurial courses' outcomes. Nonetheless, entrepreneurship does not only accommodate ambitious start-ups for growth but also small firms that significantly contribute to employability and social inclusion. Social problems are also tackled. Innovation needs to be translated to different disciplines and social contexts of populations instead of the mere proliferation of a few innovative firms' cases in classrooms. Concurrently, rapid changes in the business environment (crises) ask for reflections regarding the content of entrepreneurship from both educators and students. Thus, context and adjustment to contexts is a timely concern for the future of entrepreneurship education and its inclusive character. Given the previous considerations, the present study seeks for quantitative evidence from worldwide entrepreneurship educators on whether they adjust, or do not adjust, their teaching to the context. Contexts included in this study pertain to: political, economical, sociological, ecological/environmental and legal. Adjustment to context was also investigated for different entrepreneurial teaching tasks, such as idea generation, innovation, strategy, team formation, fundraising, social responsibility and others. The results indicate that educators take into account the context to an extent but there is a rising consensus that entrepreneurial teaching needs to be more context-aware in the future. The more the educators consider context in their current teaching the more they are willing to modify their teaching to different contexts in the future. The results show that there is room for future research regarding context-aware entrepreneurship whilst some research directions are derived in the last part of the article. This is a first attempt to quantitatively examine evidence for the role of the context in entrepreneurial teaching in order to obtain insights for a more precise confrontation of learning needs and educators' perspectives that could render entrepreneurship education more inclusive and efficient.

Keywords: entrepreneurship education, context, adjustment, teaching attitude, cross-national

1. Introduction

Context and context awareness are largely discussed as essential elements for successful education practice. The context can relate to the "learning space" in which the education, and learning occur. This concept of learning space does not in a modern view only refer to the physical environment (classroom or online, e.g.), but learning spaces also differ as cognitive and social environments (Psyché, Daniel and Bourdeau, 2019). Different stakeholders process bring into education their specific contextual variables. As Fischer et al. (2018) conclude: Contextual school- and teacher-level factors influence the classroom practices. Learning in modern education is a reciprocal process. The learners are not just receivers of information but active contributors to the learning process (Kyrö, 2018). Examples of pedagogical approaches embracing this view are, e.g., co-creation where students adopt active and participatory roles (Dollinger, Lodge and Coates, 2018), and flipped classrooms where information transmission is done before "classroom), and thetime gained is spent in various student-centered learning activities (e.g. Wasserman, Quint, Norris, & Carr, 2015). Cutrer et al. (2018) state that the contextual factors of learners influence their study achievements: "An individual's ability to learn in this manner is driven by several internal characteristics and is also impacted by numerous aspects of their context". Hood, Littlejohn and Milligan (2018) noted that in a highly standardized (between students) MOOC learning space differences in students' achievements depend on their individual context. Also educators bring to the learning space their own attitudes and experiences.

According to Thibaut et al. (2018), multi-disciplinary experience is beneficial for attitudes toward the integration of different subjects. It is natural to assume that entrepreneurship education isn´t an exception to other fields of education. Higher education entrepreneurship classrooms are nowadays typically multicultural due to increased student mobility and e.g.. immigrants' high entrepreneurial intentions but also due to the cross-disciplinary nature of entrepreneurial endeavours. However, as Kickul et al. (2011) claim, the issue of economic context is often not considered, but entrepreneurship is often regarded a global phenomenon.

Given that entrepreneurship education is a fast-growing research field with certain research gaps (e.g. Kakouris and Georgiadis 2016), the considerations above directed this study to shed light via means of a qualitative study among entrepreneurship education (EE) practitioners on how much and which ways the context-awareness is perceived by educators to be present in the current EE.

2. Literature review

2.1 Defining context

Context is a term both wide and potentially ambiguous. Context can refer to the background where the stakeholders in a process under study are coming from. As Giunchiglia, Zeni and Big (2018) state, "each individual interprets her surroundings differently because of her habits, routines, and intelligence; this represents her personal context". Since an individual's attitudes and behaviours develop in interaction with their current environment or are inherited from the society from earlier generations, context is also a social and cultural phenomenon. We identify ourselves as individuals and as parts of social systems we are connected (Turner et al., 1994). This social context can be a positive asset – social capital – that supports one´s growth, self-identity, and well-being (ibid.). Social context can also limit one´s opportunities and achievement of goals, if they contradict the ones generally valued and supported by the community. Hampden-Turner and Trompenaars (1993) showed how individuals in seemingly similar socio-economic systems have fundamentally divergent motivations to innovative and entrepreneurial efforts.

Institutions also have their own contexts made of cultures, norms, and habits. Bowen and De Clercq (2008) argue that in entrepreneurship, "country's institutional environment will influence the allocation of entrepreneurial effort, and in particular will influence the extent to which entrepreneurial effort is directed toward high-growth activities." In entrepreneurial courses and incubators/accelerators operated by higher education institutions (HEIs), the multiple contexts include the national and local cultural and social contexts as well as HEIs as a specific environment. In cross-national studies (e.g., Fleck, Kakouris and Winkel 2019, 2021) strong correlations between EE constructs and national cultural indices were found.

Watson et al. (2018) identified eight external context constructs with impact on the implementation of systems and action: (1) professional influences, (2) political support, (3) social climate, (4) local infrastructure, (5) policy and legal climate, (6) relational climate, (7) target population, and (8) funding and economic climate. In business research the most common taxonomy of the environment analysis is PESTEL, made of political, economic, social, technological, ecological, and legal factors (Kotler, 1998). A relatively new framework REGLO (e.g., Menet, 2016) proposes that analysis on local/regional environment differs in results from the analysis of the global environment. The former scope can be assumed to have more impact on the starting up and resourcing of a new enterprise, whereas the latter scope may be more impactful to opportunities and growth of a new venture.

In this study, the following definitions of guidance were given to respondents: "There are various contexts that are considered to affect our teaching, e.g. political, social, economic, technological, etc.", and, "With the keyword "context" we mean the background from where individuals (learners and educators) come from and also the operating environment where the action (education and entrepreneurship) takes place."

2.2 Principles and practices of context-aware education

Learning environments are becoming made of multiple contexts simultaneously present and evaluated (e.g., Kakouris 2016). Globalized supply chains and enlarged market opportunities (by e-commerce and virtual goods) propagate recognition of varying contexts. Boyd (2008) claimed that the "global village" discussed since the 1960s describes well how digital communication empowers people to connect across wide geographic and cultural differences. The boundaries between contexts start to blur.

According to Akkerman and Bakker (2019) "students' multiple and diverging interests differ in across-context continuity, some being shared across the school, family, and peer contexts". Moreover, the impact of learners´ context is not solely about their identity as learners, but also about parallel pursuit of interests in studies and free time (ibid.).

In both views of increasing and decreasing varieties of contexts, modern educators are assumed to possess understanding for context, i.e., are expected to be context-aware. At the same time, teachers´ attitudes and the context provided by the institution are affecting the learning process (e.g. Thibaut et al., 2019).

Earlier research has identified principles and practices that enable context-aware education. The underlying operating principle is that "a learning system that examines the learning context shall adapt learning process with respect to context change" (Wang, 2004). Educational processes are designed to match the context in which the learning happens, following the ideas of Design Science Research (DSR) more commonly discussed in the field of information systems (Collins, 1992; Yang, 2006). Similarly, modern teachers need to create relevant learning spaces, that (1) when optimized, deploy adequate learning paradigms to meet the current generations of learners and, (2) widen the idea of physical spaces virtual, cognitive, and social spaces (Psyché, Daniel and Bourdeau, 2017). Interestingly, a wide body of research of context-awareness is currently oriented to learning systems as technologies. This despite the generic nature of the context-aware education, which was coined by Hasanov, Laine and Chung (2019): "Adaptive context-aware learning environments (ACALEs) can detect the learner's context and adapt learning materials to match the context. The support for context-awareness and adaptation is essential in these systems so that they can make learning contextually relevant." Thus, educators and educational programs/schools could also be ACALEs principles.

Context-awareness leads to learning processes that are adaptive, learner-centred, and even individualized. These arrangements improve the academic achievement of the learners (Bernard et al., 2019). Fully context-aware education would allow learners to mould their learning trajectories to match their own relevant context and goals – self-mapped learning pathways (Crosslin, 2021). Just like in any activity adjusting to individually customized products (of education) to learner preferences implies opportunity costs for the learners, but also an additional cost burden to the educators (Jost and Süsser, 2020). The solutions to combine the contextual considerations to high efficiency is called mass tailoring or mass customization, where learners with a sufficient level of similarity are bundled together as learners.

2.3 The specific cases of context and context awareness in entrepreneurship (education)

Entrepreneurship is a field and research area that typically is organized in HEIs within the frame of business and engineering schools or in and institutes of entrepreneurship that serve various faculties. Lately, the trends in social entrepreneurship and self-employment have widened the area where entrepreneurship emerges. This also has enriched the contexts from which entrepreneurship educators and learners come as well as the contexts where entrepreneurial learners will apply their entrepreneurial ideas.

The ideas of being aware of the context in entrepreneurship research, education, and practice are not new. Back in 2001 Aldrich and Martinéz noted the growing interest in an entrepreneurial context. The importance of context was defined by Welter (2011): "Context simultaneously provides individuals with entrepreneurial opportunities and sets boundaries for their actions; in other words, individuals may experience it as an asset and a liability." Despite the growing interest, research focused on the topic is scarce and different facets of context have gained differing interests. Some studies focus on the technological context (e.g. Tatpuje et al., 2022) and some on the social context (e.g. Sheth, 2010).

If there are gaps and resulting quest for knowledge in the research on the *context of entrepreneurship*, the need is even more imminent for studies on *impact of context in entrepreneurship education*. Leitch, Hazlett, and Pittaway (2012) and Walter & Dohse (2012) reviewed the role of regional context in entrepreneurship education. Also, HEIs as an institutional context for entrepreneurship education has been studied (Johnson, Graig and Hildebrand, 2006; Johannisson, 2018). Relatively few works have had the entrepreneurship educator as the unit of analysis (Wraae and Walmsley, 2020). The studies by Jones and Matlay (2011) and Wraae and Walmsley (2020) are rare exceptions. The modest role of educators in the studies on context-awareness repeats in the professional practice. As Seikkula-Leino et al. (2010) remarked; "…. when asked to give the aims, the teachers describe the practices. Moreover, they "outsource" themselves but refer to aims from the pupils' perspective."

Typically, entrepreneurship is treated as one entity, phenomenon rather than as a process, where different states/stages of being and doing vary. This processual view poses a additional challenge to contextual EE research as it proposes a new fragmentation of the phenomenon, in addition to the richness of contexts and stakeholders involved in the processes studied.

2.4 Key postulates derived from literature review for the empirical study

Built on findings from earlier research, the following hypotheses were created to be tested via quantitative analysis from the responses of 60 EE practitioners.

H1: The EE practitioners whose own context differs from that of their institutions (i.e., see the multi-contextuality in their own immediate environment and live it personally) are more likely to act in a context-aware manner in their EE

H2: Experience in EE (years of EE practice) will add to one´s context awareness since the longer experience is likely to bring more real-life cases that are of different context to the EE learnings spaces

H3: Different entrepreneurial tasks (such as financing vs. technology or ideation vs. teambuilding) are different also their perceived context-boundedness

H4. Context-awareness is sticky and a permanent personal context of an educator. The more context-aware an educator behaves the more likely he/she is to increase context-awareness also in the future.

3. Methodology

The research approach applied was a quantitative one. The survey was created with the Webropol survey tool, the link to which was then sent by e-mail to the known members of the academia who (a) had published articles and conference papers during the last three years in some selected conferences and open access journals, or, (b) were personally known by the authors to be active practitioners of EE and/or members of EE communities (e.g. the members of different Entrepreneurship Education associations). The invitation e-mail was sent to each respondent's e-mail address (some 300 e-mails sent) in addition to which the respondents in scope were requested to "snowball" the invitation further to their own EE network. With the assumption of the message having been sent further to some 50 potential EE practitioners and 10% of responses coming from those second-tier recipients, an assumption of response rate of magnitude some 15-20 % can be made. Responding the survey was anonymous, but in the end of the survey the respondents were able to leave their contact (e-mail) data in order to get an executive summary of the findings once the data analysis is done.

3.1 The instrument

For the needs of the survey an online questionnaire was constructed consisted of 47 items shown in Table 1. The 4-point ordinal scales are also Likert scales without the central (zero) value. The absence of the central value seeks to identify whether participants value or not the item than identifying if the participants comprehend the item.

Table 1: Questionnaire parts and items (EE = Entrepreneurship Education)

Part	Name	Items	Scale	Reliability
Demographics (11 items)	IL	Educational institute location	6 continents	
	IMPL	EE implementation (place)	6 continents	
	AGE	Age	5 age groups	
	GEND	Gender	4 options	
	OWE	Work experience (overall)	5 groups	
	EEWE	Work experience (EE)	6 groups	
	ENTR	Entrepreneur	Yes/No	
	EEXP	Entrepreneurial experience	(If yes) 6 groups	
	STLOC	Where do students come from	6 continents	
	MIN	Educate minority people	3-point (ordinal)	
	MULT	Classroom multiculturality	4-point (ordinal)	
Contextual background (3 items)	CB1	Difference between person / institute	5-point (Likert)	Cronbach alpha = .715
	CB2	Difference between person / society		
	CB3	Difference between person / students		
Contextual issues taken into account (3 items)	CI1	Generally	5-point (ordinal)	
	CI2	In person's institute	4-point (ordinal)	
	CI3	Personally	4-point (ordinal)	
Contextual elements generally taken into account	CEG1	Political context	4-point (ordinal)	Cronbach alpha = .655
	CEG2	Economical context		
	CEG3	Sociological context		

Part	Name	Items	Scale	Reliability
(6 items)	CEG4 CEG5 CEG6	Technological context Environmental/ecological context Legal context		
Contextual elements taken into account into own EE (6 items)	CEO1 CEO2 CEO3 CEO4 CEO5 CEO6	Political context Economical context Sociological context Technological context Environmental/ecological context Legal context	4-point (ordinal)	Cronbach alpha = .696
Contextual elements' importance for EE (6 items)	CEI1 CEI2 CEI3 CEI4 CEI5 CEI6	Political context Economical context Sociological context Technological context Environmental/ecological context Legal context	4-point (ordinal)	Cronbach alpha = .849
Entrepreneurial tasks' susceptibility to contexts (11 items)	T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11	Idea Generation Innovation Feasibility analysis Strategy formulation Business Model formulation Financial literacy/statements Raising capital Social Entrepreneurship/Responsibility Economic Responsibility Ecological Responsibility Building Entrepreneurial Team	5-point (Likert)	Cronbach alpha = .867
Adaptation to contexts (1 item)	FAD	In future personal teaching	5-point (Likert)	

3.2 The sample

Data collection took place during February and March of 2022 and the final sample embraced N = 60 exploitable responses. 43.3% of the respondents were females (one preferred not to answer and another one did not answer) with age distribution 5% (20-30 years), 21.7% (31-40 years), 40% (41-50 years), 20% (51-60 years) and 13.3% (over 60 years). Educational institutes reside in North America by 20%, Mid- and South America by 1.7%, Europe by 60%, Africa by 1.7% and Oceania by 16.7% with very close percentages for the locations where respondents' EE is implemented and for the regions where students come from. This implies a limitation for the present pilot study suggesting Mid- South America and Africa regions are underrepresented in the sample. Furthermore, the sample exhibits an overall work experience average of 18 - 20 years and an overall average of 12 years as entrepreneurship educators. Around half of the sample has been an entrepreneur with an average entrepreneurial work period of around 10 years. 36.7% responded that they never or rarely educate people from minority groups, 55% answered sometimes and 8.3% answered often or most of the time. The question (MULT) for classroom multiculturality was answered by 28.3% as monocultural, by 46.7% as somewhat multicultural, by 16.7% as quite multicultural and by 8.3% as very multicultural. Thus, the sample for the pilot study offers the possibility to analyse the results despite the lack of representative answers from Mid- South America and Africa territories.

4. Results

Focusing on the research questions articulated in the theoretical framework, the variables of Table 1 CB1, CB2, CB3 for the contextual background difference, EEWE for the work years as entrepreneurship educators, CI3 for the overall contextual adaptation in personal teaching, T1 … T11 for specific entrepreneurial tasks and FAD for future adaptation to contexts are included in the analysis. In Table 2 the descriptive statistics and Spearman correlations are shown.

Table 2: Descriptives and Spearman correlations for questionnaire variables.

		MEAN	STD	CI3	FAD	CB1	CB2	CB3
CI3	Own Adaptation	2.8772	.56915					
FAD	Future Adaptation	3.9833	.79173	.339**				

		MEAN	STD	CI3	FAD	CB1	CB2	CB3
CB1	Diff. Person / Institute	3.1930	1.15633	.292*				
CB2	Diff. Person / Society	3.4138	.91832			.470***		
CB3	Diff Person / Students	3.2414	1.06475			.443***	.439***	
T1	Idea Generation	3.8983	1.22749		.319*	.291*		
T2	Innovation	4.0339	.96430					
T3	Feasibility analysis	3.9310	.91502			.317*	.312*	.315*
T4	Strategy formulation	3.9107	.93957	.364**				.346*
T5	Business Model formulation	3.9483	.98091	.343*				
T6	Financial literacy/statements	3.6034	1.10723	.360**		.317*		.398**
T7	Raising capital	4.1034	.91171	.339*	.328*			
T8	Soc. Entrep. / Responsibility	3.8276	.93917				.429**	.371**
T9	Economic Responsibility	3.7586	.92358	.368**			.365**	.307*
T10	Ecological Responsibility	3.6379	1.10340	.364**	.298*			.289*
T11	Building Entrep. Team	4.0862	.92309					
* p < .05, ** p < .01, *** p < .001								

The Kruskal-Wallis test for the variable CI3 on variable EEWE shows no statistically significant dependence ($\chi^2(5) = 4.8$, $p = .441$) at the $\alpha = 0.05$ level thus H2 is rejected. The rest hypotheses can be checked through the correlation analysis of Table 2. Contextual background difference between person and institute (CB1) positively correlates with adaptation to contexts in own teaching (CI3) ($r_s(52) = .292$, $p = .032$) therefore hypothesis H1 is supported. Also, CI3 positively correlates with future adaptation to contexts (FAD) ($r_s(55) = .339$, $p = .01$) thus hypothesis H4 is supported. Concerning H3 for the different entrepreneurial tasks, their perceived difference to adaptation to contexts can be seen through the variation of their average scores (Table 2) with innovation, raising capital and building the entrepreneurial team at the top of the list. Besides, those who are more context-aware in their own teaching (CI3) score higher for susceptibility to contexts for strategy formulation, business model formulation, financial literacy/statements, raising capital, economic and ecological responsibility. Thus hypothesis H3 is also supported. It is remarkable that those with a contextual difference with the students (CB3) score higher for different tasks such as: feasibility analysis, strategy formulation and social entrepreneurship.

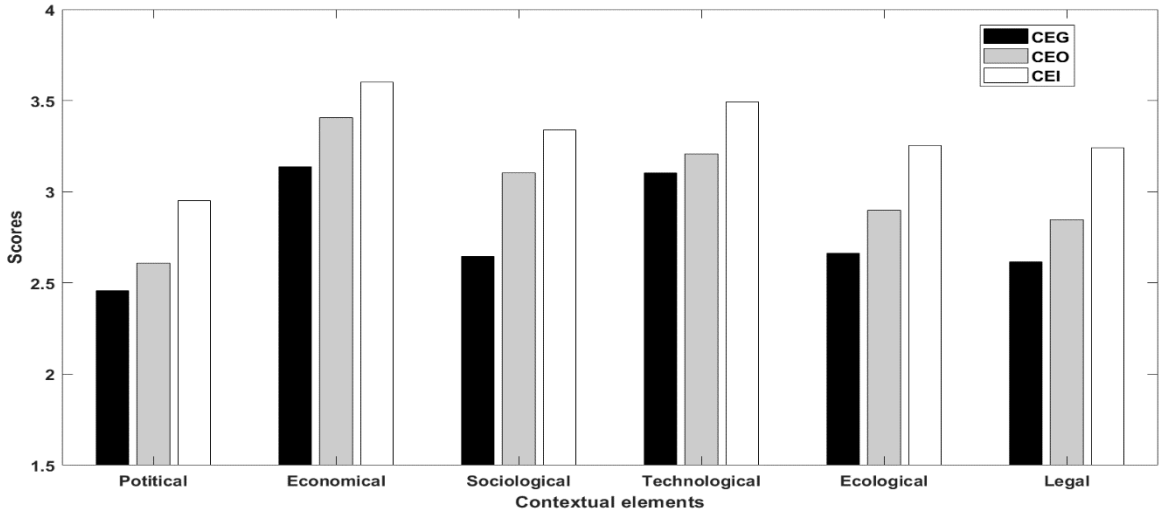


Figure 1: Comparison between six contextual elements. Black bars denote elements generally taken into account (CEG), grey bars denote contextual elements taken into account in own teaching (CEO) and white bars show the perceived importance of each contextual element (CEI)

Furthermore, six contextual elements are compared (Figure 1). These pertain to political, economical, sociological, technological, ecological and legal context. Bars in Figure 1 show how these contextual elements are perceived by the respondents regarding their consideration in general (black bars), their consideration in the respondents' own teaching (grey bars) and the perceived importance of them in teaching (white bars). The result shows that all contextual elements should be taken more into account whilst educators tend to incorporate

them into their teaching more than the average in their environment and less than the levels that are intrinsically (or ideally) required in modern entrepreneurial teaching. From the contextual elements, the economic one prevails followed by the technological which exhibits the lowest discrepancy between common consideration and ideal.

5. Discussion

Summarizing the confirmation vs. refuting of the tested hypothesis, it can firstly be concluded that educators alteration to multiple contexts and tensions between them is likely to lead to an increased context-awareness in the way an educator act in the learning spaces of entrepreneurial education. Secondly, contrary to the expectation expressed in a hypothesis, longevity of practice as an entrepreneurship educator does not predict heightened context-awareness amongst educators. This finding may derive from an educator clinging to his/her methods that have worked earlier in less context-rich environment or from the pure fact that current younger generations (also of entrepreneurship educators) have lived a life distinctively more multi-contextual and are thus able to adapt their actions to new settings more flexibly than earlier generations.

As was hypothesized, entrepreneurship (education) should not be treated as one indivisible entity when assessed its context-dependency. Different processes, knowledge and skill areas of entrepreneurial process are more prone to context-dependency than others.

Lastly, the individuals who self-perceive their approach to entrepreneurial education to be a context-aware one, are likely to take context even more into account in their professional practice in the future. This finding suggests that there is not an optimal mid-term value for context-awareness in the minds of the context-awareness educators. The ones dedicated to it state they still have room to improve in the skill.

6. Conclusions

When interpreting and generalizing the findings, some limitations due to the sampling must be taken in account. The cohorts of African and Mid/South American respondents were small, and the low number of those areas makes limits the statements of context-awareness in those areas. Despite the sufficient total number of respondents, repeated or extended study on the subject should pay extra effort on more representative sampling.

As stated in the literature review, the key construct of the study – context – is wide and prone to many differing interpretations. The wide concept used in this study was not aiming to screen for the most impactful elements of context to the presence or absence of context-awareness. The subjective interpretation on what is included in context could be avoided in further studies by studying the contexts and perceptions on it on a more granular level.

Other potential directions to further research would be to study the views on context by other stakeholders in the entrepreneurial education – learners as well as the designers and managers of educational programs and curricula. This would offer a mirror to the perceptions on the subject offered in this study by education practitioners.

Acknowledgements

The authors express their gratitude to the EE research and practitioner community that found a common interest and presented the first ideas of this direction for research and development at the VentureWell conference in the US in the Spring of 2021. The collaboration between the authors of this paper and scholars Olaf Kuhlke, Emma Fleck, Noé Vargas Hernández, Wendy Westbrook, and Dan Suhr is set to continue.

References

Akkerman, S. F., & Bakker, A. (2019). Persons pursuing multiple objects of interest in multiple contexts. *European Journal of Psychology of Education*, *34*(1), 1-24.

Aldrich, H.E. & Martinez, M.E. (2001). Many are called but few are chosen: An evolutionary perspective for the study of entrepreneurship. Entrepreneurship Theory and Practice, 25(4, Summer), 41–56.

Bernard, R. M., Borokhovski, E., Schmid, R. F., Waddington, D. I., & Pickup, D. I. (2019). Twenty-First Century Adaptive Teaching and Individualized Learning Operationalized as Specific Blends of Student-Centered Instructional Events: A Systematic Review and Meta-Analysis. *Campbell Systematic Reviews*, *15*.

Boyd, D. (2008). None of this is real: Identity and partici- pation in Friendster. In Karaganis (Ed.), *Structures of participation in digital culture* (pp. 132–157). Social Science Research Council.

Bowen, H. P., & De Clercq, D. (2008). Institutional context and the allocation of entrepreneurial effort. *Journal of International Business Studies*, *39*(4), 747-767.

Clark, B. (2001). The entrepreneurial university: New foundations for collegiality, autonomy, and achievement. *Higher education management*, *13*(2).

Collins, A. (1992). Toward a design science of education. In E. Scanlon& T.O'Shea (Eds.) *New Directions in Educational Technology*. Berlin: Springer-Verlag

Giunchiglia, F., Zeni, M., & Big, E. (2018, March). Personal context recognition via reliable human-machine collaboration. In *2018 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops)* (pp. 379-384). IEEE.

Cutrer, W. B., Atkinson, H. G., Friedman, E., Deiorio, N., Gruppen, L. D., Dekhtyar, M., & Pusic, M. (2018). Exploring the characteristics and context that allow master adaptive learners to thrive. *Medical Teacher*, *40*(8), 791-796.

Dollinger, M., Lodge, J., & Coates, H. (2018). Co-creation in higher education: Towards a conceptual model. *Journal of Marketing for Higher Education*, *28*(2), 210-231.

Fischer, C., Fishman, B., Dede, C., Eisenkraft, A., Frumin, K., Foster, B., . . . McCoy, A. (2018). Investigating relationships between school context, teacher professional development, teaching practices, and student achievement in response to a nationwide science reform. *Teaching and Teacher Education*, *72*, 107-121.

Fleck, E., Kakouris, A., Winkel D. (2019). Cultural influences on entrepreneurial motivation and identity: insights for entrepreneurship education, Paper read in *14th European Conference on Innovation and Entrepreneurship, edited by P. Liargovas and A. Kakouris*, Academic Conferences Limited, Reading, UK, pp 1250-1254.

Fleck, E., Kakouris, A., & Winkel, D. (2021). Cultural traits of entrepreneurship education: a cross-national study. *Journal of Entrepreneurship in Emerging Economies*, Vol 13 No 5, pp 838-863. https://doi.org/10.1108/JEEE-02-2020-0030

Hampden-Turner, C., & Trompenaars, A. (1993). *The seven cultures of capitalism: Value systems for creating wealth in the United States, Japan, Germany, France, Britain, Sweden, and the Netherlands*. Broadway Business.

Hasanov, A., Laine, T. H., & Chung, T. S. (2019). A survey of adaptive context-aware learning environments. *Journal of Ambient Intelligence and Smart Environments*, *11*(5), 403-428.

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education*, *91*, 83-91.

Johannisson, B. (2018). Limits to and prospects of entrepreneurship education in the academic context. In *A research agenda for entrepreneurship education*. Edward Elgar Publishing.

Johnson, D., Craig, J. B., & Hildebrand, R. (2006). Entrepreneurship education: towards a discipline-based framework. *Journal of Management development*.

Jones, C. and Matlay, H. (2011), "*Understanding the heterogeneity of entrepreneurship education: going beyond Gartner*", Education + Training, Vol. 53 Nos 8/9, pp. 692-703.

Kakouris, A. (2016). Multidimensional learning environments for entrepreneurship education. Paper read in *11th European Conference on Innovation and Entrepreneurship*, edited by I. Aaltio and M. Tunkkari Eskelinen, Academic Conferences Limited, Reading, UK, pp 344-349.

Kakouris, A., & Georgiadis, P. (2016). Analysing entrepreneurship education: a bibliometric survey pattern. *Journal of global entrepreneurship research*, 6(1), 1-18. https://doi.org/10.1186/s40497-016-0046-y

Kickul, J. R., Griffiths, M. D., Jayaram, J., & Wagner, S. M. (2011). Operations management, entrepreneurship, and value creation: Emerging opportunities in a cross-disciplinary context. *Journal of Operations Management*, *29*(1-2), 78-85.

Kotler P., 1998, Marketing Management: Analysis, Planning, Implementation, and Control, Prentice-Hall, Englewood Cliffs.

Kyrö, P. (2018). The conceptual contribution of education to research on entrepreneurship education. In A research agenda for entrepreneurship education. Edward Elgar Publishing.

Menet, G. (2016). The importance of strategic management in international business: Expansion of the PESTEL method. *International Business and Global Economy*, *35*(2), 261-270.

Psyché, V., Daniel, B., & Bourdeau, J. (2019). Adaptive learning spaces with context-awareness. In *International Conference on Intelligent Tutoring Systems* (pp. 7-13). Springer, Cham.

Seikkula-Leino, J., Ruskovaara, E., Ikavalko, M., Mattila, J., & Rytkola, T. (2010). Promoting entrepreneurship education: the role of the teacher?. *Education+ training*.

Sheth, N. R. (2010). The social context of entrepreneurship. *The Journal of Entrepreneurship*, *19*(2), 99-108.

Thibaut, L., Knipprath, H., Dehaene, W., & Depaepe, F. (2019). Teachers' attitudes toward teaching integrated STEM: the impact of personal background characteristics and school context. *International Journal of Science and Mathematics Education*, *17*(5), 987-1007.

Turner, J. C., Oakes, P. J., Haslam, S. A., & McGarty, C. (1994). Self and collective: Cognition and social context. *Personality and social psychology bulletin*, *20*(5), 454-463.

Walter, S. G., & Dohse, D. (2012). Why mode and regional context matter for entrepreneurship education. *Entrepreneurship & Regional Development*, *24*(9-10), 807-835.

Wang, Y. K. (2004). Context awareness and adaptation in mobile learning. In *The 2nd IEEE International Workshop on Wireless and Mobile Technologies in Education, 2004. Proceedings.* (pp. 154-158). IEEE.

Wasserman, N. H., Quint, C., Norris, S. A., & Carr, T. (2017). Exploring flipped classroom instruction in Calculus III. *International Journal of Science and Mathematics Education*, *15*(3), 545-568.

Watson, D. P., Adams, E. L., Shue, S., Coates, H., McGuire, A., Chesher, J., ... & Omenka, O. I. (2018). Defining the external implementation context: an integrative systematic literature review. *BMC Health Services Research*, *18*(1), 1-14.

Welter, F. (2011). Contextualizing entrepreneurship—conceptual challenges and ways forward. *Entrepreneurship theory and Practice*, *35*(1), 165-184.

Wraae, B., & Walmsley, A. (2020). Behind the scenes: spotlight on the entrepreneurship educator. *Education+ Training*.

Yang, S. (2006). Context aware ubiquitous learning environments for peer-to-peer collaborative learning. Educational Technology and Society, 9(1), 188–201.

The Development of Entrepreneurial Thinking in STEM Education: A Teaching and Learning Module for Elementary Students

Nyet Moi Siew and Jamilah Ahmad
Universiti Malaysia Sabah, Kota Kinabalu, Malaysia
sopiah@ums.edu.my
jamilahahmad99@gmail.com

Abstract: The development of modules in cultivating entrepreneurial thinking (ET) in Science, Technology, Engineering, and Mathematics (STEM) education at the elementary school level is still limited. Thus, this research was conducted to establish the feasibility of the teaching and learning (TL) module based on the socioscientific issues approach aided by the thinking wheel map (SIA-TM). A case study was conducted among 30 fifth graders in the first phase of the module evaluation. Data was collected via respondents' feedback in the 5-point Likert scale questionnaire and focused groups interviews. The students showed a high level of acceptance (m=4.53) towards the activities in the SIA-TM TL Module. Students opined that the SIA-TM TL module assisted them in developing new ideas and a responsible attitude towards their community. The second phase was evaluation through the quasi-experimental research design with the pre-test- post-test control group design. A total of 60 fifth graders were gathered into two intervention groups which were the SIA-TM group (n=30) and the control group (n=30). The results of the t-test prove a significantly positive effect of the SIA-TM TL Module on the five constructs of ET. Therefore, these findings establish that the SIA-TM TL module is feasible in promoting fifth graders' ET in STEM education.

Keywords: socioscientific issues approach, thinking wheel map, entrepreneurial thinking, STEM education

1. Introduction

Entrepreneurial thinking (ET)h as gained attention in the science curriculum due to the need for developing individuals who can think critically, creatively, innovatively, and inhibit high values. Entrepreneurial thinking is recognised as one of the most relevant thinking skills students should master to face an increasingly challenging future (Bacigalupo et al, 2016; Buang et al, 2009). This skill is not merely to become an entrepreneur but is an intrinsic skill that is important for establishing human development, fulfilling the market's demands and increasing competition (Bacigalupo et al, 2016).

According to Buang et al (2009), ET is not just a concept that brings about entrepreneurs, but it is a design-thinking skill based on scientific knowledge and entrepreneurial orientation. Buang et al state that designing a model requires students to master five important ET constructs: observation, new ideas, innovation, creativity, and values. The mastery of these constructs aids students in generating ideas, choosing ideas, sketching designs, creating models and evaluating the contribution of their design to society.

Similar to other countries, Malaysia is now preparing school students for global needs. In its Elementary School Standard Curriculum 2017 edition, the element of the entrepreneurial curriculum has been applied in all subjects, including Science. The module that is supposedly used to inculcate ET in STEM education at the elementary school level is very limited. In comparison, Karlsson et al (2021) stated that emphasis on innovation and entrepreneurship is incredibly significant to face the 21st century. Thus, a learning concept which integrates STEM, innovation and entrepreneurship in the school curriculum needs to be introduced for students to become designers, innovators and possess entrepreneurial values. In fact, emphasis on the entrepreneurial element in STEM education is another effort to attract students' interest in STEM subjects besides studying the ways of commercialising ideas with the integration of various fields of study.

Since there are gaps and issues in implementing ET in science curriculum, a teaching and learning (TL) module based on socioscientific issues approaches (SIA) aided by a thinking wheel map (TM) is developed, and its feasibility in promoting ET in STEM education is determined.

2. Theoretical framework

The design and development of the SIA-TM TL module based on the analysis of various elements was proposed, such as the application of the SIA, the use of a TM, the implementation of STEM education in elementary schools, understanding towards the learning styles of elementary school students and its relation to theories and teaching models. The SIA-TM TL module applied the concept of knowledge construction by adapting to the

environment following Piaget's theory of cognitive constructivism (1976) and Vygotsky's theory of social constructivism (Vygotsky, 1978). Piaget's theory is compatible with fifth graders in this research as it focuses on the concept of using their prior knowledge to analyse socioscientific issues and design products that can solve issues presented to them. Through the discussions and solutions to socioscientific issues, students would undergo a process of exploration and recognise their prior knowledge. The impact of this is a balance between the assimilation and accommodation processes toward new information based on their existing knowledge (Sjøberg, 2007).

In line with the students' ages (10-11 years old), Piaget's theory of cognitive constructivism states that these children are within the concrete operational stage where they are able to investigate and solve concrete problems rationally (Pascual-Leone & Johnson, 2005). Therefore, in this research, students were presented with stimulating material such as socioscientific issues and pictorials suitable for their cognitive stage. Additionally, in line with Vygotsky's theory of social constructivism, students were assigned into small groups to enable teamwork activities and the generation of ideas. Indirectly, discussion activities in these small groups applied the social aspect to the students' learning process (Jones & Brader-Araje, 2002).

Researchers realise the importance of pedagogical principles in the process of TL in elementary schools to support the process of information and knowledge construction cognitively and socially. This research applied the ET model (Buang et al, 2009), SIA (Sadler et al, 2017) and TM (Bloom, 1956; Glenn, 1972; Bengston, 2016) in the module development.

The SIA was used because of its suitability in terms of psychological, social and emotional growth for children as well as its usability in various aspects of science education (Zeidler & Nichols, 2009). Teachers who use SIA in learning sessions help students develop and evaluate arguments related to current issues (Owens et al, 2017). The first phase is focused on the issue at hand. Students build their understanding by relating issues with scientific ideas and community awareness in this phase. The second phase prepares a platform for teachers to encourage their students to understand and practice science that stresses socioscientific and community issues. In this way, students will be actively involved in searching for relations between social issues and scientific knowledge and practices that boost the relevance of the issues to be solved (Sadler et al, 2017). The last phase encourages students to synthesise ideas and practices. This phase provides students opportunities to be actively involved in manifesting ideas and opinions ethically.

The SIA has become the chosen approach to solve scientific, technological and community issues in the research of Birmingham and Barton (2014) and Nam and Chen (2017). SIA is observed to help increase students' scientific knowledge (Driver et al, 2000; Kinslow & Sadler, 2018; Sadler et al, 2017; Topçu et al, 2018). Scientific knowledge generated through socioscientific debates will drive students to produce ideas effectively because they have to relate the contributions of their inventions to real issues in society.

The TM was adapted from Bloom (1956), Glenn (1972) and Bengston (2016). The TM consists of a circle in the centre and five cycles which could help students to produce and organise their ideas. When using the SIA-TM TL module, the students were given socioscientific issues for discussion and debate. Any logical and scientific ideas will be written onto the centre of the map. These scientific ideas will trigger students to contribute ideas in the next cycle. Bengston (2016) stated that the TM is easily understood by students and stimulates their systematic thinking. This statement is compatible with this study's application, where students needed to generate ideas in groups through brainstorming sessions. Any logical and feasible idea will be entered into each cycle. Moreover, the TM aids students in collecting ideas speedily.

To merge the SIA with the TM, the researchers used the method of thorough integration (Swartz & Parks, 1994). With this method, the ET skill is taught together with the lesson's contents. The thorough integration was taught in five steps, that is: (i) introduction, (ii) thinking actively, (iii) thinking about thinking, (iv) reinforcement exercise, and (v) thinking application. In this case, two components (learning content and ET skill) are implemented as complementary in each step of the process.

In developing the unit activity in the TL module, the researchers applied the ET model which was divided into five steps that are i) plan and do purposeful observation [Observation], ii) create ideas by looking for uniqueness or strengths [New Ideas], iii) choose ideas that can be modified or improved and evaluate those ideas

[Innovation], iv) strengthen and improve good ideas in a focused manner [Creativity], and v) ensure that ideas or products are meaningful for society [Value].

The ADDIE Model (Branch, 2010), which consists of five phases that are analysis, design, development, implementation and evaluation, was adopted in the design and development of the SIA-TM TL module. The ADDIE Model was selected because it focuses on student-centred learning, its learning design is goal-oriented, and it enables students to show meaningful actions and solve issues practically. The theoretical framework for the design and development of the SIA-TM TL module is shown in Figure 1.

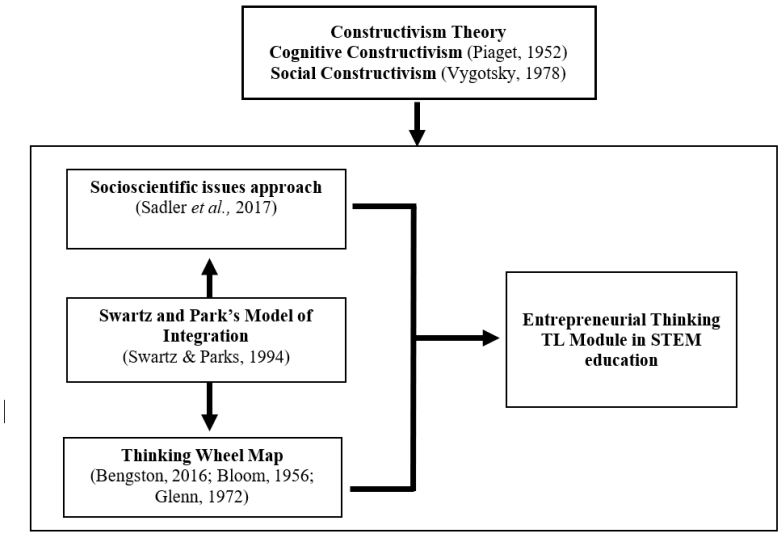


Figure 1: Theoretical framework for the design and development of SIA-TM TL module

3. Purpose and research questions

This research was conducted to design and develop a TL module that integrated the SIA and TM to inculcate ET in STEM education among fifth graders. There are three research questions that drive this study: -

- 1. How feasible is the SIA-TM TL Module for fifth graders?
- 2. How do the fifth graders make sense of their experience in constructing ET?
- 3. How effective is the SIA-TIM TL module in promoting ET?

4. Research methodology

4.1 Research design and sample

This research employed a descriptive and quasi-experimental research design. The descriptive research design involved 30 fifth graders in a case study that assessed the aspect of the feasibility of the SIA-TM TL module and explored fifth graders' experience in the construction of ET. In contrast, the quasi-experimental research design was employed to assess the effects of the SIA-TM TL module on the fifth graders' ET in STEM education. This research was conducted over 12 weeks, beginning from September to November 2020.

4.2 Ethical considerations

The researchers obtained consent from the headteachers, teachers and students. The students were provided letters of agreement for their parent's approval for their involvement in the research. All the respondents were informed about the confidential nature of the research and that they could pull out of the research without facing any punishment.

4.3 Descriptive research

4.3.1 Analysis phase

The main purpose of the SIA-TM TL module design was to encourage and inculcate ET among fifth graders in STEM education that is taught in the science subject. To achieve the objectives of this research, researchers conducted an analysis. This analysis is about the needs of the students and the context of the study. The researchers interviewed a group of 30 fifth graders from one elementary school in Tawau, Sabah. The focus group interviews were conducted in a group of five, each lasting 30 minutes from 5 – 7 July 2020.

In the analysis of students and context, the criteria were adapted from Carlton et al (2000) that focused on the unit of students' low achievement level, student's prior knowledge about Physical Science and Technology and Sustainable Life themes, sketching skills, creation skills and peer pressure. The analysis showed that students were unanimous in their opinions on all the aspects except for prior knowledge about Physical Science and Technology and Sustainable Life themes, which they considered weak. Therefore, the teaching process will be adapted to the fifth-graders level and needs as best as possible.

4.3.2 Design and development of SIA-TM TL module

The SIA-TM TL Module was developed by adapting the SIA that introduces social issues to students, which helps them study the social and scientific components of those issues and encourages them to generate solutions that are based on societal values. The TM was provided as a thinking tool to help the students solve socioscientific issues given to them. The SIA and TM was integrated through Swartz and Parks' (1994) integrated thinking model.

The module has six STEM activity units covering Physical Science and Technology and Sustainable Life themes as found in the latest edition of the Year Five Science Curriculum and Assessment Standard Documents (Curriculum Development Division, 2019). Every activity was allocated 180 minutes. However, this time suggestions for the activity implementation can be customised according to the TL in school, as this module can be executed outside TL hours.

In the observation step, students were instructed to make planned and purposeful observations. Students were provided with stimulus pictures that showcased the product designs nowadays. Then, students were asked to make observations to garner information on the building materials, design and product characteristics. Next, students were tasked with thinking ideas to look for uniqueness and strengths. This step encouraged students to search for the uniqueness and strengths of the building materials, design and product characteristics in the product they had observed. The innovative step refers to the students' activity of selecting several ideas that can be modified or improved and observing those ideas. The selection of ideas that can be improved helped the students to create a product design in the future. Students then had to evaluate those ideas by stating their reasons for choosing them. As for the creative step, this activity is to strengthen and increase ideas in a focused manner based on the previously chosen ideas. Students upgraded their ideas by making sketches, labelling and building the product design model. Next, students had to determine the product's name, offer price and the target group of buyers.

Lastly, the value step was for the students to ensure that their ideas or product was useful to society. Students stated their products' advantages to society. They could state the product's strengths in terms of its cost-saving qualities, product functions and properties, and ethics involved in the creation of the product. This step was to inculcate values such as love for the environment and the practice of using sustainable materials in creating a product for society. The students then had to present their creations in class and explain the benefits of their products.

According to the TM cycle, all these steps were carried out in stages. These five steps involved different student activities. To gain maximum effect, the activities in this module were executed in groups to ensure the exchange of ideas and the search for creative and innovative solutions. The teachers' instructions and guidance were needed in this module's implementation. Table 1 shows the integration of the SIA and TM in developing the ET TL module.

4.3.3 Evaluation phase

Taherdoost (2016) stated that a module's content must be verified before it can be applied. The first evaluation phase evaluated the module's feasibility and respondents' acceptance. This phase was conducted after the SIA-TM TL Module was shared with the 30 fifth-graders through the process of TL.

A questionnaire was distributed to the respondents to gather their perceptions about the feasibility of activities proposed in the SIA-TM TL module. The questionnaire used the Likert Scale with the value of 1 (strongly disagree) to 5 (strongly agree). As many as 11 questions were adapted from Rahman (2020), which required students to provide their feedback from the aspect of feelings, benefits from the execution of the five-step ET, the use of the SIA and TM. The questionnaires were given to fifth-graders as soon as the module's intervention was conducted.

The closing phase (evaluation phase) was done via interviews in focused groups to gain students' feedback about the implementation of the SIA-TM module. After using the SIA-TM module, they were asked to share their feelings and experiences and elaborate on how the module's use could impact them.

Table 1: Integration of SIA approach and TM in the ET TL module

Socioscientific Issues Approaches (SIA)	**Thinking Wheel Map (TM)**	**Integration of SIA and TM in the ET TL Module**
Phase 1 Students discover or are introduced to an issue	**First Cycle - Observation** Planned and purposeful observation	**Introduction** The teacher introduces a socioscientific issue to students and instructs students to make an observation of an issue in the first cycle of the TM.
Phase 2 Students study the social and scientific components related to issues in the first phase.	**Second Cycle – New Ideas** Create ideas by looking for uniqueness or strengths in a product observable in building materials, design, and product characteristics.	**Think actively** Socioscientific issues and stimulus materials are used to guide students to generate ideas by finding uniqueness or advantages through the second cycle of TM.
	Third Cycle – Innovation Selection of several ideas that can be modified or improved and evaluate those ideas	**Thinking about Thinking** Students are stimulated to choose several ideas that can be modified or improved and evaluate those ideas through the third cycle in the TM to solve the presented issues.
Phase 3 Students make an effort to generate a solution based on societal values.	**Fourth Cycle – Creativity** Strengthen and improve in a focused manner	**Consolidation Practice** Students strengthen and improve the ideas they have chosen in a focused manner in the fourth cycle of the TM and sketch their ideas for the product.
	Fifth Cycle – Value Ensure that the idea or product that is created is meaningful for society.	**Applying Thinking** Students state and ensure that the characteristics of their products are useful to society and can solve the issues presented in the fifth cycle of the TM.

4.4 Quasi experimental research

The execution phase of the experimental research involved the implementation of the SIA-TM TL module and evaluating its effectiveness in the classroom session. In line with this, the control group pre-test – post-test quasi-experimental research design was employed. A total of 60 students were chosen randomly from one elementary school in the Tawau district and were placed into two groups; the treatment group (SIA-TM, n=30) and the control group (GC, n=30). The respondents in the treatment group received the SIA-TM module that comprised six learning units for 12 weeks from October to December 2020. Each unit required the implementation time of 180 minutes with three missions to be solved; Mission 1: Discussion of socioscientific issues, Mission 2: Discussion of model design, and Mission 3: Presentation of the model design. These three missions could be conducted in three stages according to the suitability of the school's TL timetable. The

respondents in the control group were exposed to the method of designing a conventional design without using the socioscientific issues approach and thinking wheel map.

To evaluate the module's effectiveness, the ET Test (ETT) (Ahmad & Siew, 2021) that the researchers designed was used. This instrument was proven valid, reliable, and suitable for evaluating fifth-graders ET. The ETT covered 10 items that required students to answer questions in the form of statements and idea sketches. The questions were constructed based on the five constructs in ET (Buang et al, 2009), which were referred to the Curriculum and Assessment Standard Document (CASD) Grade Five Science learning contents under the Physical Science and Technology and Sustainable Life themes (Curriculum Development Division, 2019: 61-79). The main question asked students to create a handphone design to be used by future society. The context of using handphones was chosen because it is contained in the CASD under the Physical Science theme. Students were then provided with a stimulus picture, and 10 questions arranged according to the cluster construct to enable them to organise their answers and get the desired results. The ETT scoring was done based on the scoring of Ho et al (2013). Each item prepared for this test carried a minimum score of zero and the maximum score of three.

4.5 Data analysis

The quantitative data was analysed by calculating the percentage and mean. The analysis of the interview questions for the focused group was done using thematic analysis (Braun & Clarke, 2006) by deriving themes from the interviews about the experiences gained by the 30 fifth-graders after using the SIA-TM TL module. The researchers analysed the interview data thoroughly, gained the pattern linkage from the respondents' experiences, and explained the respondents' experiences in the construction of ET (Fereday & Muir-Cochrane, 2006).

5. Research findings

5.1 Students' Perception towards the Module

5.1.1 Findings from questionnaire

The students' perceptions of the feasibility of the module were collected via the questionnaire given to the respondents. The overall mean of 4.53 showed that the SIA-TM TL module had a high value of acceptance and feasibility. 30% of the respondents agreed, while 63% strongly agreed with the SIA-TM TL module's feasibility. A minimum mean of 3.50 shows that the feasibility aspect of the module is acceptable (Junus et al, 2021). The research findings between 4.06 to 4.86 proved that the SIA-TM TL module was feasible in fostering ET among fifth-graders.

5.1.2 Interviews with the focused group

Several themes were identified based on the respondents' views in the focused group interviews regarding the implementation of the SIA-TM TL module. The findings are as follows:

Arrangement of ideas and expansion of new ideas. The use of the SIA-TM TL module helped students arrange their ideas in a more organised way and expanded their new ideas.

> *"...When we were asked to write on the wheel, I told myself, why must we use a wheel? Can't we just create the product directly? But when we did it, the ideas came one by one, then (I realised) the importance of the wheel. If there were no wheel, it would be difficult to arrange ideas ..." (S2)*

> *"... ideas could be arranged easily. We could create a product more systematically..." (S14)*

Increase in STEM knowledge. Students also stated that the SIA-TM TL module increased their STEM knowledge.

> *"... I did not realise that this wheel map could help me to get to know and learn what is in STEM..." (S11)*

> *"...At first, I asked myself what STEM is. After writing on the wheel map, then I understood that we had to produce products that used the knowledge of science, technology, engineering and mathematical..." (S13)*

Excitement when creating a prototype. Students expressed their excitement and thrill when creating their

prototypes.

> *"We created a car that used water because the use of fossil fuels is not good for the environment. I feel this was very fun because the map helped us to create the car. We arranged our ideas one by one until the car was created ..." (S10)*

> *"...I am impressed with myself. Our group did not expect to create a product for the future. I am really, really happy..." (S12)*

Inculcates the value of helping the community in the future. The SIA-TM TL module proved to help students cultivate a feeling of responsibility to solve universal issues to help future society.

> *"...At first, we were given issues to discuss. I also did not know that our world is facing the issues that our teacher showed us. So in the wheel, we wrote the issues that we discussed, and then we wrote ideas to create a product. The wheel really helps the future society..." (S7)*

> *"... at first, I was scared that this project would not work out ... But when it was done as a group ... we could create a product that we wanted for the future community" (S9)*

Increase curiosity. The students' curiosity was also increased through this innovative SIA-TM TL module.

> *"... during the creation of our product, we asked each other questions in our group. Because we want to know what would happen if we did something like this? We wanted to know the outcome..." (S13)*

> *"... actually, we were afraid that our plan would not work out. But after writing ideas on the map, we did what was planned, and it was materialised. Of course. Because we already wrote ideas, we were impatient to know what would happen next..." (S2)*

Encourages teamwork in a group. The value of teamwork and unity in a group could be brought out through the innovative SIA-TM TL module.

> *"... the wheel map helps me to collaborate with my friends in creating our group project..." (S4)*

> *"...I feel that all our work became easy. Because the wheel was done together, we discussed together to get ideas. Finally, we succeeded..." (S6)*

5.2 Effectiveness of the SIA-TM TL module

5.2.1 Independent sample T-Test (ISTT)

ISTT was conducted to compare the pre-test mean score for the five constructs between the SIA-TM and CG. Analysis results (Table 2) indicated that there were no significant differences between the pre-test mean scores between SIA-TM and CG in the Observation, New Ideas, Innovation, Creativity and Value constructs with each construct's value at ($t(58) = .408$, $p > .05$; $t(58) = –.188$, $p > .05$; $t(58) = –.166$, $p > .05$; $t(58) = –.184$, $p > .05$; $t(58) = 0.00$, $p > .05$).

Gay and Airasian (2003) stated that if there were no significant differences for the mean scores between the two pre-tests, then the T-Test could be conducted on the post-test mean score. Thus, the ISTT could be carried out to compare the SIA-TM and the CG mean scores in the five constructs of ET. The analytical results show that the respondents in the SIA-TM group had a significant higher score compared to the control group from the aspect of Observation, New Ideas, Innovation, Creativity and Value constructs with each value at ($t(58) = 8.748$, $p < .05$; $t(58) = 7.906$, $p < .05$; $t(8) = 8.700$, $p < .05$; $t(58) = 8.106$, $p < .05$; $t(58) = 8.887$, $p < .05$). These results proved that there was a significant difference in the post-test for students from the SIA-TM group compared to those in the CG in the five constructs of ET.

Table 2: Results of ISTT analysis

Construct	Test	SIA-TM Group (Mean)	Control Group (Mean)	Group Difference	*t*	*df*	*P*
Observation	Pre	2.37	2.30	.067	.408	58	p> .05
	Post	4.93	3.57	1.367	8.748	58	p< .05
New Ideas	Pre	2.23	2.27	-.033	-.188	58	p> .05
	Post	4.97	3.40	1.567	7.906	58	p< .05
Innovation	Pre	2.47	2.50	-.033	-.166	58	p> .05

Construct	Test	SIA-TM Group (Mean)	Control Group (Mean)	Group Difference	*t*	*df*	*P*
	Post	5.07	3.33	1.733	8.700	58	p< .05
Creativity	Pre	2.57	2.60	-0.33	-.184	58	p> .05
	Post	5.17	3.63	1.533	8.106	58	p< .05
Value	Pre	2.40	2.40	0.00	0.00	58	p> .05
	Post	5.10	3.50	1.600	8.887	58	p< .05

Note: Significance level at p=.05

6. Discussion

Overall, the findings have proven that the SIA-TM TL module is feasible in fostering fifth-graders ET. This research demonstrated that the socioscientific issues approach, thinking wheel map, Swartz and Park's integration model, ET model and ADDIE's instructional design model were able to produce a SIA-TM TL module which is feasible in STEM education. The interview findings proved that the use of the SIA-TM TL module assisted students in organising ideas and expanding new ideas more effectively, as well as increased their STEM knowledge. Students were also discovered to have enjoyed making the prototype and were more curious throughout the SIA-TM learning experience. In fact, the students also developed an awareness and responsible attitude towards their future community and teamwork in their respective teams.

The independent sample t-test showed that fifth-graders in the SIA-TM displayed significantly better performance in the five constructs of ET in the post-test compared to the control group. This showed that using the SIA-TM TL module could promote ET more effectively than the control group.

Exposure to the socioscientific issues in the SIA-TM TL module enabled students to make connections between socioscientific issues and their experiences. The discussion of socioscientific issues encourages the beginning of observation and investigation of a phenomenon or situation (Darmaji et al, 2019). The argument made for the socioscientific issues and the observation analysis will encourage students to observe trends and predict situations that have not occurred or have not been witnessed (Syukri et al, 2013). This strengthens the point that the socioscientific issues approach aids students in providing an early visualisation of the product's concept prior to it being created.

Furthermore, exposure to the SIA through the SIA-TM TL module opens up a space for students to expand their knowledge on issues (Khishfe et al, 2017). In this approach, socioscientific issues are put forward in each activity unit and presented together with examples and pictures that show the socioscientific situations occurring at the moment. The introduction to socioscientific issues enables students to make observations based on current situations such as critical pollution. The information brought forward by these issues provides students with input to create products that could solve those socioscientific issues.

The integration of the SIA with the TM also encourages students to note down ideas systematically (Bengston, 2016). Any ideas that are thought of as logical and suitable with the observation, new ideas, innovation, creativity and value constructs about the product are entered into the thinking map's cycles. This facilitates students' endeavours because the cycle concept in the wheel helps them to collect ideas speedily and systematically. The effects of this integration are proven to aid students in mastering the five constructs of ET since the TM is easy to understand and stimulates students' systematic thinking during the brainstorming session in groups (Krueger, 2005).

The SIA aided by the TM also trains students to make decisions about social issues that involve a moral implication in a scientific context (Zeidler et al, 2005). Prior studies (Driver et al, 2000; Sadler, 2004) also agree that socioscientific issues enabled students to study and connect science with daily life and communities. This is in line with the objective of implementing ET in science lessons where students are capable of connecting science with society to create products that are compatible with societal needs and solve socioscientific issues that arise in society.

7. Conclusions

The research confirmed that the SIA-TM TL module is suitable to inculcate entrepreneurial thinking (ET) among fifth-graders. This research highlights the application of the constructivism theory, ET model, socioscientific

issues approach, thinking wheel map, Swartz and Park's integration model and ADDIE's instructional design model in creating SIA-TM TL module that is feasible and effective in promoting ET in STEM education. Students not only get to increase their level of ET but also improve their STEM knowledge, expand new ideas, create a sense of enjoyment, sense of teamwork, and a feeling of responsibility to help their community.

References

Ahmad, J., and Siew, N. M. (2021) Development of a children entrepreneurial science thinking test for STEM education. *Journal of Baltic Science Education*, *20*(4), 528–545.

Bacigalupo, M., Kampylis, P., Punie, Y., and Van den Brande, G. (2016) *EntreComp: The entrepreneurship competence framework*. Publications Office of the European Union. https://doi.org/10.2791/593884

Bengston, D. N. (2016) The futures wheel: A method for exploring the implications of social–ecological change. *Society and Natural Resources*, Vol. 29*, No.* 3, pp 374–379. https://doi.org/10.1080/08941920.2015.1054980

Birmingham, D., and Barton, A. C. (2014) Putting on a green carnival: Youth taking educated action on socioscientific issues. *Journal of Research in Science Teaching*, Vol. 51, No. 3, pp 286–314.

Bloom, B. S. (1956). *Taxonomy of educational objectives, Handbook 1: Cognitive domain* (2nd ed.) David McKay Company. https://doi.org/10.1300/J104v03n01_03

Branch, R. M. (2010) *Instructional design: The ADDIE approach*. Springer.

Braun, V., and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(77),77–101.

Buang, N. A., Halim, L., and Subahan, T. M. M. (2009) Understanding the thinking of scientists entrepreneurs: Implications for science education in Malaysia. *Journal of Turkish Science Education*,Vol. 6*, No.* 2, pp 3–11.

Carlton, D. J., Kicklighter, J. R., Jonnalagadda, S. S., and Shoffner, M. B. (2000) Design develop and formative evaluation for adult program. *Journal of The American Dietetic Association*, Vol. *100, No.*5, pp 555–563.

Curriculum Department Division. (2019) *Dokumen standard kurikulum dan pentaksiran Sains Tahun Lima* [Year Five science curriculum and assessment standard document]. Ministry of Education Malaysia.

Darmaji, Kurniawan, D. A., and Irdianti. (2019) Physics education students' science process skills. *International Journal of Evaluation and Research in Education*, Vol. 8, No. 2, pp 293–298.

Driver, R., Newton, P., and Osborne, J. (2000) Establishing the norms of scientific argumentation in classrooms. *Science Education*, Vol. 84, No. 3, pp 287.

Fereday, J., and Muir-Cochrane, E. (2006) Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme Development. *Interdisciplinary Journal of Qualitative Methods*, *5*(1), 80–92.

Gay, L. R., and Airasian, P. W. (2003). *Educational research: Competencies or analysis and applications*. Prentice Hall.

Glenn, J. (1972) Futurizing teaching vs. futures courses. *Social Science Record*, Vol. 9, No. 3, pp 26–29.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., and Tatham, R. L. (2006) *Multivariate data analysis* (6th ed.). Prentice Hall.

Ho, H.-C., Wang, C.-C., and Cheng, Y.-Y. (2013) Analysis of the scientific imagination process. *Thinking Skills and Creativity*, *10*, 68–78.

Jones, M. G., and Brader-Araje, L. (2002) The impact of constructivism on education: Language, discourse, and meaning. *American Communication Journal*, Vol. 5, No. 3, pp 1–10.

Karlsson, C., Rickardsson, J., & Wincent, J. (2021). Diversity, innovation, and entrepreneurship: Where are we and where should we go in future studies? *Small Business Economics*, *56*(2), 759–772. https://doi.org/10.1007/s11187-019-00267-1

Khishfe, R., Alshaya, F. S., BouJaoude, S., Mansour, N., and Alrudiyan, K. I. (2017) Students' understandings of nature of science and their arguments in the context of four socio-scientific issues. *International Journal of Science Education*, *39*(3), 299–334. https://doi.org/10.1080/09500693.2017.1280741

Kinslow, A. T., and Sadler, T. D. (2018) Making science relevant: Using socio-scientific issues to foster critical thinking. *The Science Teacher*, Vol. 86, No.1, pp 40–45. www.nsta.org/highschool

Krueger, N. F. 2005. The cognitive psychology of entrepreneurship. In Z. J. Acs & D. B. Audretsch (Eds.), *Handbookof entrepreneurship research* (pp. 105–140). Kluster Law International.

Nam, Y., and Chen, Y. C. (2017) Promoting argumentative practice in socio-scientific issues through a science inquiry activity. *Eurasia Journal of Mathematics, Science and Technology Education*, Vol 13, No. 7, pp 3431–3461.

Owens, D. C., Sadler, T. D., and Zeidler, D. L. (2017) Controversial issues in the science classroom. *Phi Delta Kappan*, Vol *99, No.* 4, pp 45–49. https://doi.org/10.1177/0031721717745544

Pascual-Leone, J., and Johnson, J. (2005) A dialectical constructivist view of developmental intelligence. *Handbook of Understanding and Measuring Intelligence*, pp 177–201.

Piaget, J. (1976) Piaget's theory. In *Piaget and His School* (pp. 11–23). https://doi.org/10.1007/978-3-642-46323 5_2

Rahman, M.S.A. (2020) The socio-scientific-based approach helped with future thinking map on the five constructs of students' future thinking*.* Doctoral Thesis, Universiti Malaysia Sabah, Kota Kinabalu, Malaysia

Sadler, T. D. (2004) Informal reasoning regarding socioscientific issues: A critical review of research. *Journal of Research in Science Teaching*, Vol. *41, No.* 5, pp 513–536. https://doi.org/10.1002/tea.20009

Sadler, T. D., Foulk, J. A., and Friedrichsen, P. J. (2017). Evolution of a module for socio-scientific issue teaching and learning. *International Journal of Education in Mathematics Science and Technology*, *5*(2), 75–87.

Sjøberg, S. (2007) Contructivism and learning. In *International Encyclopaedia of Education* (3rd ed.). Elsevier.

Swartz, R. J., and Parks, S. (1994) *Infusing the teaching of critical and creative thinking into content instruction: A lesson design handbook for the elementary grades*. Critical Thinking Books and Software.

Syukri, M., Halim, L., and Meerah., T.S.M. (2013) *Pendidikan STEM dalam entrepreneurial science thinking "ESciT": Satu perkongsian pengalaman dari UKM untuk Aceh* [STEM education in entrepreneurial science thinking "ESciT": An experience shared from UKM for Aceh]. *Aceh Development International Conference, 2013*, 105–112.

Taherdoost, H. (2016) Validity and reliability of the research instrument; How to test the validation of a questionnaire/survey in a research. *International Journal of Academic Research in Management*, 5(3), 28–36.

Topçu, M. S., Foulk, J. A., Sadler, T. D., Pitiporntapin, S., and Atabey, N. (2018) The classroom observation protocol for socioscientific issue-based instruction: development and implementation of a new research tool. *Research in Science & Technological Education*, Vol 36, *No.* 3, pp 302–323.

Vygotsky, L. (1978) *Mind in society: The development of higher psychological processes*. Harvard University Press.

Zeidler, D. L., Sadler, T. D., Simmons, M. L., and Howes, E. V. (2005). Beyond STS: A research-based framework for socioscientific issues education. *Science Education*, *89*(3), 357–377. https://doi.org/10.1002/sce.20048

The Technology Transfer University Capability: A Case Study From the Triple Helix Perspective

Sergio Evangelista Silva, Eloiza Luzia Boanerges de Castro and Luciana Paula Reis
Institute of Exact and Applied Sciences – ICEA, Federal University of Ouro Preto, João Monlevade, Brazil
sergio.silva@ufop.edu.br
eloiza.castro@aluno.ufop.edu.br
lucianapaula@ufop.edu.br

Abstract: The role of universities as innovation agents has received recently considerable attention in academia. As such, this interest is important wherein university, besides the education and research, also can contribute to the economic and social development of society through the generation of innovations. Accordingly, it is important to assess their innovation capability. Even though the current perspective considers the innovation capability of a university thanks to the number of patents produced, from a Schumpeterian perspective, innovation occurs only one invention is commercialized. Based on this perspective, this article introduces a set of indicators to assess the innovation capability of universities, with a focus on the composition of assignees of a patent from the lens of triple helix theory. There are presented three types of indicators to measure the capability of a university to create and license its patents: general; based on the composition of assignees according to the triple helix (university, government, and industry/society); and according to the combination between the composition of patent assignees and the knowledge area. These indicators are validated through a case study in a Brazilian university through a documental analysis. There were analyzed data from 775 patents deposited and licensing agreements of a Brazilian university, ranging from 2011 to 2021. As an empirical result, this research revealed considerable differences in the number of patents deposited and licensed thanks to the type of the patent assignees, as well as their knowledge area. As a theoretical contribution, the framework of assessment of the patents introduced in this article seems to be a useful tool for analyzing the current innovation capability of a university, serving as a starting point to investigate its causes. As a practical implication, the framework introduced in this article can be readily used to assess the innovation capability of universities individually or comparatively.

Keywords: technology-transfer, diffusion of technologies, university-industry, patents, licensing, innovation.

1. Introduction

Besides their mission of education and research, universities have incorporated the generation and diffusion of technologies to contribute to social and economic development (Daraio, Bonaccorsi and Simar, 2015). In this context, the elaboration of innovation performance indicators can be useful to universities to measure and improve their performance (Chen, Wang and Yang, 2009). There is a rich literature of models to assess university performance in the global aspects (Daraio, Bonaccorsi and Simar, 2015; Herberholz and Wigger, 2021), as well as those focused on innovation efficiency (Kalapouti et al., 2017; Chen and Shu, 2021; Luo, 2021).

A promising branch of research on university efficiency is to develop studies on the capability of universities to generate innovations (Herberholz and Wigger, 2021). Currently, the innovation capability of universities is considered in terms of the number of patents deposited and, not necessarily, patents effectively licensed to market agents. From a Schumpeterian perspective, innovation only takes place when an invention is commercialized (Nelson, 2009). Based on this opportunity of contributing to the literature, this article introduces a set of indicators to assess the innovation capability of universities, with a focus on the composition of assignees of a patent from the lens of triple helix theory. There are presented three types of indicators to measure the capability of a university to create and license the patent from three levels of scope: general, based on the composition of assignees considering the types of agents of the triple helix (university, government, and industry/society); and the combination between the composition of assignees based on the triple helix and the knowledge area of the patent. These indicators are validated through a case study in a Brazilian university through a documental analysis. They are addressed data from 775 patents deposited and licensing agreements of a Brazilian university, ranging from 2011 to 2021.

The set of indicators shows good adherence and usefulness as an instrument to measure and analyze the innovation capability of universities.

Besides this first section, this article is organized in the following way. Section 2 presents a literature review. Section 3 details the methodology, the research object, and the data analysis. Sections 4 and 5 present, respectively, the results obtained and the discussion based on the literature. Finally, Section 6 presents the conclusions and offers suggestions for future research.

2. Literature review

2.1 Patenting and licensing in the context of university-industry technology transfer from the triple helix perspective

From a Schumpeterian perspective, there is a difference between invention and innovation. An invention is the creation of something new, resulting in new products and processes or improvements to existing ones. In this context, the patent is an institutional mechanism to safeguard the rights of the intellectual property of inventors (Nelson, 2009). Accordingly, when an invention is effectively commercialized, it becomes an innovation (Schumpeter, 1982). The licensing of patented inventions is one of the main channels for transferring technology from the university to the market (Siegel et al., 2004).

The advent of Boyh-Dole law in USA stimulated the government of different countries to incentive universities in the creation and transfer of innovations to society (Mowery et al., 2001). In Brazil, this tendency manifested as the innovation law that instituted technology transfer offices in public universities (Brito and Fausto, 2015; Soares, Vitale Torkomian and Nagano, 2020) and strengthened science parks (Silva et al., 2020; Leite et al., 2022). Even with the implementation of various methods and techniques that support technological innovation (Fernandes, Reis and Serio, 2017; Araújo, Reis and Morais, 2021; Reis, Fernandes and Armellini, 2021; Reis et al., 2021), in Brazil, licensing rates are still low, as in other developing countries (Dos Santos and Torkomian, 2013). This scenario demonstrates the importance of establishing effective performance indicators capable of measuring the efficiency of technology performance of universities.

The interaction between universities and other agents for economic and social development can be explained through the concept of the triple helix (Etzkowitz, 1984; Leydesdorff and Etzkowitz, 1996; Etzkowitz and Leydesdorff, 2000), presenting the relationship between universities, government, and industry for the innovation promotion. Economic and social development occurs through the co-creation of knowledge and technology through this conjoint relation and their transference to society (Ranga and Etzkowitz, 2013; Ryan, Geoghegan and Hilliard, 2018; Perumal, Sreekumaran Nair and Unnikrishnan, 2020). In this context, the cooperation between industry and academic agents can extend the innovation capability of the first and improve their innovation performance (Ryan, Geoghegan and Hilliard, 2018). A form of measuring the performance of triple helix interactions is to assess the patents generated by academic agents and industry (Jovanović et al., 2022). Some recent studies show that triple helix interactions improve the capability of innovation ecosystems in producing science and innovation and augment investments in research activities (Zhang, Chen and Fu, 2019; Chang, Chen and Teng, 2021). In addition to the triple helix perspective, recent studies also consider various types of agents that can interact with the development of national innovation systems. For example, inspired by the triple helix concept Xue and Gao (2022) present the concept of the quadruple helix that, in addition to the agents of academy, industry and government, present civil society agents that are also important actors in the innovation process.

2.2 Assessment of performance of universities

With the purpose of measuring the efficiency of technology transfer at the university, Anderson, Daim and Lavoie (2007) used data envelopment analysis (DEA) as a productivity assessment tool. With this same objective, Secundo, De Beer and Passiante (2016) developed a maturity model based on non-monetary indicators. Through a normative approach Resende, Gibson and Jarrett (2013) propose a qualitative analysis tool for technology transfer offices to improve their efficiency, wherein they suggested 271 best practices and 43 facilitators of technology transfer. Also, in this context Aragonés-Beltrán, Poveda-Bautista and Jiménez-Sáez (2017) proposed a qualitative approach to assess their performance by analyzing the compatibility between activities carried out and the fulfilment of the established objectives of the university.

Currently, the measurement of technology diffusion in the university environment considers the diffusion of knowledge over time about a single technology (Nelson, 2009) or can compare the diffusion of different technologies (Clayton, Lanahan and Nelson, 2022).

3. Method

Due to the high level of depth in the analysis of the research object and its relationship with agents in its surroundings, this study can be classified as an in-depth case study (Yin, 2018). It is a case study about the capability of a Brazilian university in generating and transferring patented technologies to markets. Data were collected from public documents of this university, which is among the five public universities in the country that have the highest number of patents deposited (Brito and Fausto, 2015). Through two data sources, the list of patents deposited by the university from 2011 to 2021, accessed in the Brazilian office of industrial property (Instituto Nacional de Propriedade Industrial – INPI), and the list of patents licensed by this university, it was possible to calculate the value of the six indicators proposed in this article. As a method to verify possible differences between the deposit and licensing of patents, it was used triple helix terminology to classify the patents according to the type of assignees, that is, university, government, industry/society. Also, to permit further analysis, each patent was classified according to the knowledge area, wherein it was identified thirteen academic departments in the researched university, namely: Agricultural Sciences Institute, Architecture School, Biological Sciences Institute, Dentistry Faculty, Engineering School, Faculty of Medicine, Fine Arts School, Institute of Exact Sciences, Nursing School, Pharmacy Faculty, Physical Education, Physiotherapy and Occupational Therapy School, and Veterinary School. Table 1 presents a synthesis of the patents deposited by the university and used in this study, considering the adequation of its information.

Table 1: Data about the patents used in the research from 2011 to 2021

	Licensed patents	Deposited patents
Founded patents	24	853
Eliminated patents	2	78
Total used	22	775

The application of the lens of triple helix focused on its types of agents, university, industry and government, permitted to identify differences in the performance in the rates of licencing and time of transfer of patented technologies for the studied university to society. Even though it is a single case, the conceptual framework presented in this article can be replicated in other universities, which is a theoretical contribution of case studies (Einsenhardt, 1989).

4. Results

The elaboration of the indicators is based on the concept of the triple helix proposed by Etzkowitz (1984), using the quantities of patented inventions and licensing contracts. There are proposed two basic types of indicators. One type is related to the rates of technology transfer, which consists of the division of the total of licensed patents, by the total of deposited patents, according to a specific criterion (general; by knowledge area; or by the composition of assignees of the patent) in each period. The second type of indicator is related to the average time between the deposit and the licensing of patents, also according to the three criteria presented above. Figure 1 shows the set of proposed indicators detailed in Table 2.

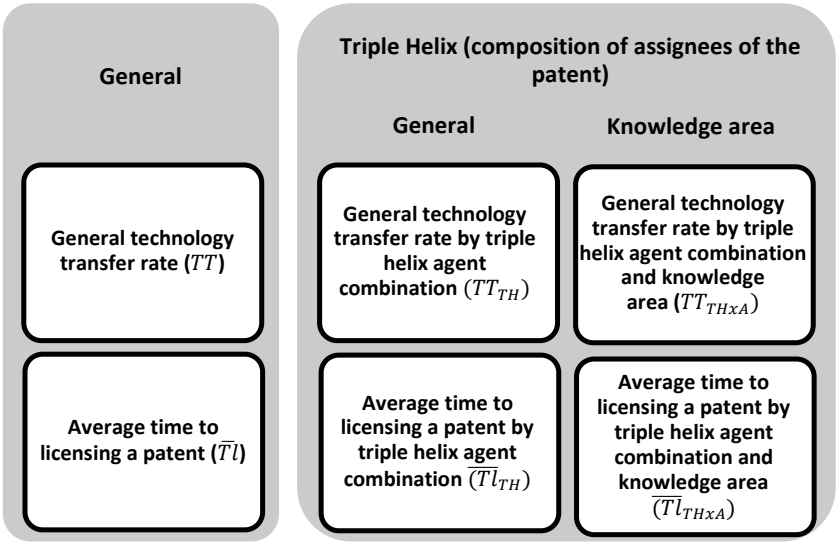


Figure 1: Set of indicators

Table 2: Performance indicators

Indicator			Formula	Description
General performance indicators		General technology transfer rate (TT)	$TT = \frac{LP}{DP}$	LP - number of licensed patents DP - number of deposited patents
		Average time to licensing a patent ($\overline{Tl}$)	$\overline{Tl} = \frac{\sum_{i=1}^{n}(Ly - Dy)}{n}$	Ly - the year of the licensing Dy - the year of patent deposit
Triple Helix	General by triple helix agent combination	General technology transfer rate by triple helix agent combination (TT_{TH})	$TT_{TH} = \frac{LP_{TH}}{DP_{TH}}$	LP_{TH} – licensing number by triple helix agent combination DP_{TH} – number of patents filed by triple helix agent combination type
		Average time to licensing a patent by triple helix agent combination ($\overline{Tl}_{TH}$)	$\overline{Tl}_{TH} = \frac{\sum_{i=1}^{n}(Ly_{TH} - Dy_{TH})}{n}$	Ly_{TH} - the year of the licensing by triple helix agent combination Dy_{TH} - the year of the patent deposit by triple helix agent combination
	Indicators by knowledge area	General technology transfer rate by triple helix agent combination and knowledge area (TT_{THxA})	$TT_{THxA} = \frac{LP_{THx\,A}}{DP_{THx\,A}}$	$LP_{THx\,A}$ – licensing number by triple helix agent combination and knowledge area $DP_{THx\,A}$ – number of patents filed by triple helix agent combination type and knowledge area
		Average time to licensing a patent by triple helix agent combination and knowledge area ($\overline{Tl}_{THxA}$)	$\overline{Tl}_{THxA} = \frac{\sum_{i=1}^{n}(Ly_{THxA} - Dy_{TH\,xA})}{n}$	Ly_{THxA} - the year of the licensing by triple helix agent combination and knowledge area $Dy_{TH\,xA}$ - the year of the patent deposit by triple helix agent combination and knowledge area

4.1 Innovation capability of the researched university in a general perspective

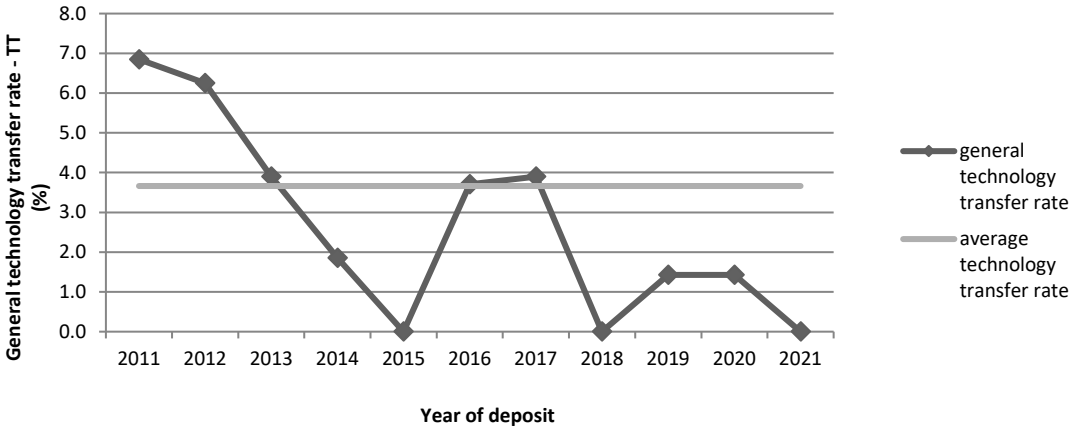
Table 3 presents the results of the general performance indicators, general technology transfer rate (TT) and average time to licensing a patent ($\overline{Tl}$). The data is organized by year. In general, one can observe a low tax on licensing of patents by the researched university. Also, there is considerable variability in the percentages of patents licensed over the years, ranging from 1.4% in 2019 and 2020 to 6.8% in 2011, maintaining a low percentage of licensing (in the order of 2.8%, being 22 licensing in a total of 775 deposited patents). Likewise, there is considerable variability in the average time from patent depositing to licensing.

Table 3: General performance indicators

Year	Licensed patents	Deposited patents	TT (%)	$\overline{Tl}$ (years)
2011	5	73	6.8	3.0
2012	5	80	6.3	4.8
2013	3	77	3.9	2.3
2014	1	54	1.9	1.0
2015	-	67	-	-
2016	3	81	3.7	1.7
2017	3	77	3.9	2.0
2018	-	66	-	-
2019	1	70	1.4	2.0

Year	Licensed patents	Deposited patents	TT (%)	$\overline{Tl}$ (years)
2020	1	70	1.4	1.0
2021	-	60	-	-

Based on Table 3, Graph 1 shows the general technology transfer rate in each year of the analyzed period and the general average rate of technology transfer.



Graph 1: Variation in the general rate of technology transfer during the analyzed period

4.2 Innovation capability of the university based on triple helix perspective

This section presents the general performance of the researched university according to the types of patent assignees to the triple helix typology (Section 4.2.1) and according to a combination of triple helix agents and the knowledge area of patents (Section 4.2.2).

4.2.1 Innovation capability according to the type of patents' assignees

Considering the performance of the university in licensing patents according to the different types of triple

helix agents, one can observe a considerable difference, whereas patents assigned by the university and society and the university, industry and government have the highest rates. In the case of society, it was observed the creation of the patent through the partnership between the university and individuals. This high rate of licensing in these two types of patents is probably because patents created in cooperation with industry and individuals are based on some specific and perceived demand that motivated the creation of the patent, which after its deposit has facilitated its licensing to market agents.

Table 4: Technology transfer rate and time by type of triple helix agent

Triple Helix Agent	TT_{TH}	$\overline{Tl}_{TH}$
University	0.024	2.367
University and government	0.015	3.250
University and industry	0.025	1.500
University, industry and government	0.118	4.000
University and society	0.667	2.000
Average	0.170	2.623

With respect to the time of licensing a patent to the market, the highest time is for patents assigned by university, industry and government. This probably occurs due to the number of agents and the diversity of interests involved in the negotiation of the rights of a patent that can delay its licensing. In contrast, patents assigned by university and industry, and university and society are those with the shortest transfer time. This situation takes place probably to the fact that as well as in the case of the licensing rate, the innovations contained in these patents are developed due to previous demands identified, wherein the patent is generated with the focus of solving a clear problem.

4.2.2 Innovation capability of the university from triple helix and knowledge area perspectives

With the purpose of further exploration of patent and licensing data, the information of assignees of patents was crossed with their knowledge field. Owing to the patents created uniquely by the university, only three departments, Exact Sciences Institute, Biological Science Institute, and Engineering School, have licensed patents, whereas the first, in addition to the best licensing rate, also has the best time to license. Considering the patents generated by the university and government, only the Medicine Faculty and the Institute of Biological Sciences have licensed patents. This is probably because in their majority, the technologies contained in these patents are destined to solve demands related to health issues and, in this case, receive the support of the government with the purpose of solving social demands.

Only the Institute of Exact Sciences, which comprehends disciplines such as physics and chemistry, has patents with the participation of university and industry licensed to markets. In fact, in this institute, there are some research groups maintaining cooperation with industrial agents with the purpose of developed technologies for specific demands. But curiously, the Engineering School, which traditionally encompasses disciplines directed to solve market problems, does not demonstrate the capability of transferring patents generated with the participation of university and industry to markets.

Table 5: Technology transfer rate and time by type of triple helix agent and knowledge area

University Department	University		University and government		University and industry		University, industry and government		University and society	
	Rate	Time (years)	Rate	Time (years)	Rate	Time (years)	Rate	Time (years)	Rate	Time (years)
Medicine Faculty	0.0	-	25.0	3.0	0.0	-	0.0	-	0.0	-
Exact Sciences Institute	3.6	1.5	0.0	-	4.9	1.5	0.0	-	0.0	-
Engineering School	1.7	2.0	0.0	-	0.0	-	0.0	-	0.0	-
Biological Sciences Institute	3.5	3.6	2.6	3.5	0.0	-	0.0	-	0.0	-
Dentistry Faculty	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Fine Arts School	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Veterinary School	0.0	-	0.0	-	0.0	-	50.0	4.0	0.0	-
Nursing School	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Agricultural Sciences Institute	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Architecture School	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-
Physical Education, Physiotherapy and Occupational Therapy School	0.0	-	0.0	-	0.0	-	0.0	-	100.0	2.0
Farmacy Faculty	0.0	-	0.0	-	0.0	-	0.0	-	0.0	-

Only the veterinary school presented licensed patents created through the interaction among the university, industry, and government. This probably occurs due to the interest of the government in supporting the agribusiness sector and the interest of this economic sector in adopting technologies to increase its productivity. However, these patents also present the biggest average time to licensing patents compared with the other modalities and other knowledge areas. This can happen due to the number of assignees and the diversity of interests of agents involved in the property rights of patents. Lastly, this research observed patents created through the partnership between the university and individuals, classified here as civil society. The fact that the totality of patents of this modality was licensed with a low time of transference (2 years) indicates probably a demand perceived in society that motivated the development of a patented invention (100% of deposited patents by Physical Education, Physiotherapy and Occupational Therapy School have been licensed).

5. Discussion

This article assumes the perspective of the social role of the university as the creator of innovative technologies and their transfer to markets (Anderson, Daim and Lavoie, 2007; Kalapouti et al., 2017). As such, the patent is

an important instrument of technology transfer between university and industry, which is in line with the literature (e.g., Siegel et al., 2004). The set of indicators proposed reinforces the current view about the importance of measuring the capability of universities in developing and transferring technologies to society (Chen et al., 2009; Chen and Shu, 2021). From an empirical perspective, this study confirms the findings of Santos and Torkomian (2013) that verified a low patent licensing rate of the universities. In this study, in a universe of 775 patents deposited between 2011 and 2021, only 22 were licensed (2.8% of the total).

This article presents an alternative view in relation to some studies about university performance indicators (Daraio, Bonaccorsi and Simar, 2015; Kalapouti et al., 2017; Chen and Shu, 2021; Herberholz and Wigger, 2021; Luo, 2021) by presenting a proposal of performance indicators to measure the technological transfer of technologies by universities, including three perspectives, general, by the type of triple helix agents, and through the combination of the type of triple helix agent and knowledge area. Thanks to the combination of the ideal types of the triple helix (Etzkowitz, 1984; Leydesdorff and Etzkowitz, 1996; Etzkowitz and Leydesdorff, 2000) and the knowledge area of a patent, this study permits the assessment of the capability of a university to transfer patented technologies to society. Additionally, this set of indicators opens the opportunity for the university to investigate the probable motives due to possible differences in the performance of these indicators, thanks to the criteria for the classification of patents.

6. Conclusion

This article adds to the literature concerning previous research that deals with the measurement of the performance of universities that are based on global performance measurement (Chen, Wang and Yang, 2009; Daraio, Bonaccorsi and Simar, 2015) or focused on their innovative capacity (Anderson, Daim and Lavoie, 2007; Resende, Gibson and Jarrett, 2013; Aragonés-Beltrán, Poveda-Bautista and Jiménez-Sáez, 2017). Its contribution is to propose a set of indicators for measuring the current capability of a university to generate patents and license them to market agents. Particularly, the assessment of the performance of patents according to the types of assignees based on the triple helix and the combination of the types of assignees and the knowledge area of a patent can be a powerful instrument to investigate the causes of eventual differences in the rate and licensing time. From a practical perspective, this set of indicators can be adopted to assess the innovation capability of universities in current ranking models. Once the innovative capability of a university is currently evaluated based only on the number of patents deposited, the indicators proposed in this article assume the Schumpeterian perspective of innovation, which considers innovation when inventions are commercialized in markets (Schumpeter, 1982). Further, they also can be used by universities to assess their performance and investigate the causes of eventual differences in licensing and time rates, with the purpose of developing more efficient policies for the creation of patents and licensing.

As an article limitation, although under capitalism, most innovations manifest themselves as something that can be commercialized, this view has its limitations. This is because there may be innovations that benefit society without necessarily being directly commercialized, for example, several innovations in the health context. This type of innovation can be termed no-market innovation and can be investigated in future studies in the university context.

References

Anderson, T.R., Daim, T.U. and Lavoie, F.F. (2007) “Measuring the efficiency of university technology transfer”, *Technovation*, Vol 27, No. 5, pp 306–318.

Aragonés-Beltrán, P., Poveda-Bautista, R. and Jiménez-Sáez, F. (2017) “An in-depth analysis of a TTO's objectives alignment within the university strategy: An ANP-based approach”, *Journal of Engineering and Technology Management*, Vol 44, pp 19–43.

Araújo, M., Reis, L. and Morais, I. (2021) “Innovation Strategies for Adaptation of Organisations in a VUCA World”, in *Proceedings of the European Conference on Innovation and Entrepreneurship,* pp 1245–1253.

Brito, E.V. de and Fausto, D.A. (2015) “Critérios utilizados por universidades públicas para o abandono de patentes e de pedidos de patentes não licenciados”, *Revista IPecege*, Vol 1, No. 2, pp 147–168.

Chen, S., Wang, H. and Yang, K. (2009) “Establishment and application of performance measure indicators for universities”, *The TQM Journal*, Vol 21, No. 3, pp 220–235.

Chen, X. and Shu, X. (2021) “The Scientific and Technological Innovation Performance of Chinese World-Class Universities and Its Influencing Factors”, *IEEE Access*, Vol 9, pp 84639–84650.

Chang, Y.C., Chen, P.H. and Teng, M.J. (2021) “How do institutional changes facilitate university-centric networks in Taiwan? The Triple Helix model of innovation view”, *Science & Public Policy*, Vol 48, No. 3, pp 309–324.

Clayton, P., Lanahan, L. and Nelson, A. (2022) "Dissecting diffusion: Tracing the plurality of factors that shape knowledge diffusion", *Research Policy*, Vol 51, No. 1, p 104389.

Daraio, C., Bonaccorsi, A. and Simar, L. (2015) "Rankings and university performance: A conditional multidimensional approach", *European Journal of Operational Research*, Vol 244, No. 3, pp 918–930.

Dos Santos, M.E.R. and Torkomian, A.L.V. (2013) "Technology transfer and innovation: The role of the Brazilian TTOs", *International Journal of Technology Management & Sustainable Development*, Vol 12, No. 1, pp 89–111.

Einsenhardt, K.M. (1989) "Building theories from case study research", The Academy of Management Review, Vol 14, No. 4, pp 532-550.

Etzkowitz, H. (1984) "Entrepreneurial scientists and entrepreneurial universities in American academic Science", *Minerva*, Vol 21, No. 2-3, pp 198–233.

Etzkowitz, H. and Leydesdorff, L. (2000) "The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations", *Research Policy*, Vol 29, No. 2, pp 109-123.

Fernandes, J.M., Reis, L.P. and Serio, L.C.D. (2017) "Planning technological businesses: a study of market positioning and the value chain", *Revista de Administração Mackenzie*, Vol 18, pp 70-116.

Herberholz, L. and Wigger, B.U. (2021) "Efficiency of European universities: A comparison of peers", *Research Policy*, Vol 50, No. 9, p 104314.

Jovanović, M., Savić, G., Cai, Y. and Levi-Jakšić, M. (2022). "Towards a Triple Helix based efficiency index of innovation systems", *Scientometrics*, pp 1–33.

Kalapouti, K., Petridis, K., Malesios, C. and Dey, P.K. (2017) "Measuring efficiency of innovation using combined Data Envelopment Analysis and Structural Equation Modeling: empirical study in EU regions", *Annals of Operations Research*, Vol 294, No. 1-2, pp 297–320.

Leite, T.Q., Silva, A.L., Silva, J.R. and Silva, S.E. (2022) "A multilevel analysis of the interaction between science parks and external agents: a study in Brazil and Portugal", *Journal of the knowledge economy*, February, pp 1-40.

Leydesdorff, L. and Etzkowitz, H. (1996) "Emergence of a Triple Helix of university—industry—government relations", *Science and Public Policy*, Vol 23, No. 5, pp 279–286.

Luo, Q. (2021) "Research on the Dynamic Evolution of Scientific and Technological Innovation Efficiency in Universities and Identification of Influencing factors—based on Markov Chain Estimation and GMM Model", *Mathematical Problems in Engineering*, Vol 2021, pp 1–11.

Mowery, D.C., Nelson, R.R., Sampat, B.N. and Ziedonis, A.A. (2001) "The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh–Dole act of 1980", *Research Policy*, Vol 30, No. 1, pp 99–119.

Nelson, A.J. (2009) "Measuring knowledge spillovers: What patents, licenses and publications reveal about innovation diffusion", *Research Policy*, Vol 38, No. 6, pp 994–1005.

Perumal, S., Sreekumaran Nair, S. and Unnikrishnan, R. (2020) "Triple helix in practice in Indian HEIs using lens of academic patenting", *Technology Analysis and Strategic Management*, Vol 32, No. 1, pp 1322-1334.

Ranga, M. and Etzkowitz, H. (2013) "Triple Helix systems: An analytical framework for innovation policy and practice in the knowledge society", *Industry and Higher Education*, Vol 27, No. 4, pp 237–262.

Resende, D.N., Gibson, D. and Jarrett, J. (2013) "BTP—Best Transfer Practices. A tool for qualitative analysis of tech-transfer offices: A cross cultural analysis", *Technovation*, Vol 33, No. 1, pp 2–12.

Reis, L.P., Fernandes, J.M. and Armellini, F. (2021). "Leveraging a Process-Oriented Perspective on Frugal Innovation Through the Linkage of Lean Product Development (LPD) Practices and Waste", *International Journal of Innovation and Technology Management*, Vol 18, No. 7, p 2130004.

Reis, L.P., Fernandes, J.M., Barreto, E.J., Lima, M.V.V. and Armellini, F. (2021). "Impact Assessment of Lean Product Development and Lean Startup Methodology on Information Technology Startups' Performance", *International Journal of Innovation and Technology Management*, Vol 18, No. 6, pp 1-24.

Ryan, P., Geoghegan, W. and Hilliard, R. (2018) "The microfoundations of firms' explorative innovation capabilities within the triple helix framework", *Technovation*, Vol 76, pp 15–27.

Schumpeter, J.A. (1982). "The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle (1912/1934)", *Transaction Publishers*, Vol 1, pp 244.

Secundo, G., De Beer, C. and Passiante, G. (2016) "Measuring university technology transfer efficiency: a maturity level approach", *Measuring Business Excellence*, Vol 20, No. 3, pp 42–54.

Siegel, D.S., Waldman, D.A., Atwater, L.E. and Link, A.N. (2004) "Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university Technologies", *Journal of Engineering and Technology Management*, Vol 21, No. 1-2, pp 115–142.

Silva, S.E., Venâncio, A., Silva, J.R. and Gonçalves, C.A. (2020) "Open innovation in science parks: The role of public policies", *Technological Forecasting and Social Change*, Vol 151, p 119844.

Soares, T.J., Vitale Torkomian, A.L. and Nagano, M.S. (2020) "University Regulations, Regional Development, and Technology Transfer: The Case of Brazil", *Academy of Management Proceedings*, Vol 2020, No. 1, p 12193.

Xue, L. and Gao, Y. (2022) "From Modeling the Interactions among Institutions to Modeling the Evolution of an Ecosystem: A Reflection on the Triple Helix Model and beyond", *Triple Helix*, Vol 8, No. 2, pp 1-11.

Yin, R.K. (2018) *Case study research and applications: design and methods*, Sage, Los Angeles.

Zhang, Y., Chen, K. and Fu, X. (2019) "Scientific effects of Triple Helix interactions among research institutes, industries and universities", *Technovation*, Vol 86, pp 33–47.

Subsidised Start-Ups for the Unemployed in Less Developed Region: Effects Behind Efficiency

Miroslav Šipikal
University Of Economics In Bratislava, Slovensko
miroslav.sipikal@euba.sk

Abstract: One of the tools that governments use to support entrepreneurship is to support entrepreneurship through subsidised start-ups for the unemployed. This tool attempts to solve two problems at once. It acts as an active labour market policy tool to reduce unemployment. On the other hand, as an economic policy measure, it seeks to promote the development of entrepreneurship. Most existing studies focus mainly on measuring the sustainability or effectiveness of this tool. The aim of this article is to identify the pros and cons of this tool from the perspective of the beneficiaries of this support themselves. The research was conducted through interviews with the beneficiaries of the support as well as those institutions that are in some way involved in the process of this support. The interviews took place in the years 2019 -2020 in the Banská Bystrica Region in the Slovak Republic, which is one of the most underdeveloped regions in the European Union. The results of the research show that the support itself also has a positive impact on other aspects of life than the business itself. A large proportion of respondents reported that they are happier in life than before and that their business is much more fulfilling than their previous job. At the same time, however, they point to a distinct form of inefficiency of the support as a tool for entrepreneurship support, with many beneficiaries not using this tool with the primary goal of starting a business. Some of the supported start-ups started their business only as a cover for black and dependent work or as a form of part-time work.

Keywords: support of unemployed, start-ups support, unemployment incentives, support of entrepreneurship, less developed regions

1. Introduction

Support for entrepreneurship of the unemployed is one of the most frequently used tools of active labor market policy and also as a way of supporting the development of entrepreneurial activities, especially in less developed regions. Most studies focus on quantifying the effectiveness and sustainability of such support. In the case of support, most studies have confirmed positive average treatment effects, and in the sustainability of created labor market instruments, this tool usually achieves one of the highest average values (Caliendo and Künn 2011, Milan et. Al 2012; Caliendo et al., 2015; Behrenz et al., 2016, Dvouletý and Lukeš, 2016; Card et al., 2017, Pisár et al., 2021). From the perspective of lagging regions, it is important to note that several studies have shown that it is even more effective for at-risk groups with limited access to traditional employment (Caliendo and Künn 2011; Rodriguez-Planas 2010). In Sweden, for example, the positive effect of employment support was significantly higher for people with basic education than for people with higher levels of education (Behrenz e al. 2016). However, other instruments are much more effective for business support per se, as companies set up by the unemployed have, on average, much worse economic results than other companies created by other forms of support (Shane, 2009; Niefert 2010, new studies). Relatively few studies have looked at qualitative research in this area, such as the impact of contributions on the unemployed themselves as beneficiaries of this instrument or the way in which aid is misused, and most have focused on Western European countries (Binder and Coad, 2016; Abreu et. al, 2019). The aim of this paper is to use interviews to identify the basic aspects of the impact of this contribution on the supported unemployed in one of the least developed regions of the EU and to highlight some qualitative aspects that may affect the quantitative results of measuring the success of this tool.

2. Theoretical framework

The subjective attitudes and motives of the supported unemployed can significantly affect the very effectiveness and sustainability of support for business start-ups by the unemployed. Two basic types of motives can be distinguished. On the one hand, there are the so-called 'pull' factors, where the objective for becoming self-employed is to explore business opportunities. These entrepreneurs are often referred to as 'opportunity' entrepreneurs. On the other hand, there are also several 'push' factors. People who become self-employed due to these of factors become self-employed out of necessity, (i.e. necessity entrepreneurs). Hence, in this case, self-employment appears to be the least unattractive of the unattractive options. Obviously, these people may quit their own businesses as soon as they get a job after becoming self-employed (Masuda 2006; Caliendo, and Künn, 2014). The study by Block et al (2015) also shows that opportunity entrepreneurs are more willing to take risks than necessity entrepreneurs. People with pull motives are much more likely to develop their own business

and subsequently innovate and employ people. In contrast, necessity entrepreneurs typically simply employ themselves (Caliendo and Kritikos, 2019) and often return to employment when given the opportunity. From an employment policy perspective, however, this might be enough, as most other support instruments also do not lead to a multiplication of the jobs created by them. Some recent studies suggest that these motives may overlap considerably. For example, Caliendo and Kritikos, (2019) identify in their research that 13% of all start-ups by unemployed people are driven only by push motives and 16% are guided only by pull motives. The remaining proportion, a majority of over 71% of all unemployed people starting their own business, are influenced by both pull and push motives. The main single factor they identified was termination of unemployment (one of the motives for 80% of people), followed by being their own boss for 60%. These motives can also have spatial differences and impacts, typically considering more necessity-based start-ups established in less developed regions (Bosma and Sternberg, 2014; Laversson, 2018).

Motives also influence the satisfaction of the self-employed. Bidner et al. (2019) found that voluntary self - employed had higher job satisfaction as well as higher life and health satisfaction. However, being forced into self-employment to avoid unemployment confers no such benefits, with both types of self-employments leading to increasing dissatisfaction with one's leisure time. However, this can also be influenced by some external factors. Abreu et al. (2019) report that job satisfaction is significantly higher for people living in semi-urban locations compared to those living in urban and rural locations. Their results also show that individuals in affluent neighbourhoods who have transitioned to self-employment experience higher job satisfaction than otherwise comparable individuals living in materially deprived neighbourhoods, although the latter experience higher levels of life satisfaction following this transition.

Relatively little research has examined how both of these motives affect artificial entrepreneurship in the form of hidden dependent work and, consequently, the results of quantitative studies embracing the effectiveness or sustainability of this tool. According to a representative survey in Slovakia (SBA 2020b), up to 27% of self-employed people perform work that can be classified as dependent work. In the case of this support, this is a situation where someone considers employing an unemployed person but does not do so directly but suggest to unemployed that he/she should use the support for self-employment and then paid for their work in the form of an invoice (so business relationship between them) rather than wage (employment relationship). The employer thus significantly reduces own labour costs and unemployed in not under the protection of employee's rights. For the unemployed who agree to this practice, this consequently constitutes very little social protection, since this ordering of services can be stopped at any time without consequences, unlike the conditions of dismissal. People in less developed regions with a low labour supply may be particularly vulnerable to this pressure.

3. Methodology

Our research paper focuses on the support for self-employment in Slovakia. This type of financial support is defined by § 49 of the Employment Services Act. According to it, financial support can be provided to a jobseeker by the Slovak Office of Labour, Social Affairs and Family to cover part of the costs associated with running a self-employed activity. In order for an unemployed person to receive support, certain conditions must be met. If the person has ceased or suspended self-employment within the 6 months before becoming unemployed, the support can be granted as early as 12 months after being entered in the unemployment register. The business supported by this grant must have been in continuous operation for at least three years from the date of signing the agreement. The maximum total amount of support varies from region to region depending on the unemployment rate, with a maximum of € 6,327.32 in regions with an average unemployment rate of more than 4 times the national average unemployment rate. The support could cover the costs related to the business activities specified in the business plan and must be used for an agreed period. It is usually used for the purchase of equipment and the payment of social insurance. In total, just over 3,000 unemployed people have been supported in this way in the region since 2012.

The research was carried out in the form of semi structured interviews. These were conducted in the Banska Bystrica self-governing region. A total of 36 interviews were conducted. Of these, 23 interviews were conducted directly with people who received and used self-employment support. The remaining 13 interviews were with institutions that were involved in the processes of obtaining or implementing support. Four interviews were conducted with representatives of job centres in various districts of the Banská Bystrica region which administer the support. Another four interviews were conducted with public or public-private partnership institutions

dedicated to business support, including support for this group of people, such as business incubators. The last five interviews were conducted with consultants from private companies that assist such people in obtaining a contribution or training in preparation for business (each person receiving a contribution can also make use of the opportunity to take a state-funded course on 'basics of business' as one of the other active labour market policy measures in Slovakia). We estimate that these people have had direct cooperation with approximately another 300-500 people who used the contribution.

The interviews were conducted in 2020 -2021. The questions focused on three areas:

- 1. Motives for using the support and starting a business
- 2. Self-perceived satisfaction as a self-employed person
- 3. The impact of other external aspects which affected their functioning, in particular in relation to entrepreneurship and employment,

4. Results

Looking at the motives that led the unemployed to start a business, the push and pull motives are relatively evenly balanced, with a larger share of push motives more evident in the most backward districts of the region. It is often the case that both motives are present, e.g. "I was unemployed for a long time, and I wanted to do something and I was quite tempted to try a new business". A range of more specific motives emerged in our sample, and among the most common of these we can include the end of unemployment benefits and thus the need for income, the desire to use one's experience from previous employment ("I worked as a seamstress all my life. When my company went bankrupt, I thought I might try to start sewing for customers myself") and the need for more independence and decision-making about their working hours (the typical motive "I want to be my own boss"). Personal motives were strongly predominated, with only a small number of motives persuaded by my family or friends, and in some cases some subtle pressure from job centres to use this tool was also mentioned.

The provision of support was often perceived as a relatively strong impetus for the final decision. Especially in less developed regions, where the amount of this support was higher and the overall wages in the region were lower, the support played an important positive role in final decision on whether to start a business. At the same time, however, financial support also proved to be the majority source of start-up capital, which logically led only to the establishment of business in low capital-intensive sectors such as seamstresses, repairers, accountants, etc. On average, support accounted for more than 75% of the start-up costs. Other sources of start-up capital reported by the unemployed were their own savings or loans from friends and family. No one in our sample used any other external form of financing, and even the interviews with support organisations confirmed that these unemployed people make virtually no use of use external financial resources (such as banks loans or business angels). This is one of the major barriers to making this support work as a business support and not just an employment support. Several other studies have identified access to capital for the unemployed as one of the key issues (Caliendo et. al, 2020). We were surprised that the relatively long period of sustainability of the business to which the unemployed had to commit, otherwise they would have to return the funds (3 years), did not play a more prominent role in their decision-making. Most of them said that they did not consider this aspect in any way in their decision-making.

As many as 87% of those who responded in our sample were satisfied with their decision and felt content with their decision to start a business, despite some problems. According to the support organisations, this contribution has a significantly higher positive impact on the satisfaction and quality of life of the unemployed who take advantage of it, compared to other forms of active labour market policy. This satisfaction was also felt by those who eventually left the business for financial reasons and found other jobs. The most significant positive factors that affected their quality of life were the management of their own time ("when I used to go to work, I spent a lot of time there for little money. Now I was earning even less, but I was under a lot less pressure, and I had more time for other things"). It is also interesting to note that for a relatively large number of people, especially women, this contribution served as an alternative to part-time work. This type of motivation was also confirmed in interviews with job centres and support organisations.

In our survey, this is mainly applicable to women who had a family. The statistics show that women (as well as married women) received support more often than married men and more often compared to their

representation in the whole sample of entrepreneurs. This suggests that women are not primarily using the allowance to start a business. These women are mostly looking after a family and do not need to have a high income. They would prefer to be employed part-time, but these jobs are not available in the local labour market. This behaviour may be partly specific to Slovakia, as part-time employment in Slovakia is less than 5%. This is one of the lowest in the EU (EU Average is 21.1%, Eurostat). This situation is even worse in those regions with high unemployment, where people are willing to work full-time even for a very low wage and employers therefore have no reason to offer part-time work. These women were particularly very satisfied with their use of the contribution, even though they often earn less than the full-time minimum monthly wage ("I couldn't afford such flexible working hours, now it's completely different"; "it's a completely different feeling of work when I do not have to meet deadlines"). They see the support as a kind of substitute for flexible part-time work they cannot otherwise find. Their spouses or partners earn enough to support the family, so they do not need to earn much and prefer to devote themselves to the family. At the same time, they are mostly engaged in an area that they enjoy, which adds to their sense of satisfaction with this form of income-generating activity. This may be one of the explanations why women use the support significantly above average compared to traditional business. Within the Banská Bystrica region, more than 65% of entrepreneurs are men, but women predominate in the use of this allowance (more than 54 %).

Paradoxically, most of the negative views on satisfaction with their decision were due to implementation problems in the delivery of the contribution. The use of the funds provided must be proven and the rules for their use are quite strict and often not fully known to the unemployed. ("After receiving the contribution, I would sort of cease to exist for them, they would not come back until I provided the necessary documents and then they would tell me that I had given them late and they could not repay them". Only when I submitted the documents did they tell me that I had to buy goods from the original manufacturer or ask for three independent quotes"). The need to repay the support thus significantly worsened the already problematic financial situation of the unemployed, which logically had an impact on their satisfaction and quality of life. Another factor leading to a lower level of satisfaction was also directly related to the implementation of the support, although this was primarily due to the unemployed themselves, namely the unpreparedness of the applicants for business. The majority of the respondents stated that they did not have a precise idea of what was ahead of them. This has often led to the aforementioned problems of an administrative nature (e.g. problems with deadlines and paperwork at the various offices such as the social insurance or the tax office), as well as to a lower sustainability of the business itself. A large part of the unemployed decided to start a business because they had quite extensive experience in the field, but significantly underestimated the universal aspects of entrepreneurship, such as marketing, accounting, or bureaucracy. Most of them had only minimal experience in these activities and did not pay enough attention to them when preparing their business. There was also a distinct lack of business advice and training in the use of the support. A negative is the inability to take advantage of training or counselling after starting a business, which are often part of these support systems in other countries and can have a significant impact on the success of the support provided (Wolff et al., 2016).

The final issue raised by the interviews was the use of the allowance to cover dependent work. According to a representative survey (SBA 2020b), up to 27% of self-employed people perform work that can be classified as dependent work. The survey also found that this kind of substitution is most used by men in construction and by women in administrative and service activities. Our survey confirmed this issue. There was only one person in our survey who could be said to have been affected by this problem, but most of the organisations interviewed confirmed this practice as fairly common and for most of the unemployed it was not their own decision. However, from our limited research it is not possible to formulate hypotheses as to how this aspect affects the overall effectiveness or sustainability of this tool. However, this substitution of the nature of the support, which is business support, may be one of the reasons why several studies identify lower survival and success rates for companies set up with this support compared to those set up without support (Shane, 2009; Caliendo et. Al., 2020).

5. Conclusion

The aim of this paper was to identify the qualitative aspects of start-up support for the unemployed in one of the least developed regions of the European Union. Most of the unemployed have both push and pull motives to use this support. We found that its use led to an improvement in the perceived quality of life, which was to some extent a greater reason to use this support as an incentive to start a real business. The downside of using this support is that it is also actually used as a substitute for dependent or part-time work.

This research was conducted only as a qualitative survey with a limited sample of respondents; therefore, it is not possible to generalise these conclusions. However, the research has identified some important aspects that may have a significant impact on the sustainability and effectiveness of this support, and which would require further in-depth research.

References

Abreu, M., Oner, O., Brouwer, A., & van Leeuwen, E. (2019). Well-being effects of self-employment: A spatial inquiry. *Journal of Business Venturing*, *34*(4), 589-607.

Binder, M., & Coad, A. (2016). How satisfied are the self-employed? A life domain view. Journal of Happiness Studies, 17(4), 1409-1433.

Block, J., Sandner, P., & Spiegel, F. (2015). How do risk attitudes differ within the group of entrepreneurs? The role of motivation and procedural utility. Journal of Small Business Management, 53(1), 183-206.

Behrenz, L., Delander, L., Månsson, J. (2016). Is starting a business a sustainable way out of unemployment? Treatment effects of the Swedish start-up subsidy. Journal of Labor Research, 37(4), 389-411.

Bosma N, Sternberg R (2014) Entrepreneurship as an urban event? Empirical evidence from European cities. Regional Studies 48(6), 1016–1033

Caliendo, M., Hogenacker, J., Künn, S., Wießner, F. (2015). Subsidized start-ups out of unemployment: a comparison to regular business start-ups. Small Business Economics, 45(1), 165-190.

Caliendo, M., Kritikos, A. S. (2010). Start-ups by the unemployed: characteristics, survival and direct employment effects. Small Business Economics, 35(1), 71-92.

Caliendo, M., Kritikos, A. S. (2019). "I want to, but I also need to": start-ups resulting from opportunity and necessity. In From industrial organization to entrepreneurship (pp. 247-265). Springer, Cham.

Caliendo, M., Künn, S. (2011). Start-up subsidies for the unemployed: Long-term evidence and effect heterogeneity. Journal of Public Economics, 95(3-4), 311-331.

Caliendo, M., Künn, S., & Weissenberger, M. (2020). Catching up or lagging behind? The long-term business and innovation potential of subsidized start-ups out of unemployment. Research Policy, 49(10), 104053.

Dvouletý, O., & Lukeš, M. (2016). Review of empirical studies on self-employment out of unemployment: do self-employment policies make a positive impact? International Review of Entrepreneurship, 14(3), 361-376.

Lavesson, N. (2018). How does distance to urban centres influence necessity and opportunity-based firm start-ups?. Papers in Regional Science, 97(4), 1279-1303.

Millán, J. M., Congregado, E., Román, C. (2012). Determinants of self-employment survival in Europe. Small Business Economics, 38(2), 231–258

Pisár, P., Mertinková, A., Sipikal, M. (2021). What Factors Influence the Survival of Subsidised Start-ups for the Unemployed in Slovakia? Central European Public Admininistration Review, 19, 109.

Rodríguez-Planas, N., Jacob, B. (2010). Evaluating active labor market programs in Romania. Empirical Economics, 38(1), 65-84.

Shane, S. (2009). Why encouraging more people to become entrepreneurs is bad public policy? Small business economics, 33(2), 141-149.

Slovak Business Agency - SBA (2020): Analýza vybraných aspektov podnikania SZČO, Bratislava http://monitoringmsp.sk/wp-content/uploads/2020/05/Anal%C3%BDza-vybran%C3%BDch-aspektov-podnikania-SZ%C4%8CO-1.pdf Accessed 3rd May 2021.

Wolff, J., Nivorozhkin, A., & Bernhard, S. (2016). You can go your own way! The long-term effectiveness of a self-employment programme for welfare recipients in Germany. International Journal of Social Welfare, 25(2), 136-148.

Legal Incentives and Constraints on Innovation: Keeping the Balance

Robert Brian Smith and Mark Perry
University of New England, Armidale, Australia
r.b.smith@unswalumni.com
mperry21@une.edu.au

Abstract: The COVID-19 pandemic forced civil society and business to face a new reality where much greater reliance needed to be placed on networked devices and internet distributed communications, including the provision of services ranging from medical advice to food, entertainment and even the facility to interact with family. The ability to meet in-person with family, friends, colleagues, business associates or customers was severely restricted leaving internationalisation as a utopian dream as borders were closed, students were denied access to a physical classrooms and businesses had to rapidly "pivot" or fail. These alternatives to real life have seemed less appealing to many, with every aspect of life "going online", whether virtual lectures, exams, meetings, mediations, court appearances, job interviews, shopping for a piece of cheese or starting a new trade relationship. Much innovation over the last two years has been around deploying online business models. There has also been a wider use of artificial intelligence to support "efficient" operations partly stimulated by the falling staffing levels due to the pandemic directly through sickness or forced isolations, or indirectly by a growing sense of the futility of working for a business, known as the Great Resignation ("Over the 12 months ending in January 2022, hires totalled 76.4 million and separations totalled 70.0 million…" indicating a huge refocusing on jobs in the USA) This paper looks at the challenge for legal systems to pivot around the growing trends in deployments of online innovation. Some businesses are now widely deploying software-based analysis systems, such as Airbnb, which is using them to "verify the identity and trustworthiness of a user of an online system" and flag potential guests who may be problematic. Although Airbnb is a multibillion-dollar business, it is a good example of how through using publicly available data, user supplied information, and smart software (artificial intelligence) a business can make predictions on the behaviour of its potential customers. Other AI resources have been creating new gaming scenarios, reporting on the news, and even creating new artworks and music. These kinds of use of AI in the marketplace have challenged the legal frameworks that support individual privacy and also ideas around human creativity.

Keywords: legal systems, online innovation, COVID-19, artificial intelligence, great resignation

1. Introduction

In March 2020 the world was turned upside down as COVID-19 spread around the world. Countries closed their borders and introduced what were sometimes draconian measures to counter the spread of the disease as the number of hospitalisations and deaths rose exponentially. Suddenly, the lexicon, even in non-English speaking countries included the word "lockdown". Infected persons and their close contacts were suddenly confined to strict quarantine as were those international and in many cases interstate travellers who were actually allowed to travel. For instance, Australia closed itself of from the world for nearly two years. Mask mandates became the norm and once vaccines became readily available there were vaccine mandates.

The impact on the world economy was enormous (see Table 1). Businesses around the world were confronted with the impacts of the lockdowns, staff shortages and supply chain delays as the global economy contracted. Where possible staff worked from home and online shopping surged. Businesses had to refocus their operations to suit. Unfortunately, not all managed to tailor their operations to meet the new environment – some business failed but others flourished. Suddenly people became very active on social media and suddenly businesses, teachers, university lecturers and conference organisers were learning the intricacies of tools such as Zoom, Microsoft Teams and Skype as well as adapting YouTube from a social media tool to an essential business and learning tool.

Table 1: OECD, IMF and World Bank World-wide economic forecasts

Organization	Percentage Change in Real GDP Growth			
	2019	2020	2021	2022
OECD (Sep. 2021 Projections)		-3.4	5.7	4.5
IMF (Oct. 2021 Projections)		-3.1	5.1	4.9
World Bank (Jan. 2021 Projections)	2.3	-4.3	4.0	

Source: (Jackson et al, 2021, p 33)

The academic Andrew Klotz coined the phrase "the great resignation is coming" during the second year of the COVID-19 pandemic (February 2021) (Clark, 2022). Klotz considered that there were four possible reasons for

phenomenon: pent-up resignations from the first year of the pandemic; workers became burnt out; Terror Management Theory – the idea that people when are confronted with serious illness or death reflect on the meaning of life; and people who had worked from home saw the benefits of this lifestyle and wanted to keep their autonomy. In February 2022 4.4 million people left the workforce. This represented 2.9% of the working population and would clearly have a significant impact on the industries in which they work.

This led to the need for innovation at the local level as well as at the "high-tech" global level. At the same time the general populous was knowingly, but more often than not unknowingly, forgoing their privacy as they engaged on social media and provided personal data to online businesses large and small.

In the broader context it has been argued that "no matter its industry or current standing, an organization cannot expect to maintain a competitive edge if innovation is not part of the overall business strategy" (Purcell, 2019). This paper seeks to recognise, understand, and communicate the legal incentives and constraints on innovation, especially in the last two years of pandemic. It provides a helicopter view and indicates areas for further research.

2. Status quo – WIPO and the GII

Intellectual Property (IP) frameworks are the laws and administrative bodies and arrangements used to implement intellectual property norms, which over the last century have seen growing global harmonisation under international treaties, conventions, and unilateral agreements. National IP processes deploy these frameworks within a country in the name of fostering innovation and creativity as well as achieving other policy goals, such as boosting a particular manufacturing sector. The IP institutions are an important part of a country's innovation pipeline organisation, which partly determines national innovation competitiveness. There are significant differences in how internationally harmonised IP frameworks are implemented by country specific processes in different countries. Given the variances in outcomes in terms of innovation, it is considered that processes influence outcomes.

IP laws create a bundle of rights and duties through statute or common law, bestowing monopolies with defined limitations, over creations of the human intellect. The breadth of IP has been extended to include many forms of creativity, invention, design, commercial secrets and reputation, plant breeding, control of unfair competition, integrated circuits, and, it is sometimes claimed, even some datasets required for regulatory approvals. Each type of IP has legislative or common law frameworks that prescribe the prerequisites for rights, and their limitations. These rules are implemented through legislative and administrative processes, often involving legal and other expert advisors. There are many transactions and transaction costs involved, which affect the strategic and economic positions of the parties. The application of transaction costs concepts to law and policy reform is illustrated in (Martin and Shortle, 2010).

The coverage of IP and the duration of protection has increased over the decades. This is partly due to international free trade agreements, and global harmonisation of IP rights through the World Trade Organization (WTO) and the World International Property Organization (WIPO). This evolution particularly reflects the interests of countries with strong IP portfolios and powerful business systems, pursuing national and corporate interests. There is evidence that IP is sometimes used by powerful corporations to suppress competitors, but the extent to which IP is used in this way in Australia, and the impacts of IP based competitive tactics on Australian firms, is not known.

IP processes can be modified to improve the implementation of internationally compliant IP frameworks. Conventions, treaties, and free trade agreements require harmonisation of basic IP frameworks (Perry, 2018), but there are jurisdictional variations (Wan and Perry, 2019). The variations to the innovation process of countries involve IP transaction costs and administrative processes, process impediments to collaboration, and can target support to fields of national advantage. In particular, SMEs find it especially hard to maximise the benefits of IP and can encounter barriers put up by powerful incumbents (Wilkinson and Perry, 2005). For instance, Australia has been attempting improvements to its intellectual property legislation for decades, largely through multiple changes to the Patent Act (2020). The result of many amendments is a comparatively convoluted intellectual property regime, that does not appear to have delivered significant benefit (as indicated by innovation metrics).

3. Does the GII Reflect the Reality of Innovation

One of the perennial issues with the GII is that the data array varies year by year and the method of measuring indicators can change. For instance, in the GII for 2021 eleven of the 81 indicators were modified (World Intellectual Property Organization, 2021, p 176). Five indicators involved changed methodology, three indicators were added, two dropped and one indicator underwent a name change. Timeliness is also an issue. The data used in calculating the GII for 2021 included 30.0% from 2021, 41.4% from 2019, 17.5% from 2018, 5.9% from 2017, 1.2% from 2016 and a "small remainder" of 4.0% were from "earlier years" (p 176-177). The GII for included 63 quantitative/objective/hard data; 15 composite indicators/index data: and 3 survey/qualitative/subjective/soft data indicators. (p. 177). It should be further noted that year on year rankings depend on the actual performance of the economy; adjustments made to the GII framework, and the economies included or excluded in the sample (p. 177). Finally,

> *A detailed economy study based on the GII database and the economy profile over time, coupled with analytical work on the ground, including that of innovation actors and decision-makers, yields the best results in terms of monitoring an economy's innovation performance, as well as in identifying possible avenues for improvement. (p. 178).*

Stavbunik and Pelucha (2019, pp 13-14) found that all seven indicators consistently correlated against some of the sub-pillars although in some cases the relationships were negative (p. 14). Concluding that higher innovation results in higher competitiveness of an economy as competitiveness is "a multi-faceted and complex phenomenon" (Jankowska et al, 2017, p 90). Redman (2020) opined that:

> *Nevertheless, as imperfect as it is, measuring innovation and ranking it remains a preoccupation of administrations around the world . . . So, the issue is not if innovation is going to be measured but how it can be measured in a way that will be meaningful . . . (p 2499 & 2501).*

Even now in 2020, the opinion expressed by Gu (1999) seems prescient. developing nations have greatly differentiated institutional structures policy and measures from one system to another and cannot be simply moved from one jurisdiction to another (p 61). He argues that the National Innovation Strategy (NIS) approach is more appropriate (p 61) as it:

> *advocates for a policy process which keeps the most basic principles, such as promoting knowledge inflows and enhanced learning, creating innovative dynamics, facilitating the development of knowledge networking. Detailed policy measures may be better made only based on intimate analysis of local situations in technology, institution, human capital, and other aspects. And as a process an initiated policy must be open to timely adjustment (p 61).*

When even the authors of GII 2021 are against simply use the Global Innovation Index as **the** measure of innovation why do countries still persist in using it exclusively to measure their innovation performance?

4. Innovation independent of IP

In recent years, particularly in Europe, increasing attention is being paid to managing IP competitive effects. Europe achieves greater innovation output with IP overall (World Intellectual Property Organization, 2021, p 21), whilst also implementing globally harmonised IP laws (Margoni, 2019). The performance differences in innovation output are due to many variables. The EU has focussed on three policy goals: "open innovation", "open science", and "open to the world" (European Commission Directorate-General for Research and Innovation, 2016), aiming to foster access to knowledge for advancement, and overcoming innovation barriers while retaining alignment with harmonised IP frameworks. It is premature to draw conclusions about the effectiveness of the EU approach (Margoni et al, 2016, Guibault and Margoni, 2015, Guibault, 2020).

A recent study by Ji et al (2020) explored open innovation from the perspective of patent citations, focussing on the driver assistance system (DAS) as the research case (p 5). They noted that "the storm of digitization and intellectualization in recent years has forced them to cope with the dual dilemmas caused by innovation and cost" (p. 5). On the other hand, Information and Communications Technology (ICT) companies have entered into the research and development field of driver assistance systems. They found that flow of knowledge that "exists between different types of firms significantly facilitates the [Open Innovation] network" (p 9). They also found that the formation of open innovation networks was improved by the geographic proximities of firms and the number of employees. Their research confirmed that "small firms are more active in OI strategies, as they hope

to rapidly increase their capabilities and quickly bridge funding gaps by marketing their technologies, while the flexible organizational structure within them also indirectly promotes the above behaviour".

The efficacy of open access publishing continues to draw criticism, especially following the early publications of Jeffrey Beall and his controversial "Beall's List" which at times conflated "open access" with "predatory" (Krawczyk and Kulczyck, 2021) (p. 1). The criticisms of the Open Access movement often use Beall's lists and his paradigm for a predatory journal as well as his bias against the Open Access model (p 9). Kumar et al (2022) argue that open access publications are at risk of predatory publications in the internet era and argue for a universally accepted definition of a predatory journal (90). In response to their article, Papanikos (2022) argues that the whole discussion around predatory journals is specious and that the only test that should be that a journal is "demanded" ie "academics read it and researchers submit papers to be considered for publication".

Collective intelligence of open access journals has been found to create more open innovation than closed access journals (Yun et al, 2022). It increased in response to the digital transformation, with the "increased moderating effects of references on the correlation between collective intelligence and open innovation and the increased references from digital transformation with the growth of Open Access, which created greater open innovation (p 2574-16).

5. Impact of COVID-19 on innovation

The pandemic saw the development of innovative contact tracing applications. Some apps were a success and others were essentially failures (Rowe, 2020) (p. 1). The use of QR codes were widely adopted. Rowe considered that there were three critical conditions for such an *app* to be effective in identifying infected individuals:

- Correct information qualifying individuals as infected and contagious requires that population be tested and that tests are not error-prone,
- High likelihood that when a contagious person meets or crosses another person an infected person both parties have a smartphone,
- A very high proportion of smartphone users download the app (Rowe, 2020) (p. 2).

He considered it would be very likely that all of these conditions would be met. Further he noted the inherent dilemma that "[W]hile privacy is a fundamental human right, freedom to move and safety are also fundamental" (Rowe, 2020, p 2). Again, there is another dilemma who or what should be protected. For instance, contract tracing may have the greatest benefit in protecting health workers and the more vulnerable members of the population. Privacy is a major issue and Rowe pointed out that those apps which used Bluetooth technology were subjecting the user to major privacy issues as Bluetooth is "notoriously fraught with data breaches". Further the haste with which apps were developed often resulted in technological solutions "that runs completely against all socio-technical lessons from IS and other sociotechnical disciplines" (p 4). Fahey and Hino 92020) summed up the situation fairly succinctly and therefore has been quoted in full:

> *"The experience of health authorities seeking to rapidly develop and implement digital contact tracing applications in countries around the world should serve as a sobering case study for researchers whose work relies on gathering large amounts of information about individuals – both in public health and across many other fields. The wide divergence of different approaches has revealed a complex set of overlapping national and regional factors related to priorities in research data collection, strength of privacy protection both in law and in common perception, depth of public trust in various institutions, and the ability of national authorities to resist or avoid the path-dependency imposed by the dominance across many fields of a small number of technology companies" (p. 102181-4).*

As developing countries, in general, were impacted more severely by the COVID-19 pandemic the report prepared by Ramalingam (2020) on innovation, development and COVID-19 is enlightening. He used the OECD Observatory of Public Sector Innovation (OPSI) to assess the innovation (pp. 6-7):

- Mission-driven innovation – this includes development of COVID-19 vaccines and arrangements for their equitable distribution;
- Enhancement-oriented improvements – "tracking, tracing quarantining and shielding vulnerable groups builds on lessons learned from previous epidemic responses, with adjustments made for the specific epidemiology of COVID-19";

- Adaptive innovations – original, simple and locally generated ideas; and
- Anticipatory – governments are trying to rethink the possible landscape of the post-pandemic world.

Hamer and Goldstone (2020) from PricewaterhouseCoopers Australia opined that, as many companies have adopted the "work from home" following its success during COVID-19:

- "The pandemic-induced economic downturn may not necessarily be stifling innovation, but a lack of water cooler talk, and casual communication could"; and
- "Organisations need to find a way to decrease the amount of time spent in structured meetings and increase opportunities for people to be creative."

6. Impact of deployment of AI on innovative aspirations of nations

The adoption of AI technologies can have a significant impact in agriculture (Galaz, 2020). For this to happen in a responsible way, Galaz argues that the key players "must revise their simplistic assumptions about AI". He argues that the idea that the benefits of AI will not automatically trickle down to those most in need. The cost of digitalisation of agriculture is likely to require a large investment, developed infrastructure such as internet access and user education. Finally, he argues that "[t]echnology giants, governments and civil society need to work with sustainability scientists to develop strong principles that guide the development of AI towards sustainability for all". Algorithms already drive drip irrigation, top-soil monitoring monitors, weed-detecting rovers, self-driving tractors as well as combine harvesters (Tzachor, 2022). They are, however, subject to hacking, accidents, malfunctions, and programming errors. As a result, safety should be preferred over speed and AI design for agricultural use should utilise experts from different fields in the process. Rose et al, (2021) consider that responsible development must include those who might be affected by autonomous agricultural robots including manufacturers, regulators, and rural communities. Regulators should develop obligations of the operators of the robots, conditions of operation and responsibility for the safety of the workers and the public.

There is evidence that the AI algorithms are "notoriously prone to biases" (Douglas, 2019). AI researchers have focussed on the development algorithms that are procedurally fair due to the features of the algorithms themselves rather than the impact of their deployment. They propose that the developers focus on maximising the accuracy of the AI design with state regulator ensuring fairness with expert and democratic input. Such an approach has been successful in medicine where the medical practitioners promoting patient well-being whilst health funders and policymakers promoting fair allocation of resources across patients.

AI is being used increasingly in predictive policing around the world but "the apparent neutrality of the data is questionable" (Rowe, 2018). So:

> *society needs to maintain a critical perspective on the use of AI on moral and ethical grounds. Not least because the details of the algorithms, data sources and the inherent assumptions on which they make calculations are often closely guarded secrets. Those secrets are in the hands of the specialist IT companies that develop them who want to maintain confidentiality for commercial reasons. The social, political and criminal justice inequalities likely to arise should make us question the potential of predictive policing (Rowe, 2018).*

The impact of the COVID-19 pandemic resulted in the use of Artificial Intelligence (AI) to "respond to the health crisis and mitigate its effect on many industries and society" (Coombs, 2020, p 2. He suggests that there are a number of arguments in favour the increased adoption rates of AI: namely changing consumer preferences, increasing familiarity with IA technologies and increasing business confidence in the technology. On the other hand, there are still a number of influences against: availability of big data and its reliability (GIGO), many tasks are still better done by humans, as AI technologies are still narrow in application and there is a high availability of human workers. Finally, he argues that "practitioners must keep in focus on the limitations of [AI]" (p 4). To ensure the best outcomes: "business leaders may need to consider new job redesign strategies that take into account role changes and new skill requirements for human workers to maximise the return from [AI] investments" (p 4).

(Drydakis (in press) developed a 10-item scale to assess AI usage in Small and Medium Enterprises (SMEs) in London, England (no pagination). He analysed their AI roles in marketing, sales, communication, predictions, pricing and cash flow, fake reviews, cybersecurity, recruitment, and legal services. He found that the business risks caused by the COVID-19 pandemic declined with the use of AI applications. A literature review conducted

by Kumar and Kalse, (in press) concluded that adoption of AI can improve the conditions of SMEs especially after the pandemic. They found that adoption of AI will benefit SMEs in roles such as those investigate by (Drydakis, in press) above. It "will also help in achieving sustainability because of less usage of physical resources, economies of scale in production, and transition towards technology" (Kumar and Kalse, in press). Eighteen semi-structured interviews were conducted by Baez and Igbekele (2021) to investigate challenges of AI adoption in Swedish SMEs (p 16). The research found that organisational change is a "fundamental challenge of AI adoption" (p 21). Another challenge is that "[a] previously failed project might demotivate others to initiate a similar project (p 22). Data was "seen as one of the biggest challenges ". The business problem must be identified first before adopting AI and not the other way around (p 23) and the development team must consist of more than AI specialists and include other specialties including the business owner or expert that understands the business issues and can "translate" them to the rest of the AI implementation team (p 24).

7. Discussion

This paper has given a helicopter view of legal incentives and constraints on innovation, particularly during the current pandemic. The first issue that was raised was the impact of big business particularly the pressure that can be applied to negotiations in free trade agreements and at the World Trade Organization by the economically powerful economies to the detriment of their developing neighbours. Clearly, the developing economies would benefit from Open Intellectual Property frameworks, but will such a system be acceptable to the large economies such as the United States which have a strong IP enforcement culture?

Whilst the Global Innovation Index has been largely accepted as a measure of innovation there is enough evidence to suggest that countries need to delve into the data rather than just seek to improve their ranking. Focussing on areas to improve the ranking will not necessarily lead to a more innovative economy. What they must do is focus on their particular needs to develop a national innovation framework.

Open innovation is becoming more pervasive, particularly in the area of academic publications. Even some books are being published to join the plethora of Open Access journals which provide ready access to ideas. There are no doubt predatory journals but as suggested by Papanikos (2022) the best test is whether the journal articles are read, and researchers submit papers. Open access in the areas of patents is a much more fraught area and it is considered that many battles will be fought before it is a widespread phenomenon.

Innovation came to the fore during the COVID pandemic particularly in the response to the health emergency. It also led to the development of AI solutions, some which were a success and others that we an abject failure. Privacy was often poorly considered. The development of AI solutions requires a multi-skilled team and should not rely solely on IT professionals.

8. Conclusion

A number of priority areas for further research have been identified in this study. These include:

- Countries take pride in their advancement in the GII ranking. Recent research has called the efficacy of the GII into question as countries strive to improve their ranking by focusing on key elements of the GII, rather than taking their own national view of what types of innovation should be focused upon for internal gains. In this case the research question would be *"Does the GII Reflect the Reality of Innovation within a jurisdiction?"*
- The drive for open innovation, particularly in Europe, has been studied but the possibility of transplanting such a system into developing countries is more problematic as much of the innovation is imported. This requires further investigation to see whether open innovation is possible where much of the innovation has been developed in a different jurisdiction.
- COVID-19 brought about many innovations at both the global and local levels. There is already a significant literature available on the impact of COVID-19 on many areas of life, including innovation. Not all of the innovations have been successful. This needs to be further investigated at both the enterprise and global level. At times it will focus on an industry and at other times may have more global implications.
- Although there have been rapid recent advances, artificial intelligence and its deployment on a broad scale is still very much a work in progress. The areas for legal and scientific research are open ended.

Acknowledgements

This research is supported by an Australian Government Research Training Program (RTP) Scholarship to the first author.

References

Baez, J.R. and Igbekele, R. (2021). *Challenges of AI Adoption in SMEs: Insights from the Swedish AI Ecosystem.* Master of Science, KTH Royal Institute of Technology.

Clark, P. (2022). "The man who predicted the Great Resignation says quitting is contagious", *The Financial Review,* 7 April 2022, [online] https://www.afrcom/work-and-careers/careers/the-man-who-predicted-the-great-resignation-says-quitting-s-contagious-20220406-p5abbc.

Coombs, C. (2020). "Will COVID-19 be the tipping point for the Intelligent Automation of work? A review of the debate and implications for research", *International Journal of Information Management,* Vol. 55**,** No. 102182, 1-4.

Douglas, T. (2019). "Biased algorithms: here's a more radical approach to creating fairness", *The Conversation,* 21 January 2019 [online], https://theconversation.com/biased-algorithms-heres-a-more-radical-approach-to-creating-fairness-109748.

Drydakis, N. (in press). "Artificial Intelligence and Reduced SMEs' Business Risks. A Dynamic Capabilities Analysis During the COVID-19 Pandemic", *Information Systems Frontiers,* https://doi.org/10.1007/s10796-022-10249-6.

European Commission Directorate-General for Research and Innovation (2016). *Open Innovation, Open Science, Open to the World – a vision for Europe,* Luxembourg, Publications Office of the European Union.

Fahey, R.A. and Hino, A. (2020). "COVID-19, digital privacy, and the social limits on data-focused public health responses", *International Journal of Information Management*, Vol. 55, No. 102181, 1-5.

Galaz, V. (2020). "AI can tackle the climate emergency – if developed responsibly". *The Conversation*, 23 April 2020, [online], https://theconversation.com/ai-can-tackle-the-climate-emergency-if-developed-responsibly-132908.

Gu, S. (1999). Implications of national innovation systems for developing countries - Managing change and complexity in economic development. *UNU/INTECH Discussion Papers,* No. 9903.

Guibault, L. (2020). "Drawing the Contours of the European Public Domain". *In:* Godt, C., Van Overwall, G., Guibault L. and Beylefeld, D. (eds.) *The Boundaries of Intellectual Property* [online], https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=408281.

Guibault, L. and Margoni, T. 2015. "Legal Aspects of Open Access to Publicly Funded Research". *In:* OECD (ed.) *Enquiries into Intellectual Property"s Economic Impact.* Paris: OECD.

Hamer, B. and Goldstone E.L. (2020). "The work-from-home innovation drought" [online], Sydney: PwC, https://www.pwc.com.au/digitalpulse/work-from-home-innovation-drought.html.

Jackson, J. K., Weiss, M.A., Schwarzenberg, A.B., Nelson, R.M., Sutter, K.M. and Sutherland, M.D. (2021). "Global economic effects of COVID-19: Updated November 10, 2021". *CRS Report R47270*: Congressional Research Service [online] https://sgp.fas.org/crs/row/R46270.pdf.

Jankowska, B., Matysek-Jedrych, A. and Mroczek-Dąbrowska, K. (2017). "Efficiency of national innovation systems – Poland and Bulgaria in the context of the Global Innovation Index". *Comparative Economic Research,* Vol. 20**,** No. 3, 77-94.

Ji, Y., Yu, X., Sun, M. and Zhang, B. (2020). "Exploring the evolution and determinants of open innovation: A perspective from patent citations". *Sustainability,* Vol. 14**,** No. 2574, 1-11.

Krawczyk, F. and Kulczyck, E. 2021. "How is open access accused of being predatory? The impact of Beall's lists of predatory journals on academic publishing". *The Journal of Academic Librarianship,* Vol. 47, No. 102271, .

Kumar, A., Gupta, R., Tripathi, K.K. & Singh, R.R. (2022). "Predatory publications in the era of the internet and technology: Open access publications are at risk". *Athens Journal of Mass Media and Communications,* Vol. 8**,** No. 2, 79-92.

Kumar, A. & Kalse, A. (in press). "Usage and adoption of artificial intelligence in SMEs", *Materials Today: Proceedings,* https://doi.org/10.1016/j.matpr.2021.01.595.

Margoni, T. (2019). "Design rights and 3D printing in the UK - Balancing innovation and creativity in a (dis)harmonised and fragmented legal framework", *In:* Mendis, D., Lemley, M. and MATTHEW, R. (eds.) *3D Printing and Beyond: The Intellectual Property and Regulation.* Cheltenham UK: Edward Elgar.

Margoni, T., Cacso, R., Ducato, R., Guardo, P. and Moscon, V. (2016). "Open access, open science, open society". *In:* Loizides, F. & Schmidt, B. (eds.) *Positioning and Power in Academic Publishing: Players, Agents and Agendas: Proceedings of the 20th International Conference on Electronic Publishing.* Amsterdam: IOS Press.

Martin, P. and Shortle, J. S. (2010). "Transaction costs, risks, and policy failure". *In:* Soares, C. D., Milne, J., Ashiabor, H. and Deketelaere, K. (eds.) *Critical Issues in Environmental Taxation: International and Comparative Perspectives.* Oxford: Oxford University Press.

Papanikos, G.T. (2022). "Predatory Publications in the Era of Internet and Technology: A Comment", *Athens Journal of Mass Media and Communications*, 8, (in press).

Patents Act 1990 (Compilation No. 49, includes commenced amendments up to Act 9, 2020). Cth. (Australia) 26 August 2021 ed.

Perry, M. 2018. "Copyright and (dis) harmonisation: Can developing nations prioritise their own public good in a global gopyright hegemony?" *In:* Gilchrist, J. and Fitzgerald, B. (eds.) *Copyright, Property and the Social Contract: The Reconceptualisation of Copyright,* Springer Nature Switzerland AG, Cham.

Purcell, W. (2019). "The importance of innovation in business." Northeastern University, https://www.northeastern.edu/graduate/blog/importance-of-innovation/.

Ramalingam, B. (2020). "Innovation, development and COVID-19: Challenges, opportunities and ways forward". Paper: OECD, 1 December 2020 [online] https://read.oecd-ilibrary.org/view/?ref=1059_1059289-s3nykmbav2&title=Innovation-development-and-COVID-19-Challenges-opportunities-and-ways-forward.

Redman, J.C.A. (2020). "An overview of innovation in the Arab Gulf States: From origins and five-year plans to new cities and indices". *Social Science Quarterly,* Vol. 101**,** No. 7, 2485-2506.

Rose, D., Hanheide, M. and Pearson, S. (2021). "Robot farmers could improve jobs and help fight climate change – if they're developed responsibly". *The Conversation,* 23 June 2021 [online], https://theconversation.com/robot-farmers-could-improve-jobs-and-help-fight-climate-change-if-theyre-developed-responsibly-162718.

Rowe, F. (2020). "Contact tracing apps and values dilemmas: A privacy paradox in a neo-liberal world", International Journal of Information Management, Vol. 55, No. 102178, 1-5.

Rowe, M. (2018). "AI profiling: the social and moral hazards of 'predictive' policing". *The Conversation,* 7 March 2018 [online], https://theconversation.com/ai-profiling-the-social-and-moral-hazards-of-predictive-policing-92960.

Stavbunik, Y. & Pelucha, M. (2019). The innovation system of Kazakhstan in the context of the Global Innovation Index, *The Innovation Journal: The Public Sector Innovation Journal,* Vol. 24**,** No. 1, article 2, 1-24.

Tzachor, A. (2022). "Using AI in agriculture could boost global food security – but we need to anticipate the risks", *The Conversation,* 30 March 2022 [online], https://theconversation.com/using-ai-in-agriculture-could-boost-global-food-security-but-we-need-to-anticipate-the-risks-178104?fbclid=IwAR3CUJNerfCSo5mVao2jb64PEgofZ1vOvLgmQH_17A220sZYF5STlcwN0lI.

Wan, Z. and Perry, M. (2019). "Breeding exemption in plants under intellectual property regimes",. *In:* Corbin, L. and Perry, M. (eds.) *Free Trade Agreements: Hegemony or Harmony.* Singapore: Springer Singapore.

Wilkinson, M.A. and Perry, M. (2005). "Leveraging Knowledge Assets: Can Law Reform Help?" *Canadian Journal of Law and Technology,* Vol. 4**,** No. 1, 1-21.

World Intellectual Property Organization (2021). *Global Innovation Index 2021: Innovation Investments Resilient Despite COVID-19 Pandemic,* World Intellectual Property Organization, Geneva.

Yun, J.J., Liu, Z., Jeong, E., Kim, S. and Kim, K. (2022). "The difference in open innovation between open access and closed access, according to the change of collective intelligence and knowledge amount". *Sustainability,* Vol. 14**,** No. 2574, 1-19.

Intellectual Capital of Social Sciences and the Efficiency of its Formation at the Scientific Institutions

Inese Spica, Baiba Berzina, Ernests Spics and Rozite Katrina Spica
Scientific Institution Business Competence Centre, Riga, Latvia
inese.spica@gmail.com
baiba.berzina@tvnet.lv
ernests.spics@gmail.com
rozite.spica@gmail.com

Abstract: The theme of the research is topical in the present situation of intellectual capital of social sciences (ICSS) formation at the scientific institutions (SI) in Latvia. The object of the present research is the formation of ICSS at the SI. The subject of the research is a comparative analysis of the efficiency of the involvement of academic staff and students in the formation of ICSS at the SI of Latvia. The objective of the research is to study the involvement of academic staff and students in the formation of ICSS at the SI in Latvia from 2013 till 2018. The tasks are advanced in order to reach the objective: to study the ICSS formation at the SI; to identify the concept of the efficiency of the involvement academic staff and students in the formation of ICSS; to calculate their main indicators; to carry out comparative analyses of indicators characterising the efficiency of the involvement academic staff and students in the formation of ICSS at the SI 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

Every six years, the Ministry of Education and Science of the Republic of Latvia (IZM) shall organise an international evaluation of the scientific institutions registered in Latvia. The previous International Evaluation of Scientific Institutions' Activity (IESIA) in Latvia covered the period from 2006 to 2011. The last IESIA took place in the period from 2013 to 2018. In order to establish the dynamics of the efficiency indicators of the academic staff involved in the formation of ICSS at the SI of Latvia (IZM, 2021), the authors used the output data of findings across the set of social sciences institutions evaluations per period from 2013 to 2018 offered by "Technopolis-group" (TG).

TG developed the above IESIA for the period from 2006 to 2011 and from 2013 to 2018 by the similar methodology. Consequently, it provides an opportunity for the authors to calculate the IC indicators in social sciences at the SI of Latvia and to compare their dynamics during the period from 2013 to 2018.

The comparative analysis of efficiency indicators of involvement of the academic staff of social sciences at the SI of Latvia in the IC formation will enable them to know whether and how the technological business environment affects them. IESIA happened 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 social sciences at the SI of Latvia in the IESIA of TG coincides with the place of the SI of Latvia in the ratings of the IC indicators, and whether the overall score of the SI of Latvia also reflects the efficiency of the involvement of the academic staff of the SI of Latvia in the IC formation.

Hypothesis: The overall score of the SI shows the efficiency of the IC formation in the SI of Latvia.

2. Theoretical background

The authors rely on historical development of the concept of IC in higher education establishments, the increasing IC capacity (Brenca and Garleja, 2013; 2016), research of understanding, adapting, applying IC in universities (Mercado-Salgado et al, 2016), and research of the role of human capital in educational-training process at the university (Contu, 2017) presented different aspects of IC. Spica et al (2017a) state that IC is an economic category, the spiritual value created by the human potential, and it can be accumulated and converted into the value of other capitals. By investigating certain information about the management of education, we can increase the capacity and significance of the country's total economic capital movement. Spica et al (2017a; 2017b) have worked out four indicators of the efficiency of the formation of IC in the higher education establishment: (1)The efficiency of the involvement of academic staff in the formation of IC per year in

percentages (AIK); (2)The efficiency of the involvement of academic staff with a Doctorate degree in the formation of IC per year in percentages (DIK); (3)The efficiency of the involvement of students in the formation of IC per year in percentages (SIK); (4)Mutual efficiency of the involvement members of the academic staff with Doctorate degrees and the academic staff without Doctorate degrees in the formation of IC per year in times, (DE).

3. Methodology

In order to calculate the AIK, DIK, SIK, and DE of the HEE Spica et al (2017a; 2017b) have worked out four formulas: (1) AIK = (ZPS : AS) x 100; (2) DIK = (ZPS : DS) x 100; (3) SIK = (ZPS : SS) x 100; (4) DE = DIK : AIK. Where: ZPS represents the number of scientific publications of the HEE per year; AS represents the number of academic staff in full-time jobs per year; DS represents the number of academic staff with Doctorate degrees holding in full-time jobs per year; SS represents the number of students per year.

The authors modified the above mentioned formulas for the purposes of the study. Namely, calculate IC efficiency indicators for total numbers of full time equivalent (FTE) academic and research personnel (KIK), for FTE academic personnel (AIK), for FTE academic research personnel (PIK) and for PhDs completed at the SI (SIK). In addition, all the authors of the above-mentioned 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 proceeds included in WoS or SCOPUS (WS), articles in peer reviewed edited journals and conference proceedings not included in WoS or SCOPUS(RS), monographs (MS), patent Latvian (LPS) and patent of Europe and International patents (EPS). The authors calculated mutual efficiency indicators (PE) regarding involvement of the FTE academic research personnel (PS) and the FTE academic personnel (AS) in the formation of IC. in times.

In the present research, the authors used the following data from the IESIA: output data on the number of FTE academic personnel (AS), the number of FTE academic and research personnel (PS), the total number of FTE academic and research personel (KS), the number of PhDs completed (SS), the number of articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS (WS), the number of articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS (RS), the number of monographs (MS), the number of patents Latvian (LPS), the number of Europe and International patents (EPS) and total number of self-reported outputs (KS) in period 2013-2018 per SI. of social sciences in Latvia. Authors revised the above WS, RS, MS, LPS, EPS and KS for the year.

The number of scientific publications and patents are the main results of IC formation of SI. TG analysed 15 SI of Latvia. In the IESIA there were collected output data on 11 public SI of Latvia including 5 Latvian universities, and on 4 SI of Latvia founded by legal entities or private SI.

During the period analysed in the IESIA, there were only 15 such SI of Latvia: The BA School of Business and Finance (SBF/S); RISEBA Faculty of Business and Economy (RISEBA/S); ISMA Business Laboratory (ISMA/S); Rezekne Academy of Technology, Research Institute for Regional Studies (RAT/RS); Rezekne Academy of Technology, Research Institute for Business and Social Processes (RAT/BS); Vidzeme University of Applied Sciences (VU); Foundation “Baltic Studies Centre” (BSC); Riga Stradins University, Platform of Social Sciences (RSU/S); Center for Security and Strategic Research (CSSR); Daugavpils University research programme “Educational sciences, psychology, economy, and law” (DU/S); Liepaja University Educational Sciences Unit (LU/ES); Faculty of Engineering Economics and Managment, Riga Technical University (RTU/S); Latvia University of Life Sciences and Technologies Social Sciences (UL/LT); Economy and Entrepreneurship Unit, Liepaja University (LU/EE); Cluster of Social Sciences, University of Latvia (UL/SS).

In this study, one scientific publication or one patent are accepted as one unit of IC. Further, using the modified formulas 1; 2; 3; and 4, were calculated: KIK, AIK, PIK, SIK, PE. Then, according to the results obtained through the author's calculations, a corresponding rating place was assigned to each SI of Latvia per year and each of the above indicators KIK, AIK, PIK and SIK.

Each rating location was then assessed with an appropriate score, where the lowest score is 1 point, while the highest score is 5 points. Thus the SI, who took the first to third place in the KIK, AIK, PIK and SIK received 5 points in the ranking, took fourth to sixth place - received 4 points, seventh to ninth place - received 3 points,

tenth to twelfth place - received 2 points and thirteenth place - received 1 point. The above mentioned assessment system makes it possible to compare the quantitative efficiency indicators of SI of Social Science in Latvia calculated by the authors with IESIA overall assessment criterion - quality of the research performance of the SI. The relevant Panel of the TG was a score of the research performance of each SI using the scale, where score 5 means outstanding level of research, score 4 means very good level of research, score 3 means good level of research, score 2 means adequate level of research, score 1 means poor level of research (IZM, 2021). The score assigned to the overall assessment by the relevant Panel of the TG was based on the assessment of five sub elements A to E, where element A characterises the quality of the research, element B - the impact on the development on the field of science, element C - the economic impact and social impact of the research, element D - the research environment and infrastructure of the institution, element E -the development potential of the institution. 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 (IZM, 2021).

The follow-up authors compared the results of their own estimates of SI quantitative indicators to the relevant Panel of the TG's results of qualitative indicators, calculated the difference between the indicators and the changes. For this purpose, the authors calculated for each SI average score of indicators recording efficiency of IC and compared these scores with scores of quality of the research of each SI and overall score developed by Panel of the TG.

4. Results

From the IESIA, it follows that in Latvia 11 SI corresponding fields of science are Economics and Business, 7 SI corresponding fields of science - Educational Sciences, 5 SI corresponding fields of science - Other Social Sciences. In turn, such co-responding fields of sciences as Psychology; Social Science; Social and Economic Geography; Media and Communications operated 3 SI in each field of science.

According to the authors' estimates, from the IESIA data, the total number of self-reported outputs of SI, the largest proportion is taken by the RS - 50,77%, a, followed by the WS - 44,00%, the MS - 5,08%., the LPS - 0,13%, the EPS - 0,02%.

To calculate the efficiency of the involvement of academic and research personnel in the formation of WS, the authors used formulas that were developed and approbated already before and now modified.

$$AIK = (WS : AS) \times 100 \quad (1)$$
$$PIK = (WS : PS) \times 100 \quad (2)$$
$$KIK = (WS : KS) \times 100 \quad (3)$$
$$SIK = (WS : SS) \times 100 \quad (4)$$
$$PE = PIK : AIK \quad (5)$$

These indicators of SI and their place in the rating of SI of SS in Latvia, and its scores are summarized in Table 1. The table of the SI indicators, ratings and score was made by authors. The summarized indicators show that in general, In Table 1, the figure rests in the range from 15% to 1650% in respect of the SI in Latvia. The highest indicator is PIK in the RISEBA/S, but the lowest indicators are PIK and KIK in the CSSR. Comparing the figures collected in Table 1, the authors conclude that the highest AIK indicator of 596% is for the RAT/RS, while the lowest AIK indicator of 59% is for the LU/EE, the highest KIK indicator of 278% is for the ISMA/S, while the lowest KIK indicator of 15% is for the CSSR, the highest SIK indicator of 667% is for RAT/BS, while the lowest SIK indicator of 58% is for CSSR. The PS of the RISEBA/S is 7,6 times more efficient in the WS formation, while the PS of the VU.is only 0,3 times more efficient.

In Table 1, the authors created the rating and score of the SI in Latvia based on the AIK, PIK, KIK, SIK indicators of the efficiency of the academic research personnel and PhDs involvement in the formation of WS. According to the AIK indicator, the first place and highest score is taken by the RAT/RS, according to the PIK indicator the first place and highest score is taken by the RISEBA/S, according to the KIK indicator the first place and highest score is taken by the ISMA/S and according to the SIK indicator the first place and highest score is taken by the RAT/BS.

On the other hand, when comparing the average KIK without SIK, the highest score are obtained by the ISMA/S and RSU/S, while comparing the average KIK with SIK - the highest score is obtained in RAT/RS.

The authors compared the SIK indicators of all students of Higher Education Establishments (HEE) in Latvia to that SIK indicators of PhDs students of the SI of the HEE and found that the SIK indicators of the PhDs students were infinitely higher. It follows from the study by Spica et all (2018) that in 2013 the highest SIK indicator of 1,45% was for Daugavpils University and 1,82% for the University of Latvia in 2014. Meanwhile, between 2013 and 2018, the highest annual SIK indicator for PhDs students was the RAT/BS and represented 667%.

In Table 2 authors calculate efficiency of the involvement of academic and research personel in the formation of RS, the authors used formulas 6; 7; 8; 9; 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 1: The efficiency of the involvement of academic and research personnel in the formation of WS at the SI in Latvia per year in period 2013-2018 (%)

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
SBF/S	76	12	2	242	8	3	58	12	2	2,5	3,2	81	10	2	2,3
RISEBA/S	217	6	4	1650	1	5	192	4	4	4,5	7,6	103	9	3	4,0
ISMA/S	556	2	5	556	3	5	278	1	5	5,0	1,0	0	0	0	3,3
RAT/RS	596	1	5	514	5	4	276	2	5	4,5	0,9	327	4	4	4,3
RAT/BS	77	11	2	136	11	2	49	13	1	2,0	1,8	667	1	5	3,0
VU	289	4	4	90	13	1	69	10	2	2,5	0,3	156	7	3	2,7
BSC	0	0	0	92	12	2	92	7	3	1,0	0	0	0	0	0,7
RSU/S	345	3	5	729	2	5	234	3	5	5,0	2,1	71	11	2	4,0
CSSR	0	0	0	15	15	1	15	15	1	0,5	0	58	13	1	0,7
DU/S	109	8	3	474	6	4	89	8	3	3,5	4,3	647	2	5	4,0
LU/ES	92	10	2	155	10	2	58	11	2	2,0	1,7	148	8	3	2,3
RTU/S	169	7	3	290	7	3	107	6	4	3,0	1,7	236	5	4	3,3
UL/LT	226	5	4	545	4	4	160	5	4	4,0	2,4	222	6	4	4,0
LU/EE	59	13	1	89	14	1	35	14	1	1,0	1,5	550	3	5	2,3
UL/SS	105	9	3	218	9	3	71	9	3	3,0	2,1	61	12	2	2,7
Average	144			256			92				1,8	112			

In the first two tables, the average indicators AIK, PIK, KIK, SIK and PE are the same. In Table 2 the figure rests in the range from 24% to 900% in respect of the SI in Latvia. The highest indicator is PIK in the RISEBA/S , but the lowest indicators are SIK in the RSU/S.

In Table 3 authors calculate efficiency of the involvement of academic and research personnel in the formation of MS, the authors used formulas 11; 12; 13; 14; 15.

AIK = (MS : AS) x 100 (11)
PIK = (MS : PS) x 100 (12)
KIK = (RS : KS) x 100 (13)
SIK = (RS : SS) x 100 (14)
PE = PIK : AIK (15)

Table 2: The efficiency of the involvement of academic and research personnel in the formation of RS at the SI in Latvia per year in period 2013-2018 (%)

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
SBF/S	212	4	4	675	2	5	161	3	5	4,5	3,2	225	7	3	0,7
RISEBA/S	118	8	3	900	1	5	105	7	3	4,0	7,6	56	12	2	3,3
ISMA/S	0	0	0	0	0	0	0	0	0	0,0	0,0	0	0	0	0,0
RAT/RS	468	1	5	404	5	4	217	1	5	4,5	0,9	257	6	4	4,3
RAT/BS	69	12	2	122	12	2	44	13	1	2,0	1,8	600	3	5	3,0
VU	228	3	5	71	13	1	54	11	2	3,0	0,3	123	10	2	2,7
BSC	0	0	0	175	10	2	175	2	5	1,0	0,0	0	0	0	0,7
RSU/S	117	9	3	248	8	3	80	9	3	3,0	2,1	24	13	1	2,3
CSSR	0	0	0	39	14	1	39	14	1	0,5	0,0	150	9	3	1,3
DU/S	137	7	3	596	3	5	111	6	4	4,0	4,4	814	1	5	4,3
LU/ES	161	6	4	272	7	3	101	8	3	3,5	1,7	260	5	4	3,7
RTU/S	233	2	5	401	6	4	147	4	4	4,5	1,7	325	4	4	4,3
UL/LT	182	5	4	438	4	4	129	5	4	4,0	2,4	178	8	3	3,7
LU/EE	82	11	2	124	11	2	49	12	2	2,0	1,5	767	2	5	3,0
UL/SS	100	10	2	208	9	3	67	10	2	2,5	2,1	58	11	2	2,3
Average	144			256			92				1,8	112			

Comparing the figures collected in Table 2, the authors conclude that the highest AIK indicator of 468% is for the RAT/RS, while the lowest AIK indicator of 69% is for the RAT/BS , the highest PIK indicator of 900% is for the RISEBA/S, while the lowest PIK indicator of 39% is for the CSSR, the highest SIK indicator of 814% is for DU/S, while the lowest SIK indicator of 24% is for RSU/S.

When comparing the average AIK and PIK, the highest score are obtained by the SBF/S, the RAT/RS and the RTU/S, while comparing the average KIK with SIK - the highest score is obtained in the RAT/RS, the DU/S and the RTU/S..

Table 3: The efficiency of the involvement of academic and research personnel in the formation of MS at the SI in Latvia per year in period 2013-2018 (%)

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
SBF/S	3	12	2	8	13	1	2	14	1	1,5	2,7	3	12	2	1,7
RISEBA/S	22	5	4	167	2	5	19	5	4	4,5	7,6	10	9	3	4,0
ISMA/S	79	3	5	79	3	5	40	3	5	5,0	1,0	0	0	0	3,3
RAT/RS	91	2	5	79	4	4	42	2	5	4,5	0,9	50	4	4	4,3
RAT/BS	0	0	0	0	0	0	0	0	0	0,0	0,0	0	0	0	0,0
VU	51	4	4	16	10	2	12	6	4	3,0	0,3	27	6	4	3,3
BSC	0	0	0	4	14	1	4	13	1	0,5	0,0	0	0	0	0,3
RSU/S	137	1	5	290	1	5	93	1	5	5,0	2,1	28	5	4	4,7
CSSR	0	0	0	24	7	3	24	4	4	1,5	0,0	92	1	5	2,7
DU/S	10	7	3	45	5	4	8	8	3	3,5	4,5	61	3	5	4,0
LU/ES	9	8	3	16	11	2	6	10	2	2,5	1,8	15	8	3	2,7
RTU/S	14	6	4	24	6	4	9	7	3	4,0	1,7	20	7	3	3,7
UL/LT	8	11	2	20	8	3	6	11	2	2,5	2,4	8	10	2	2,3
LU/EE	9	10	2	14	12	2	5	12	2	2,0	1,6	83	2	5	3,0
UL/SS	9	9	3	19	9	3	6	9	3	3,0	2,1	5	11	2	2,7
Average	16			28			10				1,8	12			

In Table 3, according to the AIK , PIK and KIK indicators the first place and highest score is taken by the RSU/S, according to the SIK indicator the first place and highest score is taken by the CSSR.

When authors compared the average AIK and PIK, the highest score are obtained by the ISMA/S and the RSU/S, while compared the average AIK, PIK and -SIK, the highest score is obtained only in the RSU/S..

In Table 4 authors calculate efficiency of the involvement of academic personnel and research personnel in the formation of LPS, the authors used formulas 16; 17; 18; 19; 20.

AIK = (LPS : AS) x 100 (16)
PIK = (LPS : PS) x 100 (17)
KIK = (LPS : KS) x 100 (18)
SIK = (LPS : SS) x 100 (19)
PE = PIK : AIK (20)

In Table 4, according to the AIK , PIK, KIK and SIK indicators the first place and highest score is taken by the UL/LT. The average score for all SI is the same.

Table 4: The efficiency of the involvement of academic and research personnel in the formation of LPS at the SI in Latvia per year in period 2013-2018 (%)

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
RAT/RS	3	2	5	3	2	5	1	2	5	5,00	1,0	2	2	5	5,00
RTU/S	1	3	5	1	3	5	0	3	5	5,00	1,0	1	3	5	5,00
UL/LT	3	1	5	8	1	5	2	1	5	5,00	2,7	3	1	5	5,00
Average	0,45			0,80			0,29				1,8	0,35			

In Table 5 authors calculate efficiency of the involvement of academic personnel and research personel in the formation of EPS, the authors used formulas 21; 22; 23; 24; 25.

AIK = (EPS : AS) x 100 (21)
PIK = (EPS : PS) x 100 (22)
KIK = (EPS : KS) x 100 (23)
SIK = (EPS : SS) x 100 (24)
PE = PIK : AIK (25)

Of the 15 Latvian SI in the field of social sciences, only the RTU/S has the Europe and International patent.

Table 5: The efficiency of the involvement of academic and research personnel in the formation of EPS at the SI in Latvia per year in period 2013-2018 (%)

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
RTU/S	1	1	5	1	1	5	0	0	0	5,0	1,0	1	1	5	5,00
Average	0,06			0,11			0,04				1,8	0,05			

Table 6: The Comparison of the results of qualitative and quantitative evaluation of Latvian SI in the field of social sciences by form of IC for the period 2013-2018

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 (OTG-TAAPS)
SBF/S	2	2	1,7	0,3	0,3	1,4	0,6	0,6
RISEBA/S	2	2	2,6	-0,6	-0,6	2,0	0,0	0,0

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 (OTG-TAAPS)
ISMA/S	1	1	2,0	-1,0	-1,0	1,3	-0,3	-0,3
RAT/RS	3	3	3,7	-0,7	-0,7	3,5	-0,5	-0,5
RAT/BS	2	2	0,8	1,2	1,2	1,6	0,4	0,4
VU	3	3	1,7	1,3	1,3	1,6	1,4	1,4
BSC	4	3	0,5	3,5	2,5	0,2	3,8	2,8
RSU/S	2	3	2,6	-0,6	0,4	1,9	0,1	1,1
CSSR	1	2	0,5	0,5	1,5	1,3	-0,3	0,7
DU/S	3	3	2,2	0,8	0,8	2,6	0,4	0,4
LU/ES	2	2	1,6	0,4	0,4	1,8	0,2	0,2
RTU/S	3	3	4,3	-1,3	-1,3	4,2	-1,2	-1,2
UL/LT	3	3	3,1	-0,1	-0,1	2,9	0,1	0,1
LU/EE	1	2	1,0	0,0	1,0	2,1	-1,1	-0,1
UL/SS	3	3	1,7	1,3	1,3	1,5	1,5	1,5

Table 7: The Comparison of the results of qualitative and quantitative evaluation of Latvian SI in the field of social sciences by IC overall for the period 2013-2018

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)
SBF/S	2	2	1,6	0,4	0,4	1,6	0,4	0,4
RISEBA/S	2	2	2,2	-0,2	-0,2	1,8	0,2	0,2
ISMA/S	1	1	2,0	-1,0	-1,0	0,0	1,0	1,00
RAT/RS	3	3	4,0	-1,0	-1,0	3,6	-0,6	-0,6
RAT/BS	2	2	0,4	1,6	1,6	1,4	0,6	0,6
VU	3	3	1,6	1,4	1,4	1,8	1,2	1,2
BSC	4	3	1,8	2,2	1,2	0,0	4,00	3,0
RSU/S	2	3	2,6	-0,6	0,4	2,0	0,0	1,0
CSSR	1	2	1,2	-0,2	0,8	1,8	-0,8	0,2

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)
DU/S	3	3	2,0	1,0	1,0	3,0	0,0	0,0
LU/ES	2	2	1,4	0,6	0,6	1,8	0,2	0,2
RTU/S	3	3	4,2	-1,2	-1,2	4,2	-1,2	-1,2
UL/LT	3	3	3,0	0,0	0,0	2,8	0,2	0,2
LU/EE	1	2	1,0	0,0	1,0	2,4	-1,4	-0,4
UL/SS	3	3	1,6	1,4	1,4	1,4	1,6	1,6

From the results summarised in the tables 1; 2; 3; 4; 5, authors conclude that for all IC forms the average PIK indicators are the highest. They are followed average AIK, SIK and KIK indicators.

5. Conclusions

The study of the authors did not result in confirming hypothesis. When comparing the qualitative ratings of TG group to the quantitative assessments perfomed by the authors, it can be concluded that they differ from 2,8 to 5,4 points in total.

The study shows that the KIK, AIK, PIK, SIK, and PE of SI of SS in Latvia were higher as shown by the results compiled by the relevant Panel of the TG.

References

Brenca, A. and Garleja, R. (2016) "Conflictology Culture - A Structural Element of Intellectual Capital Formation", *Proceedings of the 8th European Conference on Intellectual Capital*, 12-13 May, pp 38-44.

Brenca, A. and Garleja, R. (2013) "Intellectual Capital in the Higher Education Institutions of Latvia in the Context of International Trade", *Proceedings of the Internationale Conference on Intellectual Capital, Knowledge Management & Organizational Learning*, pp 495-505.

Contu, E.G. (2017) "The Role of Intellectual Capital in Higher Education", *Proceedings of the 9th European Conference on Intellectual Capital, Lisbon, Portugal, 6-7 April*, pp. 66 -70.

Latvijas Republikas Izglītības un zinātnes ministrija (2021) "International Evaluation of Scientific Institution Activity, Latvia", *Report by the Technopolis group per period 2013.-2018 , Riga, 5 March*

Mercado-Salgado, P., Cernas-Ortiz, D.A. and Gil-Monte, P. (2016) "Intellectual Capital Model for Mexican Public Universities", *Proceedings of the 8th European Conference on Intellectual Capital*, 12-13 May, pp 172-177.

Spica, I., Garleja, R., Berzina, B. and Spics, E. (2018) "The Involvement of Students in the Formation of Intellectual Capital in Latvia", *Proceedings of the 19th European Conference on Knowledge Management, Padua, Italy, 6-7 September*, pp. 811 -820.

Spica, I., Garleja, R. and Berzina, B. (2017a) "Intellectual Capital as the Performance Indicator of the University Studies", *Proceedings of the 9th European Conference on Intellectual Capital, Lisbon, Portugal, 6-7 April*, pp. 312 -320.

Spica, I., Garleja, R. and Berzina, B. (2017b) "The Efficiency of the Involvement of Academic Staff in the Formation of Intellectual Capital in Latvia", *Poster of the 9th European Conference on Intellectual Capital, Lisbon, Portugal, 6-7 April.*

Academic Entrepreneurship and Inequality: Evidence From Administrative Data

Joseph Staudt
US Census Bureau, USA
joseph.staudt@census.gov

Abstract: Over the past several decades, universities have increasingly emphasized knowledge and technology transfer. Faculty are key agents facilitating this transfer, engaging in commercial and entrepreneurial activities such as, consulting, student placement, patenting, and the founding of start-ups. This paper documents the prevalence of faculty commercial engagement as well as the extent to which it widens earnings inequality among faculty. In contrast to previous work that uses surveys with low response rates to measure the commercial engagement of university faculty, this paper uses detailed administrative data from universities (UMETRICS) linked to confidential earnings data at the Internal Revenue Service (IRS) and U.S. Census Bureau (including the universe of W2 and 1099 tax records) to analyse how often university faculty engage in the types of commercial and entrepreneurial activity that catalyse knowledge/technology transfer.

Keywords: academic commercial engagement, entrepreneurship, technology transfer, inequality

1. Introduction

As the links between universities and industry have grown tighter over the past several decades, opportunities for faculty entrepreneurship – that is commercial engagement – have flourished (Bozeman, 2000; Bozeman et al, 2015). These opportunities can take many forms, including patenting, start-ups, consulting, and contract research. Though academic commercial engagement has been heavily studied (Perkmann et al, 2013; Miller et al, 2018), an underexplored by-product is the effects it may have on faculty earnings inequality. In principle, it could reduce inequality if lower-earning faculty can use commercial engagement opportunities to reach parity with their more highly paid peers. However, inequality could increase if high-earning faculty are disproportionately privy to commercial engagement opportunities outside the university. This paper establishes basic facts about the commercial engagement of faculty that, for the first time, are based on high quality administrative payroll and tax data. These linked data are then used to present the first-ever analysis of how commercial engagement opportunities impact faculty earnings inequality.

The main contributions of this paper to the literature on academic entrepreneurship and faculty commercial engagement can be broken into three parts. First, this is the first work to measure engagement, such as participation and earnings, using high-quality linked administrative payroll and tax records. As noted, there already exists a large literature analysing the extent to which faculty engage in commercial activity. However, nearly all this work relies on cross-sectional survey data with low response rates. Surveys of US faculty, with response rates in brackets, include Bird and Allen (1989) [27%], Blumenthal et al (1996) [65%], Boardman (2008) [38%], Boardman and Corley (2008) [38%], Boardman and Ponomariov (2009) [38%], Boardman (2009) [38%], Bozeman and Gaughan (2007) [38%], Campbell and Slaughter (1999) [34%], Lee (1996) [43%], Lee (1998) [43%], Lee (2000) [64%], Lin and Bozeman (2006) [44%], Link et al (2017) [38%], Louis et al (2001) [64%], Ponomariov (2008) [38%], Ponomariov and Boardman (2008) [37%], and Renault (2006) [14%].

Thus, compared previous work, this paper can paint a more complete portrait of academic commercial engagement. Faculty are identified using administrative payroll data from UMETRICS (Lane et al., 2015). Faculty are then linked to the universe of W2 and 1099 tax records and unemployment insurance (UI) wage records. These linked data reveal each faculty member's entire US-based earnings and employment history (2005-2018). This includes earnings from both employers and self-employment, thus distinguishing between university and non-university income, and enabling the separation of earnings received from different types of employers, including older incumbent firms, younger or start-up firms, and high-tech/low-tech firms.

The second main contribution is the use of this new linked administrative data to establish basic facts about how often university faculty participate in various types of commercial engagement as well as the earnings they receive from these entrepreneurial activities. A substantial fraction of UMETRICS faculty, about 43%, receive non-university earnings each year. Further, while faculty receive earnings from both employers and self-employment, most faculty commercial engagement is driven by self-employment. Indeed, each year, approximately 32% receive earnings from self-employment while only 16% receive earnings from employers. It

is notable that only 3% of UMETRICS faculty receive earnings from a young/start-up firm (5 years old or less) each year, which is quite striking given the perception that these firms are disproportionately innovative (Haltiwanger et al, 2013). In sum, a large fraction of faculty is entrepreneurial in the sense of participating in some type of commercial activity outside the academy, but there is considerable variation in the extent to which they receive earnings from different sources.

In addition to documenting faculty participation in various commercial activities, this paper provides information on the fraction of a typical faculty member's earnings that comes from different sources, revealing the extent to which faculty augment their university salary with other sources of income. On average, UMETRICS faculty earn about $151,400 per year, of which, about $128,800 (85%) comes from a university and about $22,600 (15%) comes from a non-university. Thus, while university earnings constitute the bulk of earnings for the typical faculty member, a substantial fraction of total earnings is derived from non-university sources. In addition, though faculty participation in commercial activity is dominated by self-employment, the typical faculty member only receives about a third of their non-university earnings ($8,000) from self-employment with the remaining two-thirds coming from an employer ($14,600).

Finally, the third main contribution is the first-ever analysis of how academic commercial engagement impacts faculty earnings inequality. In contrast to the large literature on faculty participation in commercial activities, there has been little work examining faculty earnings inequality generally (e.g., Monk, 2003) and there is no work (of which the author is aware) that specifically studies the relationship between faculty commercial engagement and faculty earnings inequality. However, the 15% of earnings that the typical faculty member receives from non-university sources is large enough to meaningfully contribute to (or dampen) the overall inequality in faculty earnings.

As noted, the existence of commercial engagement opportunities could, in principle, increase or decrease *total earnings* (university plus non-university earnings) inequality beyond inequality in university earnings. In fact, a decomposition of total earnings inequality suggests that non-university earnings exacerbate inequality, proportionately accounting for nearly half of total inequality (university earnings accounts for the other half). In other words, if commercial activities outside the university were unavailable to faculty, earnings inequality would be much lower – in fact, it would be cut in half. Thus, it appears that more highly paid faculty can take advantage of commercial opportunities that further increase their earnings relative to their lower paid peers.

The rest of this paper is organized as follows. Section 2 discusses the data, including administrative data from the UMETRICS program and tax/UI wage records from the IRS and the US Census Bureau. Section 3 presents results, establishing basic facts about faculty commercial engagement and exploring the contribution of this entrepreneurial activity to faculty earnings inequality. Finally, Section 4 concludes.

2. Data

As mentioned, most work measuring the entrepreneurial activity of university faculty relies on surveys with low response rates. This section discusses an alternative and more comprehensive way to measure faculty commercial engagement: linked administrative data. Indeed, establishing these data linkages is one of the main contributions of the paper. Though administrative data has limitations (see conclusion for a discussion), the linked data allow for tracking the same individual through time and can more decisively answer questions about various economic activities undertaken by faculty.

2.1 UMETRICS

UMETRICS is transaction-level data on all payments made by university grants to employees and vendors and is directly captured through university payroll and human resources records (Lane et al, 2015). These data include information on the occupations of individuals paid by a grant, which are used to identify faculty. The data also include information on the timing of payments which is important because some individuals transition, over time, from graduate students or post-docs into faculty. However, this paper focuses on the commercial engagement of faculty *while they are faculty*, not before or after.

2.2 Employment and earnings history

UMETRICS faculty are linked to three sources of administrative earnings data: 1) W2 tax records, 2) unemployment insurance (UI) wage records from the Longitudinal Employer-Household Dynamics (LEHD) program, and 3) 1099 tax records from the Integrated Longitudinal Business Database (ILBD). Taken together, these three sources provide a complete picture of the entire US-based earnings history of every UMETRICS faculty member between 2005 and 2018. This includes earnings from universities, private firms, government, and self-employment.

The W2 tax records are maintained by the Internal Revenue Service (IRS) and provide annual information on individual earnings. The LEHD-UI wage records provide quarterly information on jobs for most U.S. workers (Vilhuber et al, 2014). Both the W2 and LEHD-UI earnings records have tax identification numbers that allow distinguishing between university and non-university earnings and to link firm-level information, such as firm age or industry. These firm-level characteristics identify whether earnings come from various firm types, such as incumbent firms (over five years old), young/start-up firms (five years old or younger), high-tech firms, or low-tech firms (definitions from Goldschlag and Miranda (2020)).

The ILBD is the universe of non-employer firms in the US and is derived from 1040 tax forms with attached schedule C(s) (Goetz et al, 2021). The ILBD is used to measure earnings from self-employment. Overall, non-employer businesses account for about 75% of businesses in the United States (Jarmin, 2007), and, as documented below, incorporating self-employment income is crucial to properly measuring faculty commercial engagement.

Taken together, these administrative earnings data completely characterize the entire US-based earnings history of UMETRICS faculty between 2005 and 2018. Further, they identify the different sources from which earnings is received. The author is unaware of any other work that has tracked the employment and earnings history of faculty so comprehensively and reliably.

2.3 Final sample

For every year between 2005 and 2018, the final analysis sample is comprised of UMETRICS faculty with positive W2/LEHD earnings from a university. Since the paper focuses on *faculty* commercial engagement, the only years included are those after the individual has been identified as a faculty member at their UMETRICS university. For instance, if an individual is classified in UMETRICS as a post-doc in 2005-2007 and as a faculty member in 2008-2018, only the 2008-2018 period is kept for this individual. In all, the sample contains approximately 59,500 faculty across 25 universities (which account for about 20% of all research funding in the US). Faculty are tracked over time, so all analyses take place at the faculty-year level. Since not all faculty appear in every year, the panel is unbalanced.

3. Results

3.1 Faculty commercial engagement: Basic facts

The paper first establishes how common it is for UMETRICS faculty to engage in commercial activities outside of the university. Figure 1 displays participation rates – specifically, the fraction of UMETRICS faculty that receive positive wages from university and non-university sources. First note that, as discussed in Section 2, the sample is defined so that only faculty with positive university earnings in a given year are included. Thus, by definition, the fraction of faculty receiving positive university wages is 1. Nevertheless, the university bar is included to emphasize this sample restriction.

The first substantive finding is that a large minority of UMETRICS faculty engage in some form of entrepreneurial activity outside the university. Indeed, the yearly fraction of faculty receiving positive non-university earnings is about 43%. Thus, though the majority of faculty each year rely exclusively on university earnings, a sizable fraction is commercially engaged.

Separating commercial engagement into its component parts, it is clear that self-employment is much more common than working at an employer firm. Indeed, the yearly fraction of faculty with positive earnings from self-employment and an employer firm is, respectively, about 32% and 16%. Thus, faculty are about twice as

likely to engage in self-employment as they are to work at an employer firm. It is important to emphasize that these engagement activities are not mutually exclusive – the same individual can receive earnings from both self-employment and an employer firm each year. In other words, faculty can engage in multiple commercial activities simultaneously.

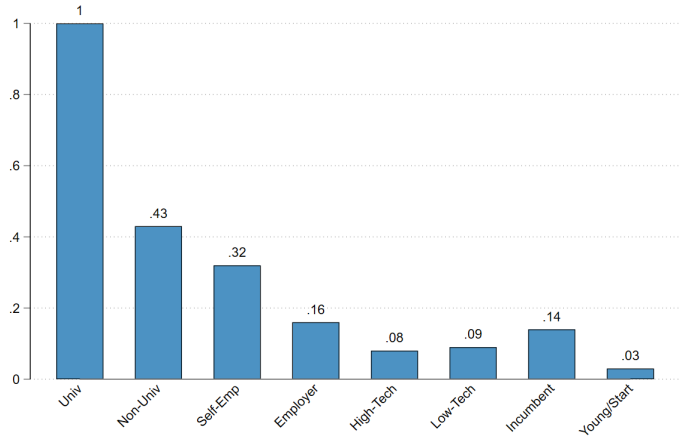


Figure 1: This figure shows the factions of UMETRICS faculty that receive positive earnings from the following sources: University, non-university, self-employment, an employer firm, an incumbent firm, a young/start-up firm, a high-tech firm, and a low-tech firm. By definition, all UMETRICS faculty in my sample receive positive university earnings

Separating engagement at employer firms by industry, Figure 1 shows that faculty are about equally likely to receive positive earnings from high-tech and low-tech firms: about 8% and 9%, respectively. Thus, perhaps surprisingly, it appears that faculty do not disproportionately engage with the high-tech sectors of the economy. This may be driven by different faculty commercially engaging for different reasons: for instance, some may have opportunities to work at high-tech firms to advance a collaborative research agenda, while others (perhaps adjuncts) need to supplement low university pay by working at low-tech firms.

Separating by age, Figure 1 reveals that it is quite rare for UMETRICS faculty to receive earnings from a young/start-up firm – only about 3% do so each year. Given widespread perceptions about the innovativeness of young firms and the closeness of universities to innovative sectors of the economy, this low level of participation is quite surprising. In contrast, a much larger fraction of faculty receives earnings from an incumbent firm – approximately 14% each year. Of course, older firms account for a disproportionate fraction of employment generally, so this higher level of participation is unsurprising. Overall, faculty are about 5 times more likely to receive earnings from an incumbent firm than they are from a young/start-up firm. Again, note that none of these categories are mutually exclusive – it is possible for faculty to work at a high-tech, low-tech, incumbent, and young/start-up firms (or any combination) in the same year.

In sum, in any given year, most faculty rely exclusively on universities for their earnings, but a large minority engage in entrepreneurial activities outside the university. Self-employment is the most common source of non-university earnings, which is about twice as common as working at an employer firm. Working at a young/start-up firm is quite rare and faculty are about equally likely to work at high-tech and low-tech firms.

In addition to measuring faculty participation in various entrepreneurial activities, this paper also measures the extent to which these outside activities supplement the university earnings of faculty. Specifically, the fraction of total earnings that a typical UMETRICS faculty member receives from non-university earnings is measured. Table 1 sheds light on this by providing summary statistics for the various components of earnings.

Table 1 show that the typical UMETRICS faculty member earns about $151,400 per year. Of this total, about $128,800 (85.1%) comes from a university and about $22,630 (14.9%) comes from a non-university source. Thus, the typical faculty member relies on universities for the bulk of their earnings, but also derives a non-trivial fraction though commercial engagement.

Of the $22,630 earned from non-university sources, $14,580 (64.4%) comes from employer firms and $8,056 (35.6%) comes from self-employment. This difference is stark because faculty are twice as likely to be self-employed as they are to work at an employer firm, which means a much larger fraction of faculty earn nothing from employer firms. Thus, conditional on positive earnings from an employer firm, faculty likely receive an even higher percentage of non-university earnings from employer firms.

Of the $14,580 earned from employer firms, the typical faculty member receives much more from incumbents ($13,280, or 91.1%) than from young/start-up firms ($1,299, or 8.9%). This is unsurprising, given the much higher probability working at an incumbent firm. Alternatively, about $9,294 (63.7%) comes from high-tech firms and $5,284 (36.2%) comes from low-tech firms. Given the equal probability of working at high-tech and low-tech firms, this suggests a high-tech wage premium for faculty.

Table 1 also reveals a striking feature of the distributions of faculty wages: a very high degree of variation. For total wages, the standard deviation is $161,800, which is a bit above 100% of the mean. University earnings are less variable, with a standard deviation that is about 88% of the mean. In contrast, the non-university wage components have extremely high variability relative to their means. For instance, total non-university earnings have a standard deviation of $110,700, which is nearly 5 times higher than the mean. The standard deviations of the sub-components of non-university earnings range from 6 (incumbent earnings) to 20 (start-up earnings) times higher than the mean. As will be shown in the next section, this extreme variability has important implications for the contribution of non-university earnings to overall faculty earnings inequality.

Table 1: This table shows summary statistics of earnings for UMETRICS faculty. The unit of observation is a person-year, but only the person (faculty) counts are reported.

	Mean	SD	Coef. of Variation
Total Wages	$151,400	$161,800	1.069
University Wages	$128,800	$112,900	0.877
Non-University Wages	$22,630	$110,700	4.892
Self-Employment Wages	$8,056	$59,610	7.399
Employer Wages	$14,580	$92,040	6.313
Incumbent Wages	$13,280	$81,630	6.147
Young/Start-up Wages	$,1,299	$26,010	20.023
High-Tech Wages	$9,294	$83,500	8.984
Low-Tech Wages	$5,284	$37,790	7.152
Faculty Count: 59,500			

3.2 Commercial engagement and inequality

The means and standard deviations from Table 1 can be used to decompose the inequality of total earnings into contributions from each constituent source using methods discussed in Shorrocks (1982, 1983). This decomposition is displayed, along with associated statistics, in Table 2. Column (1) shows the correlations between total wages and each wage component, which are used (in combination with the standard deviations from Table 1) to determine the contribution of each component to total inequality. All earnings components are positively correlated with total earnings, and obviously the correlation of total wages with itself is 1. The largest coefficients are for university and non-university earnings, which are quite similar at 0.73 and 0.72, respectively.

Column (2) displays the proportionate contribution of each component to total inequality, which is equivalent to the slope coefficient from a bivariate regression of the component on total earnings (multiplied by 100). This exercise reveals that university earnings account for about 50.9% of total inequality and that non-university earnings account for the remaining 49.1%. Thus, even though non-university earnings make up only 15% of total earnings, they account for nearly half of total inequality. This is possible because, though the mean of non-university earnings is much lower than the mean of university earnings ($22,630 vs. $128,800), these two earnings components have quite similar standard deviations ($110,700 vs. $112,00) and correlations with total earnings (0.72 vs. 0.73). As noted, the coefficient of variation (ratio of the standard deviation to the mean) is about 4.9 for non-university earnings and only about 0.88 for university earnings. Thus, since non-

university earnings are far more variable relative to their mean than university earnings, they contribute to total inequality far beyond what their much lower mean might initially suggest.

Table 2: This table shows the proportionate contribution of each earnings component to total earnings inequality. The unit of observation is a person-year, but only the person (faculty) counts are reported

	Correlation with Total Wages	Proportionate Contribution to Inequality
Total Wages	1.00	100.00
University Wages	0.73	50.94
Non-University Wages	0.72	49.07
Self-Employment Wages	0.45	16.70
Employer Wages	0.57	32.36
Incumbent Wages	0.55	27.70
Young/Start-up Wages	0.29	4.66
High-Tech Wages	0.51	26.28
Low-Tech Wages	0.26	6.08
Faculty Count: 59,500		

Table 2 also shows that, of the 49.1% contribution of non-university earnings to total inequality, about 32.4 percentage points are attributable to earnings from an employer and the other 16.7 percentage points are attributable to earnings from self-employment. Thus, earnings from an employer contribute about twice as much to total inequality as do earnings from self-employment. Breaking out the 32.4% contribution of employer earnings by firm age, 27.7 percentage points are attributable to earnings from incumbent firms and 4.7 percentage points are attributable to earnings from a young/start-up firm. Similarly, breaking out the contribution of employer earnings by industry, 26.3 and 6.1 percentage points are attributable to earnings from high-tech and low-tech firms, respectively. Thus, earnings from incumbent and high-tech firms contribute far more to total inequality than do earnings from young/start-up and low-tech firms.

In sum, while the existence of academic commercial engagement could, in principle, decrease faculty earnings inequality, it in fact increases it dramatically. Indeed, despite accounting for only 15% of total earnings for the typical faculty member, non-university earnings, because it has a very large standard deviation relative to its mean, accounts for about half of total earnings inequality. Put another way, if commercial activities outside the university were unavailable to faculty, earnings inequality would be much lower – indeed, they would be about half as large.

4. Discussion and conclusion

Overall, this paper finds that a large fraction of UMETRICS faculty is commercially engaged – around 43% each year. The most common form of commercial engagement is self-employment, in which about 32% of faculty participate. A lower fraction, about 16%, receive positive earnings from employer firms. Though the typical faculty member relies on university earnings for the bulk of their salary, around 15% comes from non-university sources. Thus, there is significant scope for commercial engagement to either exacerbate or mitigate overall earnings inequality among faculty.

Turning to inequality, this paper reveals that non-university earnings account for nearly half of total earnings inequality among UMETRICS faculty. This is possible despite non-university earnings only accounting for 15% of total income because non-university earnings are substantially more variable relative to the mean than is university earnings, allowing for a disproportionate contribution to total earnings inequality. Overall, the decomposition suggests that, in the absence of commercial engagement, total earnings inequality would be cut in half (though this ignores possible general equilibrium effects).

Using surveys to measure faculty commercial engagement, as has been the norm in this literature, certainly offers some benefits. For instance, they typically allow for a more detailed set of questions to be examined. However, surveys also have well-known limitations, especially non-response bias. Indeed, it is common for surveys attempting to measure faculty commercial engagement to have response rates of 30-40%. In contrast, the linked administrative data used in this paper allows for a full and accurate characterization of the entire

US-based earnings history (between 2005 and 2018) of every UMETRICS faculty member, a feat that, until now, had not yet been accomplished in the faculty commercial engagement literature.

References

Bird, Barbara J and David N Allen (1989). "Faculty Entrepreneur/Ship in Research University Environments", *The Journal of Higher Education*, Vol 60, No. 5, pp. 583-596.

Blumenthal, David, Nancyanne Causino, Eric Campbell, and Karen Seashore Louis (1996). "Relationships Between Academic Institutions and Industry in the Life Sciences—An Industry Survey", *New England Journal of Medicine*, Vol 334, No. 6, pp. 368-374.

Boardman, P Craig (2008). "Beyond the Stars: The Impact of Affiliation with University Biotechnology Centers on the Industrial Involvement of University Scientists", *Technovation*, Vol 28, No. 5, pp. 291-297.

Boardman, P Craig (2009). "Government Centrality to University–Industry Interactions: University Research Centers and the Industry Involvement of Academic Researchers", *Research Policy* Vol 38, No. 10, pp. 1505-1516.

Boardman, P Craig and Elizabeth A Corley (2008). "University Research Centers and the Composition of Research Collaborations", *Research Policy* Vol 37, No. 5, pp. 900-913.

Boardman, P Craig and Branco L Ponomariov (2009). "University Researchers Working With Private Companies", *Technovation*, Vol 29, No. 2, pp. 142-153.

Bozeman, Barry (2000). "Technology Transfer and Public Policy: A Review of research and Theory", *Research Policy*, Vol 29, No. 4-5, pp. 627-655.

Bozeman, Barry, Heather Rimes, and Jan Youtie (2015). "The Evolving State-of-the-Art in Technology Transfer Research: Revisiting the Contingent Effectiveness Model", *Research Policy*, Vol 44, No. 1, pp. 34-49.

Bozeman, Barry and Monica Gaughan (2007). "Impacts of Grants and Contracts on Academic Researchers' Interactions with Industry", *Research Policy*, Vol 36, No. 5, pp. 694-707.

Campbell, Teresa Isabelle Daza and Sheila Slaughter (1999). "Faculty and Administrators' Attitudes Toward Potential Conflicts of Interest, Commitment, and Equity in University-Industry Relationships", *The Journal of Higher Education*, Vol 70, No. 3, pp. 309-352.

Goetz, Christopher and Zachary Kroff (2021). Recent Improvements to the Integrated Longitudinal Business Database (ILBD)", CES Technical Notes Series 21-02, Center for Economic Studies, U.S. Census Bureau.

Goldschlag, Nathan and Javier Miranda (2020). "Business Dynamics Statistics of High Tech Industries". *Journal of Economics & Management Strategy*, Vol 29, No. 1, pp. 3-30.

Haltiwanger, John, Ron S Jarmin, and Javier Miranda (2013). "Who Creates Jobs? Small Versus Large Versus Young", *Review of Economics and Statistics*, Vol 95, No. 2, pp. 347-361.

Jarmin, Ron S (2007). "Integrated Longitudinal Business Database: Presentation", Kauffman Symposium on Entrepreneurship and Innovation Data.

Lane, Julia I, Jason Owen-Smith, Rebecca F Rosen, and Bruce A Weinberg (2015). "New Linked Data on Research Investments: Scientific Workforce, Productivity, and Public Value", *Research Policy*, Vol 44, No. 9, pp. 1659-1671.

Lee, Yong S (1996). "'Technology Transfer and the Research University: A Search for the Boundaries of University-Industry Collaboration", *Research Policy*, Vol 25, No. 6, pp. 843-863.

Lee, Yong S (1998). "University-Industry Collaboration on Technology Transfer: Views from the Ivory Tower", *Policy Studies Journal*, Vol 26, No. 1, pp. 69-84.

Lee, Yong S (2000). "The Sustainability of University-Industry Research Collaboration: An Empirical Assessment", The Journal of Technology Transfer, Vol 25, No. 2, pp. 111-133.

Lin, Min-Wei and Barry Bozeman (2006). "Researchers' Industry Experience and Productivity in University Industry Research Centers: A Scientific and Technical Human Capital Explanation", *The Journal of Technology Transfer*, Vol 31, No. 2, pp. 269.290.

Link, Albert N, Donald S Siegel, and Barry Bozeman (2017). "An Empirical Analysis of the Propensity of Academics to Engage in Formal University Technology Transfer". *Universities and the Entrepreneurial Ecosystem*. Edward Elgar Publishing.

Louis, Karen Seashore, Lisa M Jones, Melissa S Anderson, David Blumenthal, and Eric G Campbell (2001). "Entrepreneurship, Secrecy, and Productivity: A Comparison of Clinical and Non-Clinical Life Sciences Faculty", *The Journal of Technology Transfer*, Vol 26, No. 3, pp. 233-245.

Miller, Kristel, Rodney McAdam, and Maura McAdam (2018). "A Systematic Literature Review of University Technology Transfer from a Quadruple Helix Perspective: Toward a Research Agenda", *R&D Management*, Vol 48, No. 1, pp. 7-24.

Monks, James (2003). "Increasing Earnings Inequality in Faculty Labor Markets", Working Paper.

Perkmann, Markus, Tartari Valentina, Maureen McKelvey, Erkko Autio, Anders Brostrom, Pablo D'Este, Riccardo Fini, Aldo Geuna, Rosa Grimaldi, Alan Hughes, and Others (2013). "Academic Engagement and Commercialisation: A Review of the Literature on University-Industry Relations", *Research Policy*. Vol 42, No. 2, pp. 423-442.

Ponomariov, Branco and P Craig Boardman (2008). "The Effect of Informal Industry Contacts on the Time University Scientists Allocate to Collaborative Research with Industry", *The Journal of Technology Transfer*, Vol 33, No. 3, pp. 301-313.

Ponomariov, Branco L (2008). "Effects of University Characteristics on Scientists' Interactions with the Private Sector: An Exploratory Assessment", *The Journal of Technology Transfer*, Vol 33, No. 5, pp. 485-503.

Renault, Catherine Searle (2006). "Academic Capitalism and University Incentives for Faculty Entrepreneurship", *The Journal of Technology Transfer*, Vol 31, No. 2, pp. 227-239.

Shorrocks, Anthony F (1982). "Inequality Decomposition by Factor Components", *Econometrica*, pp. 193-211.

Shorrocks, Anthony F (1983). "The Impact of Income Components on the Distribution of Family Incomes". The Quarterly Journal of Economics, Vol 98, No. 2, pp. 311-326.

Vilhuber, Lars and Kevin McKinney (2014). "LEHD Infrastructure Files in the Census RDC-Overview" Center for Economic Studies, US Census Bureau, Working Paper 14-26.

Digital Adoption in The Family Business: A State-of-the-art Review

Nyayu Lathifah Tirdasari[1,2], Wawan Dhewanto[3] and Neneng Nurlaela Arief[3]
[1]Doctoral Program of Science in Management, School of Business and Management, Institut Teknologi Bandung, Bandung, Indonesia
[2]School of Business, IPB University, Bogor, Indonesia
[3]School of Business and Management, Institut Teknologi Bandung, Bandung, Indonesia
nyayu.lathifah@sbm-itb.ac.id
w_dhewanto@sbm-itb.ac.id
neneng.nurlaela@sbm-itb.ac.id

Abstract: The high-volume rise of digital technology is restructuring every side of the business and profoundly impacting how the business works. The concept of management and leadership are vividly changing. However, no business can avert the implications, challenges, and opportunities that originated from the digital revolution. It pushes companies to transform their setup. Against this background, many businesses are not ready to transform. The family business is not an exception. It is expected to adopt digitalization as a keenly prevalent business practice worldwide. Furthermore, its involvement in the digital economy is still essential. However, studies on digital adoption in the family business remain limited. At the same time, family businesses have unique characteristics that make them different from other forms of business in general. It is perceived that the two issues are opposing. The family business is commonly viewed with slow evolutions. On the other hand, digitalization is characterized as a rapid action. This research is a theoretical review that aims to fill the gap by exploring the state-of-the-art digital adoption literature. In addition, it develops areas for future research primarily related to family business topics. This article carried out a systematic literature review. It employed a Prisma approach on a Scopus database with all the articles written in English. The results showed that most digital adoption literature mainly focuses on two contexts: (1) general business and (2) academic institutions. Moreover, it provides geographical trends in this domain, the most cited authors, and the top journal on this topic. This study further found that very few discuss digital adoption even in the literature on the family business. Thus, many family business areas can be explored. To this end, this study provides propositions associating digital adoption with the family business areas. At the same time, it further provides several future research agendas.

Keywords: family business, digital adoption, literature review, prisma approach, state-of-the-art

1. Introduction

The family business is a keenly prevalent business practice worldwide. It dominates up to 98% of global companies (Kets de Vries, 1993; Chua, Chrisman and Chang, 2004; Eddleston, Kellermanns and Sarathy, 2008). Hence, it plays an essential role in a country's economic growth (Fan *et al.*, 2011; Koentjoro and Gunawan, 2020). In many countries, the family business contributes more than 70% of the national income. It also absorbs labor from more than 50% of the total working-age population in the world (Poza and Daugherty, 2018). Thus, it is a trustworthy economic power source, from micro to global enterprises (Waldron, 2021). Therefore, the need to do digital adoption has caught the consideration of these key business players. Continuity is critical for them (Tirdasari and Dhewanto, 2012, 2014, 2020a, 2020b; Sigliano, 2017; Tirdasari, Indrawan and Fahmi, 2019). In addition, business operation is generally inseparable from digitalization (Cahyadi and Magda, 2021). It vividly changes the concept of management and leadership. It made this ask how the family business will do the digital adoption. Cahyadi and Magda (2021) mentioned that agility in countering digitalization is a measure of the success of a business. Digital infrastructure, such as the internet, is utilized for business development.

However, a limited business can avert the digital revolution's implications, challenges, and opportunities. Many businesses are not ready to transform. The family business is not an exception, where it is also forced to adopt digitalization. Moreover, studies on digital adoption in the family business remain limited. Most of the research on digitalization was investigated at the general company, health industry, and academic institutions. Thus, research on digital adoption in the family business is vital to understanding the domain more broadly. Understanding this area is vital because it must be ready to engage with this wave. Scholars emphasized that business transformation was of specific importance for the family business (Calabro and McGinness, 2021). Scholars revealed that the time to digitize the business is now. It is necessary to cut the lengthy bureaucratic process and maintain the entrepreneurial mindset within the family business (Burt et al., 2021). This research explores the trend or the state-of-the-art digital adoption literature.

This study found only one study carried out a systematic review of the required conditions for digital entrepreneurship adoption for the family business. Thus, this research aims to understand better the factors influencing the adoption of digital technologies in the business sectors by systematically reviewing previous works of literature. The purpose is to understand better the factors influencing the adoption of digital technologies, particularly by a family business with unique characteristics. In addition, compose an initial model, proposition, and future research agenda in the family business context. Furthermore, this study aims to update previous literature reviews. This systematic literature review followed the updated preferred reporting items for systematic review and meta-analyses (PRISMA) reporting guidance Page *et al.* (2021). It is because PRISMA reporting is complete, and the procedure is transparent. In addition, this article is part of the doctoral research on developing digital adoption models, whose factors will be identified by this study and adapted to the family business's characteristics. This study undertakes a systematic literature review of digital adoption in the family business and poses the following research question explicitly:

RQ: What digital adoption factors regarding family business characteristics need to be identified?

The present study sheds light on the specific topics of digital adoption in family businesses. Theoretically, it participates in studies related to the family business. Also, it participates in understanding the phenomena of digitalization in family businesses. The target reader for this review is threefold. First, we object to scholars who would like to get a literature review of the digital adoption factors and models of family business research. Second, we aim at family business performers who would like to determine related factors that can influence the process of digital adoption that relate to its characteristics. Last, we aim at digital vendors or developers who would like to value the family business characteristics that need to be well planned before the implementation. Furthermore, the paper takes action to the recent suggestion by Basly and Hammouda (2020) to consider family business territorial in the digital transformation study. Family business runs and grows in contexts that profoundly affect entrepreneurial and strategic attitudes.

This article is organized into seven sections. Section 1 describes the research background, and Section 2 explains the methodology, while the results are described in Section 3. Then, the discussion is subsequently discussed in Section 4. The last three sections elaborate on the conclusions of this study and suggestions for future study, acknowledgments, and a list of references.

2. Methods

This study undertook a systematic literature review to collate and synthesize works of literature on digital adoption in the family business. Three major academic databases that are the most broadly used repositories to retrieve social sciences literature, namely Scopus, ProQuest, and Emerald, were used in the data-gathering process. This current systematic literature review was conducted from November 2021 to March 2022. It was executed according to PRISMA guidelines. It has three main phases, which are 1) identification, 2) screening, and 3) inclusion (page 2020). First, the identification phase is to search for articles from various database sources. Moreover, duplicate records are removed in this phase before getting into the next phase, screening. Second, the screening phase is to filter the records based on eligibility criteria. The criteria are article type, year, subject area, and so on. In addition, this phase filters documents that can be accessed in full text. In this phase, scholars need to read the full text to sort out how many reports are sought for retrieval and reports not retrieved. The last phase is the final number of studies included in the review. Records selection was conducted without time limitation but restricted to only published English papers. Two comprehensive search queries were developed and combined using the parentheses' AND' in the search process. One identifies all the appropriate keywords for digital adoption, and another identifies the appropriate keywords for a family business. The following figure describes the work steps in conducting a systematic literature review.

2.1 Eligibility criteria

This study included four inclusion criteria to guide the authors in gathering the relevant pieces of literature for this review. First, all journal articles (IC1) with a research design ranging from quantitative or qualitative and mixed-methodology have been included in the search process. Second, only manuscripts were written in English (IC2) were included because it is a common language employed by scholars in the academic community. Third, this article has only included studies in the business and management area (IC3). Forth, IC4 was included to answer the research questions.

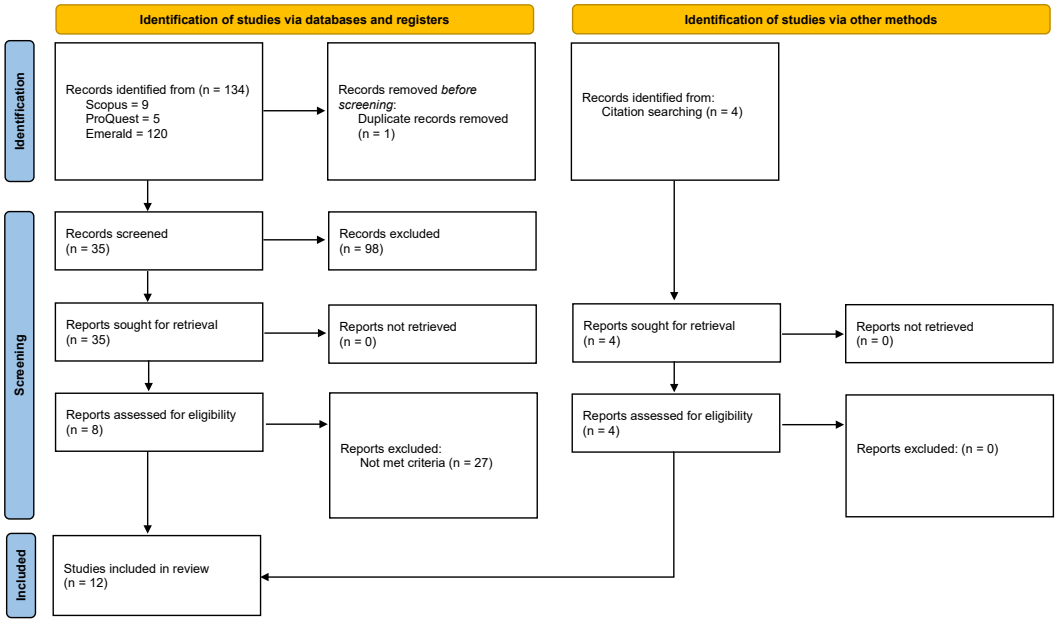


Figure 1: PRISMA flow diagram (Page *et al.*, 2021)

This article also included two exclusion criteria to improve the data search process when selecting the relevance of each paper screened. First, this research has excluded all studies that solely discuss digital adoption in non-business sectors (EC1). Second, this study has excluded all subject areas in the Scopus database, except Business, Management, and Accounting (EC2). The following table lists the inclusion and exclusion criteria for the review guidelines.

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
IC1: Journal articles	EC1: Non-business sectors
IC2: Written in English	EC2: All subject areas, except Business, Management, and Accounting
IC3: Research area in business and management	
IC4: Research aimed at investigating factors that influence the digital adoption, specifically in the family business	

The selected articles were thoroughly screened initially by considering the inclusion criteria. Finally, these articles were classified according to several factors.

2.2 Information sources

The primary search was performed using online databases with generous repositories of scientific studies, including Scopus, ProQuest, and Emerald. It was performed based on the predefined search strategy. This research removed papers that the authors could not fully access. In addition, it glanced over the reference lists contained in the papers to discover related works of literature.

2.3 Study selection

The study selection was performed in the following four steps:

- 1. The search string was selected based on the research interest in reviewing related digital adoption factors in the family business. Two comprehensive search queries were developed and combined using the parentheses' AND' in the search process. The keywords included in the search queries are listed in the following table.

Table 2: Keywords included in the search queries

Topic	Keywords
Digital adoption	digital adoption, digital use, digital usage, digital acceptance, digital entrepreneurship, and digital transformation
Family business	family business, family firm, family enterprise, family entrepreneur, and family company

Those keywords were searched in each online database used in this study. The search strings in each online database are listed in the following table.

- 2. Exploration and selection of title, abstract, and keywords of identified papers were performed according to eligibility criteria. This step is done twice. First, the title and abstract are read on the website database. Second, the keywords, title, and abstract are reread after updating the details on Mendeley.
- 3. Based on the eligibility criteria, a complete reading of the not removed papers was performed to decide whether it should be counted in the systematic literature review.
- 4. The reference list of the papers was checked to discover related research and restart from Step 2.

Table 3: Search strings of this systematic literature review

Databases	Search string	Initial results
Scopus	(TITLE-ABS-KEY ("family business" OR "family firm" OR "family enterprise" OR "family entrepreneur" OR "family company") AND TITLE-ABS-KEY ("digital adoption" OR "digital use" OR "digital usage" OR "digital acceptance" OR "digital entrepreneurship" OR "digital transformation"))	9
ProQuest	ab("family business" OR "family firm" OR "family enterprise" OR "family entrepreneur" OR "family company") AND ab("digital adoption" OR "digital use" OR "digital usage" OR "digital acceptance" OR "digital entrepreneurship" OR "digital transformation")	5
Emerald	(title:"family business" OR "family firm" OR "family enterprise" OR "family entrepreneur" OR "family company") AND (abstract:"digital adoption" OR "digital use" OR "digital usage" OR "digital acceptance" OR "digital entrepreneurship" OR "digital transformation")	120

2.4 Data collection process

All results found through the initial search process utilizing the search strings were collected in a spreadsheet. Details from the primary search were also saved to a reference software (Mendeley) for relevance assessment, removing duplicates. Subsequently, based on the inclusion and exclusion criteria, the remaining records were screened for relevance according to the titles, keywords, and content drawn from the abstracts. After the initial screening process, the full text of all pieces of literature fulfilling all the eligibility criteria was downloaded. The information of these articles was further examined to discover the extent to which they suit the scopes of this systematic literature review.

The spreadsheet specified details consisting of the following information: article type, title, number of citations, and so on. Figures and tables are also extracted in the data collection process. This study assessed each potentially relevant paper by reading the full text and extracting data.

2.5 Data items collection

- 1. Demography of selected papers with the following content:
- *Distribution of digital adoption study*
- *Countries involved in a digital adoption study*
- *Sources of digital adoption study*
- *Distribution of methodologies of study*
- 2. Digital adoption factors related to the family business

The intention of elaborating data item number 1 was to offer the information to scholars, family business actors, and developers. Data item number 2 was then utilized to describe related digital adoption factors to understand the cause of the driver and barrier of digital adoption in the family business. All data extracted were explored by adopting a thematic synthesis approach. This approach helped uncover patterns and relationships within the data.

3. Results

This study reviewed twelve articles regarding digital adoption and family business. The following table summarizes the topic covered by each article.

Table 4: Articles included in the review

No	Study	Focus
1	(Ano and Bent, 2021)	Human determinants influencing factors
2	(Basly and Hammouda, 2020)	Creating a conceptual model
3	(Brenk *et al.*, 2019)	Business model innovation
4	(Chatterjee, Chaudhuri and Vrontis, 2021)	Adoption of a technology platform as a moderator
5	(Chung, Chang and Kitamura, 2021)	Digital advertising
6	(Dressler and Paunovic, 2021)	Digital work transformation
7	(Kraus *et al.*, 2020)	Family firm crisis management
8	(Pollák and Markovič, 2021)	Size of business as an influencing factor
9	(Pöschl and Freiling, 2020)	Succession on digitalization
10	(Rashid and Ratten, 2020)	The role of dynamic capabilities
11	(Reissig, Stoinescu and Mack, 2022)	Use of e-government services
12	(Soluk and Kammerlander, 2021)	Digital transformation stages

Based on the articles found, considering the importance of digital adoption to a family business, only a few numbers of scholars have explored this topic. Of twelve articles, eleven are research papers, and one represents review papers (Basly and Hammouda, 2020). There are studies regarding this topic across many countries, including French (Ano and Bent, 2021), Germany (Brenk *et al.*, 2019; Pöschl and Freiling, 2020; Dressler and Paunovic, 2021; Pollák and Markovič, 2021; Rondi, De Massis and Kraus, 2021; Soluk and Kammerlander, 2021), India (Chatterjee, Chaudhuri and Vrontis, 2021), Japan (Chung, Chang and Kitamura, 2021), Pakistan (Rashid and Ratten, 2020), and other European countries. Most research is conducted in Europe and investigates the wineries from many perspectives. However, no research has been done in Indonesia yet. The objective itself varies among the twelve works of literature. Ano and Bent (2021) explored the human factors in digital strategy implementation. Rashid and Ratten (2020) and Soluk and Kammerlander (2021) employed dynamic capabilities to investigate the family business and so on. The most commonly utilized method is qualitative (8 articles), and three articles used the quantitative approach.

Initially, in 2019 only one article was published. However, between 2020 and 2021, the was an increase in the number of articles regarding digital adoption and family business. The following figure contains the distribution of articles from 2019 to 2022.

It is essential to note that the increased number might be due to the pandemic. Pandemic has accelerated the need for transformation (Bartsch *et al.*, 2021; Msila, 2021). The high-volume rise of digital technology is restructuring the business and profoundly impacting how the business works in one way or another (Kane *et al.*, 2019; Pradhan, 2019; Sasmoko *et al.*, 2019; Maheshwari and Yadav, 2020; Soluk and Kammerlander, 2021). However, the lined decline in yearly publications in 2022 might be because of the time this study started. As of not all publication in 2022 is presented as projection. Nevertheless, to the best of the author's knowledge, the trend will be growing.

Research regarding digital adoption and the family business is spread in various journals. The following table contains a list of the journal sources and the Scopus ranking included in the review.

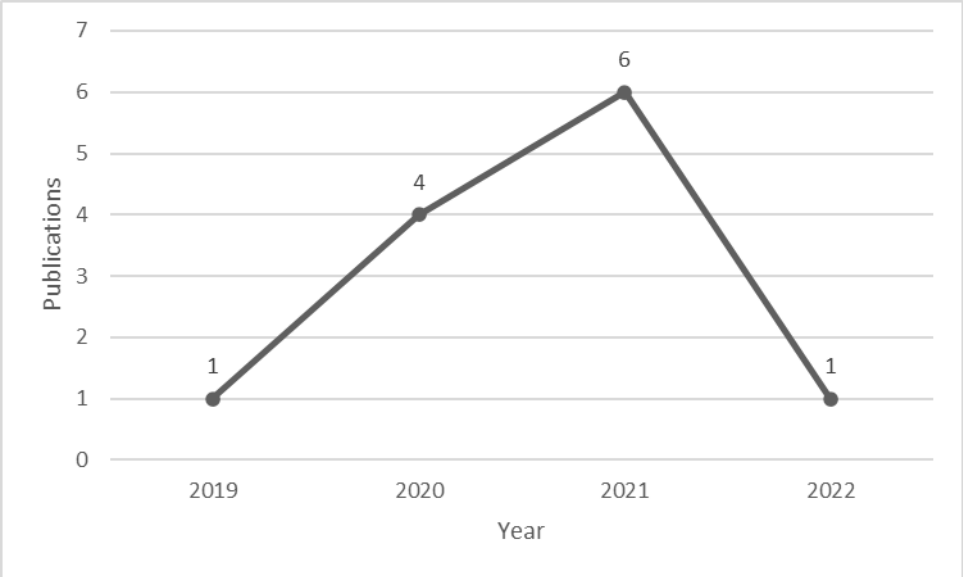


Figure 2: The annual number of publications from 2019 to 2020

Table 5: Journal sources and rank

Journal	Rank
European Journal of Information Systems	Q1
International Journal of Entrepreneurial Behavior and Research	Q1
Journal of Business Economics	Q1
Journal of Family Business Management	Q1
Journal of Family Business Management	Q1
Journal of Rural Studies	Q1
The Journal of Entrepreneurship	Q1
Agricultural Economics	Q2
International Journal of Information Systems and Project Management	Q2
Journal of Enterprising Communities	Q2
Journal of Open Innovation: Technology, Market, and Complexity	Q2
Administrative Sciences	n/a

Most of the articles published in the Q1 journal are the leading ranking of Scopus. The journals are the European Journal of Information Systems, International Journal of Entrepreneurial Behavior and Research, Journal of Business Economics, Journal of Family Business Management, Journal of Family Business Management, Journal of Rural Studies, and The Journal of Entrepreneurship. Four articles were published in the Q2 journal. The journals are Agricultural Economics, International Journal of Information Systems and Project Management, Journal of Enterprising Communities, and Journal of Open Innovation: Technology, Market, and Complexity. One journal has no information regarding the Scopus ranking, Administrative Sciences.

According to geography, this study found that nine countries contributed to the study related to digital adoption and family business. Europe accounted for the highest continent contributors with 83%, and the rest in Asia. To be more specific, three countries in Asia contributed to this topic. The figure below presents the publication based on geography.

Around three articles from Asia constituted this study. Those countries are Pakistan, India, and Japan, with one article. Indonesia is not contributed yet, so there are still many areas that can be explored within this domain. Indonesia's context becomes one of the novelties of this research.

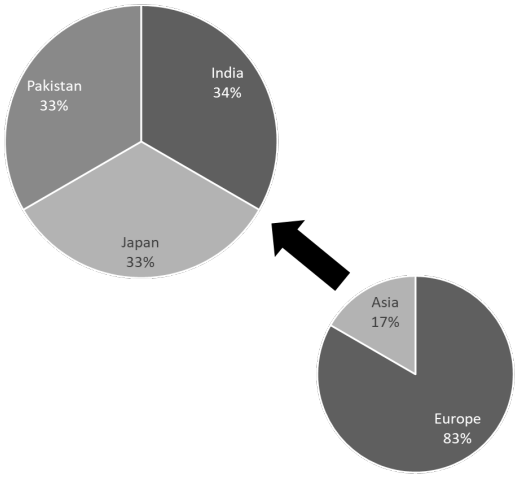


Figure 3: Publications based on continents and Asia-specific

4. Discussion

Surprisingly, the family business study has not tackled the topic of digital adoption, knowing that it is a critical medium for a company's growth recently. Like all other companies, the family business is involved in entrepreneurship and innovation to grow and sustain their business. In the beginning, it seems mismatched to connect family business and digital adoption. Scholars revealed a debate between those terms. Some found a negative relationship between the family business and digital adoption. It is because family business is risk-averse. Thus, they are less likely to invest in R&D and innovation. In addition, it tends to have a conventional deed. The result is that high-risk strategies, such as technology investment, could be detained (Fernández and Nieto, 2006). On the other hand, a stream of scholar argues a positive relationship between family business and digital adoption. For example, between family business and power to establish new products and services has a positive correlation (Gudmundson, Tower and Hartman, 2003). In addition, family businesses inherently drive a more significant innovation (Llach and Nordqvist, 2010). Compared to non-family businesses, the superior ability of family businesses tends to innovate a varied range of products and services (Westhead, 1997). In the following sections of the paper, this study depicts a preliminary model of digital adoption in the family business. In this model, three independent and one moderating variables are proposed. The model relies on the main facets of digital entrepreneurship and family involvement in the company (Basly & Hammouda, 2020).

This study adopts and adapts the main idea of Basly and Hammouda (2020) and Soluk and Kammerlander (2021). Not only because the information is contemporary and from a reliable source, but the author found their study valuable and suitable to build the proposed model. Basly and Hammouda's (2020) article suggested that a conceptual model supporting family business takes up the benefit and beats the difficulty of digital entrepreneurship. It employed the socio-emotional wealth logic, a perspective recently used by a family business study to understand the paradox regarding innovation. This perspective includes non-economy aspects such as identity, ability to exercise family influence, and continuation of the family empire. So, the desire to preserve socio-emotional wealth is related to the implementation of digitalization. Basly and Hammouda (2020) revealed three moderator variables based on the socio-emotional wealth logic: family ownership, CEO tenure, and generational involvement. Unfortunately, this article lacks evidence. Therefore, the limitation will be addressed in the up coming article of this study.

In line with Basly and Hammouda's (2020), Soluk and Kammerlander's (2021) article bridged family business with resource limitations and digital transformation. This article employed dynamic capabilities perspective and revealed barrier factors to the digital transformation. The barriers are family business paternalism, incompatible understanding of digital transformation, and member of staff resistance. They classified digital transformation into three stages. First is the process digitalization stage. It focuses on sensing the opportunities of digital. Dressler and Paunovic (2021) investigated family wineries to improve their understanding of utilizing a new technology. The article mentioned two factors that impact the deployment: pull factors or servitization factors and push factors or digital transformation factors. The second is the

product/service digitalization stage. It highlights the capture of digital opportunities by mobilizing the company's resources. Business model digitalization is the third stage. It seeks to transform the company continuously. Brenk et al. (2019) mentioned that companies need to transform the current business models to adapt to the dynamic changes. They suggested a way to adapt the existing business model. It is by separating the proposed business model from the older one. The separation can decrease cognitive uncertainty associated with business model innovation processes, such as creating a new decision-making logic parallel to the existing one.

The proposed model is displayed in the following figure. It shows this study's main ideas: family business and digital adoption.

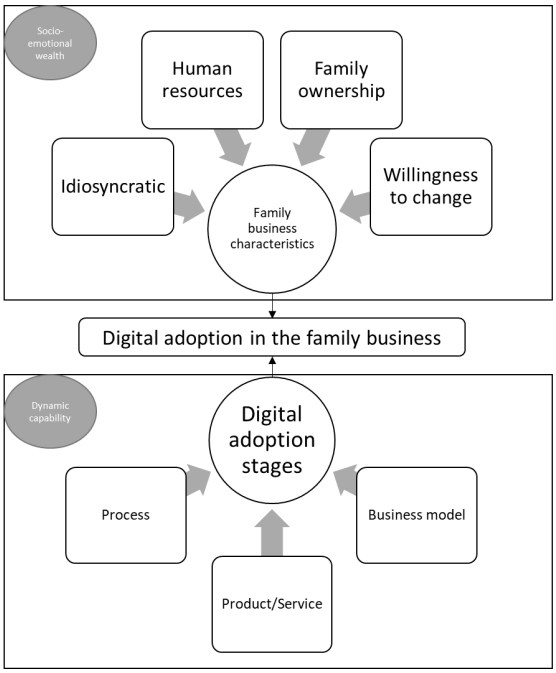


Figure 4: Proposed model

This study adopts and adapts the main idea of Basly and Hammouda (2020) and Soluk and Kammerlander (2021). Not only because the information is contemporary and from a reliable source, but the author found their study valuable and suitable to build the proposed model. Basly and Hammouda's (2020) article employed the socio-emotional wealth logic, a perspective recently used by a family business study to understand the paradox regarding innovation. Unfortunately, this article lacks evidence. Therefore, my dissertation will improve the weakness of the research by examining the proposed model quantitatively. The family business characteristics include idiosyncratic, human resources, family ownership, and willingness to change. In line with Basly and Hammouda's (2020), Soluk and Kammerlander's (2021) article bridged family business with digital transformation. This article employed dynamic capabilities perspective and revealed the stages of digital transformation: process digitalization, product/service digitalization, and business model digitalization.

5. In conclusion

Basly and Hammouda (2020) suggested that scientific studies consider family business territorial in the digital transformation study. The present study believes that the result is relevant for understanding digital adoption in the family business. The result identified four characteristics of family business: idiosyncratic, human resources, family ownership, and willingness to change, and three stages of digital adoption: process, product/service, and business model. This study only focused on family business type of enterprise, which is led and managed by family members. Moreover, it does not nail various or specific industries which may lead to different results. Even though this study acknowledges limited relevance in this regard, it generates future areas for research. For example, explore the relationship between each aspect of digital adoption and family business characteristics. Second, the family business is 80% of global companies worldwide. Consequently, it is essential to discover these ideas in various cultural contexts with varying values and characteristics embraced by the family business. Such studies would deliver a broad systematic contribution to both theory and practical implication in what is an essential yet under-studied area. Another future research is to explore the digital

adoption process of family businesses specifically from the perspective of management domain, such as human resources, financial, marketing, operational, and information system.

Acknowledgements

We would like to thank the Puslapdik (*Pusat Layanan Pembiayaan Pendidikan*) and LPDP (*Lembaga Pengelola Dana Pendidikan*) for supporting and financing this work.

References

Ano, B. and Bent, R. (2021) 'Human determinants influencing the digital transformation strategy of multigenerational family businesses: a multiple-case study of five French growth-oriented family firms', *Journal of Family Business Management*. doi: 10.1108/JFBM-12-2020-0117.

Bartsch, S. *et al.* (2021) 'Leadership matters in crisis-induced digital transformation: how to lead service employees effectively during the COVID-19 pandemic', *Journal of Service Management*, 32(1), pp. 71–85. doi: 10.1108/JOSM-05-2020-0160.

Basly, S. and Hammouda, A. (2020) 'Family Businesses and Digital Entrepreneurship Adoption: A Conceptual Model', *Journal of Entrepreneurship*, 29(2), pp. 326–364. doi: 10.1177/0971355720930573.

Brenk, S. *et al.* (2019) 'Learning from failures in business model innovation: solving decision-making logic conflicts through intrapreneurial effectuation', *Journal of Business Economics*, 89(8–9), pp. 1097–1147. doi: 10.1007/s11573-019-00954-1.

Cahyadi, A. and Magda, R. (2021) 'Digital leadership in the economies of the G20 countries: A secondary research', *Economies*, 9(1). doi: 10.3390/economies9010032.

Calabro, A. and McGinness, T. (2021) *Mastering a comeback How family businesses are triumphing over COVID-19*. Available at: https://assets.kpmg/content/dam/kpmg/xx/pdf/2021/03/family-business-survey-report.pdf#page=9 (Accessed: 19 October 2021).

Chatterjee, S., Chaudhuri, R. and Vrontis, D. (2021) 'Entrepreneurial behavior of family firms in the Indian community: adoption of a technology platform as a moderator', *Journal of Enterprising Communities*. doi: 10.1108/JEC-08-2021-0122.

Chua, J. H., Chrisman, J. J. and Chang, E. P. C. (2004) 'Are Family Firms Born or Made? An Exploratory Investigation', *Family Business Review*, 17(1), pp. 37–54. doi: 10.1111/J.1741-6248.2004.00002.X.

Chung, Y. C. Y., Chang, H.-H. and Kitamura, Y. (2021) 'Digital and traditional media advertising and business performance of agribusiness firms–Empirical evidence in Japan', *Agricultural Economics*, 67(2), pp. 51–59.

Dressler, M. and Paunovic, I. (2021) 'Sensing technologies, roles and technology adoption strategies for digital transformation of grape harvesting in sme wineries', *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2). doi: 10.3390/joitmc7020123.

Eddleston, K. A., Kellermanns, F. W. and Sarathy, R. (2008) 'Resource configuration in family firms: Linking resources, strategic planning and technological opportunities to performance', *Journal of Management Studies*, 45(1), pp. 26–50. doi: 10.1111/J.1467-6486.2007.00717.X.

Fan, C. W. *et al.* (2011) *Asian Family Businesses Report 2011*. Switzerland.

Fernández, Z. and Nieto, M. J. (2006) 'Impact of ownership on the international involvement of SMEs', *Journal of international business studies*, 37(3), pp. 340–351.

Gudmundson, D., Tower, C. B. and Hartman, E. A. (2003) 'Innovation in small businesses: Culture and ownership structure do matter', *Journal of Developmental entrepreneurship*, 8(1), p. 1.

Kane, G. C. *et al.* (2019) 'How digital leadership is(n't) different'. Massachusetts Institute of Technology. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85071363336&partnerID=40&md5=486a0dc3ee1afab6c363d5371a699d8f.

Kets de Vries, M. F. R. (1993) 'The dynamics of family controlled firms: The good and the bad news', *Organizational Dynamics*, 21(3), pp. 59–71. doi: 10.1016/0090-2616(93)90071-8.

Koentjoro, S. and Gunawan, S. (2020) 'Managing knowledge, dynamic capabilities, innovative performance, and creating sustainable competitive advantage in family companies: A case study of a family company in Indonesia', *Journal of Open Innovation: Technology, Market, and Complexity*, 6(3). doi: 10.3390/JOITMC6030090.

Kraus, S. *et al.* (2020) 'The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis', *International Journal of Entrepreneurial Behaviour and Research*, 26(5), pp. 1067–1092. doi: 10.1108/IJEBR-04-2020-0214.

Liberati, A. *et al.* (2009) *The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration*, *Journal of clinical epidemiology*. doi: 10.1016/j.jclinepi.2009.06.006.

Llach, J. and Nordqvist, M. (2010) 'Innovation in family and non-family businesses: A resource perspective', *International Journal of Entrepreneurial Venturing*, 2(3–4), pp. 381–399.

Maheshwari, S. K. and Yadav, J. (2020) 'Leadership in the digital age: Emerging paradigms and challenges'. Inderscience Publishers. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85113148467&doi=10.1504%2FIJBG.2020.110950&partnerID=40&md5=857bf61edcd6dd1cfcc46f364041c521.

Msila, V. (2021) 'Digitalization and decolonizing education: A qualitative study of university of south africa (unisa) leadership'. International Journal of Information and Education Technology. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85116053969&doi=10.18178%2Fijiet.2021.11.11.1564&partnerID=40&md5=96b169f3e268bc8b5ba77754efb43573.

Page, M. J. *et al.* (2021) 'The PRISMA 2020 statement: An updated guideline for reporting systematic reviews', *The BMJ*, 372. doi: 10.1136/bmj.n71.

Pollák, F. and Markovič, P. (2021) 'Size of business unit as a factor influencing adoption of digital marketing: Empirical analysis of SMEs operating in the central European market', *Administrative Sciences*, 11(3). doi: 10.3390/admsci11030071.

Pöschl, A. and Freiling, J. (2020) 'The impact of family-external business succession on digitalization: Exploring management buy-ins', *International Journal of Information Systems and Project Management*, 8(2), pp. 24–46. doi: 10.12821/ijispm080202.

Poza, E. J. and Daugherty, M. S. (2018) *Family business*. 5th edn. Boston: Cengage.

Pradhan, B. B. (2019) 'Review paper on virtual leadership'. Hampstead Psychological Associates. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85084462687&doi=10.37200%2FIJPR%2FV23I6%2FPR190820&partnerID=40&md5=aa72e6a527add20c40b405bc0e2f6772.

Rashid, S. and Ratten, V. (2020) 'A dynamic capabilities approach for the survival of Pakistani family-owned business in the digital world', *Journal of Family Business Management*, 10(4), pp. 373–387. doi: 10.1108/JFBM-12-2019-0082.

Reissig, L., Stoinescu, A. and Mack, G. (2022) 'Why farmers perceive the use of e-government services as an administrative burden: A conceptual framework on influencing factors', *Journal of Rural Studies*, 89, pp. 387–396.

Rondi, E., De Massis, A. and Kraus, S. (2021) 'Servitization through open service innovation in family firms: Exploring the ability-willingness paradox', *Journal of Business Research*, 135, pp. 436–444. doi: 10.1016/j.jbusres.2021.06.040.

Sasmoko *et al.* (2019) 'Dynamic capability: The effect of digital leadership on fostering innovation capability based on market orientation'. Growing Science. Available at: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85069474042&doi=10.5267%2Fj.msl.2019.5.024&partnerID=40&md5=d799655de39335fd51dc762dd749e2e8.

Sigliano, K. (2017) *The Digital Transformation of Family Business: Legacy, Speed and Customers*, *ie University*. Available at: https://www.ie.edu/insights/articles/the-digital-transformation-of-family-business-legacy-speed-and-customers/ (Accessed: 19 October 2021).

Soluk, J. and Kammerlander, N. (2021) 'Digital transformation in family-owned Mittelstand firms: A dynamic capabilities perspective', *European Journal of Information Systems*, 30(6), pp. 676–711. doi: 10.1080/0960085X.2020.1857666.

Tirdasari, N. L. and Dhewanto, W. (2012) 'Family Business Succession in Indonesia: A Study of Hospitality Industry', *Procedia - Social and Behavioral Sciences*, 57, pp. 69–74. doi: 10.1016/j.sbspro.2012.09.1159.

Tirdasari, N. L. and Dhewanto, W. (2014) 'Family Business Succession of Hospitality Industry in Indonesia', *Journal of Asia Pacific Business Innovation & Technology Management*, 004, pp. 021–029.

Tirdasari, N. L. and Dhewanto, W. (2020a) 'Critical Success Factors in Business Succession: The Indonesian Family Business', in Fahmi, I. (ed.) *Advances in Economics, Business and Management Research*. Bogor: Atlantis Press, pp. 74–78. doi: 10.2991/aebmr.k.200514.017.

Tirdasari, N. L. and Dhewanto, W. (2020b) 'When is the right time for succession? Multiple cases of family businesses in Indonesia', *Journal of Family Business Management*, 10(4), pp. 349–359. doi: 10.1108/JFBM-10-2019-0064.

Tirdasari, N. L., Indrawan, D. and Fahmi, I. (2019) 'Family Business in Agriculture: Challenge and Strategy to Face Global Business', in Fahmi, I. (ed.) *Advances in Economics, Business and Management Research*. Bogor: Atlantis Press, pp. 155–158. doi: 10.2991/icot-19.2019.33.

Waldron, J. (2021) *The Digital Transformation of Traditional Family Businesses*, *metasfresh*. Available at: https://metasfresh.com/en/2021/09/15/the-digital-transformation-of-traditional-family-businesses/ (Accessed: 19 October 2021).

Westhead, P. (1997) 'Ambitions, external environment and strategic factor differences between family and non–family companies', *Entrepreneurship & Regional Development*, 9(2), pp. 127–158.

The Role of Accelerators in Shaping Entrepreneurial Identity

Anita Ellen Tobiassen[1], Ingunn Elvekrok[21] and Line Skreosen[1]
[1]Oslo Business School, Oslo Metropolitan University, Norway
[2]School of communication, leadership and marketing, Kristiania University College, Norway
aetobi@oslomet.no
ingunn.elvekrok@kristiania.no
line.skreosen@outlook.com

Abstract. This study explores how a Norwegian accelerator influenced the entrepreneurial identity of those accellerated. The importance of entrepreneurial identity, or how entrepreneurs see themselves and their business ventures, is highlighted in effectuation theory as one of the means that drives entrepreneurial action and is seen as important for entrepreneurs' perceived opportunity space. The study is an explorative single-case study of a Norwegian accelerator targeting new ventures. Data were collected through in-depth interviews with seven entrepreneurs who had recently participated in the accelerator. The findings indicate that the accelerator had an impact on entrepreneurial identity, both at the individual and team levels and on start-up identity. Participation in the program also influenced related factors, such as business model development and customer- and capital access. The impact on identity varied according to how the entrepreneurs saw themselves pre-participation and how far they had come in developing their firms' business concepts. The study contributes to the literature on the effects om accelerators in general, and its role in fostering entrepreneurial identity at different levels in particular.

Keywords: accelerator, entrepreneurial identity, venture identity, team identity, effectuation, start-ups

1. Introduction

Only one in four start-up companies survives, often due to limited resources and unforeseen obstacles (Panda and Dash 2015). Acknowledging the importance of entrepreneurial activity for jobs and economic performance, the government and investors are investing heavily in fast-growing entrepreneurial ecosystems and different means to better prepare entrepreneurs for the venturing process. A relatively new instrument in this ecosystem is accelerators. Accelerators target entrepreneurs in the early phase of a start-up, providing a time-limited and intense mentorship and educator programme that contributes to the development and upscaling of new ventures (Cohen, 2013). The accelerators provide workshops and seminars delivered by accelerator directors, mentors, or guest speakers, and the entrepreneurs receive direct feedback that is valuable for avoiding potential pitfalls (Hallen et al., 2016).

Entrepreneurial identity is seen as important for entrepreneurs' perceived opportunity space (Farmer, Yao, and Kung-Mcintyre, 2011; Alsos et al., 2016), in particular in the early stages of new ventures, when entrepreneurial effort often consists of little more than business concepts crafted by entrepreneurs trying to seize novel market opportunities (Navis & Glynn, 2011). The identity of entrepreneurs has been found to influence start-up outcomes, such as the acquisition of resources (Ahsan et al., 2018) and networks and business contacts (Stoyanov et al., 2018).

Entrepreneurial identity is highlighted in effectuation theory as one of the means (together with entrepreneurs' competence and networks) that drive entrepreneurial action (Sarasvathy et al., 2008). Previous studies indicate that participants in accelerator programmes achieve new competence and access to new networks as takeaways (Cohen, 2013; Nielsen & Lassen, 2012; Sarmento et al., 2016). The discussion on how identity unfolds and changes through the entrepreneurial process is limited (Nielsen & Lassen, 2012; O'Neil et al., 2020), and specifically related to accelerator programmes. Thus, the aim of this study is to address this gap and explore the change in identity, as called for by Wagenschwanz (2021), who argued that ecosystems, that is, accelerators, may shape and change identity.

Following Navis and Glynn's (2011, p. 480) framework, we consider entrepreneurial identity as "the constellations of claims around the founders, organisation, and market opportunity of an entrepreneurial identity that gives meaning to questions of "who I am/who we are?" and "what we do?". Hence, we discuss two

[1] Corresponding author

levels of identity: identity at the entrepreneurial level, "who I am/who we are", and identity at the start-up level, "what we do". Since most start-ups are founded by a team, "who we are" as a team may be more relevant for a start-up than "who I am". Team identity has been less investigated and called for in recent literature (Powell & Baker, 2017; Wagenschwanz, 2021).

2. Theoretical framework

2.1 Entrepreneurial identity from an effectuation perspective

Early definitions of identity focused on the central, distinctive, and enduring features of an individual or group/organisation (Albert & Whetten, 1985). Although people think of identity as something persistent, it is generally agreed that identity is influenced by surroundings and is therefore subject to continuous development (Gioia et al., 2013). Brown (2015, p. 20) argued that identity is people's subjective understanding of who they were, are, and desire to become.

In this paper, we discuss identity based on effectuation theory (Sarasvathy, 2001, 2008). The main idea behind effectuation theory is that entrepreneurs start with a generalised aspiration for their firms rather than spending time on analysis and planning, using the means at their disposal (i.e., who they are, what they know, and who they know), which influence their course of action and goals. Effectuation theory acknowledges that identity may change when entrepreneurs meet new people, discover new opportunities, and gain access to new resources (Sarasvathy, 2008), as this will change their means. Effectuation is considered particularly relevant in dynamic situations with a high degree of insecurities about the future, which is generally the case for start-ups. The effectuation model is presented in Figure 1.

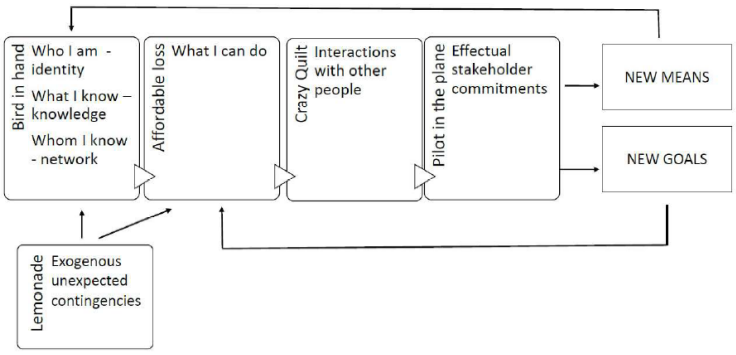


Figure 1: The effectuation model (Sarasvathy, 2001, 2008)

Sarasvathy (2001) described entrepreneurial identity as an individual's traits, preferences, and skills, and it was strongly linked to the individual. The understanding of entrepreneurial identity in effectuation theory has developed over time, and it has been acknowledged that identity in an entrepreneurial context occurs at levels other than the individual (Read et al., 2016). Identity at the team level is highly relevant, since many start-ups are founded by more than one entrepreneur (Elfving, 2015; Leitch & Harrison, 2016). Yet, it is acknowledged that team members may have different identities related to their role in the start-up (Navis & Glynn, 2011). Team identity has been less investigated and called for in recent literature (Powell & Baker, 2017; Wagenschwanz, 2021).

Scholars argue that the identity of the individual entrepreneur(s) and the identity of the start-up are closely linked and influence each other (Ashforth et al., 2011; Cruz et al., 2018). Lindgren and Wåhlin (2001) claimed that the identity of a start-up is shaped by entrepreneurs' experiences and is therefore under continuous development. Thus, a start-up's identity reflects the activities entrepreneurs engage in on a "daily basis" (Read et al., 2016). According to Ashforth et al. (2011), individual identity, "I think", affects collective identity, "we think", through social processes, and the collective identity of a group becomes a common understanding of how things are, "that's how it is", as well as who they are as an organisation, that is, "what we do". This identity may be different or similar to other ventures/existing organisations in the industry (Navis & Glynn, 2011).

2.2 Accelerators and entrepreneurial identity

Accelerators target entrepreneurs in start-ups' early phases, providing a time-limited and intense mentorship and educator programme that contributes to the development and upscaling of new ventures (Cohen, 2013). Previous studies indicate that participants achieve a new understanding of "self" as one of the takeaways from participation in accelerators or similar types of programmes (Nielsen & Lassen, 2012; Tobiassen et al., 2018). Entrepreneurs' choices and behaviours are largely influenced by their perceptions of themselves or who they want to be (Cruz et al., 2018). Entrepreneurship research has demonstrated that founders' identities, in the sense of "who I am" and "who I want to be," shape their behaviour (e.g., Cardon et al., 2009; Farmer et al., 2011). Mathias and Williams (2017) argued that it is unlikely that first-time founders will fully understand the variety of role identities implicated in entrepreneurial activity; instead, this is an aspect that is discovered and negotiated throughout the process.

Because start-ups are developed in interaction with its environment (Leitch & Harrison, 2016), their identity may be influenced by external entities, such as accelerators. Leitch and Harrison (2016) argued that start-ups' identities are in many ways a reflection of expectations from the environment and that interaction with the environment helps entrepreneurs gain a clearer understanding of the start-up's identity. This is also highlighted by Wagenschwanz (2021), who claimed that it is important to incorporate the external environment in consideration of entrepreneurs' identity.

Elfving (2015) emphasised that a start-up company is highly dependent on partners and other stakeholders to succeed; accordingly, it must adapt parts of its identity to satisfy these entities. These can include certain expectations related to the start-up identity. Navis and Glynn (2011) argued that a name such as "Tony's Pizza" is perceived as appropriate for a restaurant, whereas "Tony's Bank" is inappropriate for a financial institution. Since the environment is dynamic, the start-up's identity may need to change continuously to satisfy its surroundings over time (Fisher et al., 2016). Others have argued that a start-up should not uncritically adapt its identity to external influences. Elfving (2015) claimed that the part of the start-up's identity that encompasses the entrepreneurs' views of themselves and the start-up's vision or mission should remain stable. Tryba and Fletcher (2019) emphasised that start-ups should have a clear perception of their own vision, and that it is vital that this contains some continuity.

3. Methods

3.1 Case study

A single embedded case study was chosen as the appropriate research strategy. Case studies combine inductive and deductive research to build theory, and are well adapted to study issues in a realistic context (Eisenhardt, 1989). The study is based on a Norwegian accelerator, The Factory, with participating entrepreneurs/new ventures representing the embedded units of analysis.

The Factory was established in 2016 in Oslo by a group of Norwegian serial entrepreneurs. It offers services, investments, and accelerator programmes for early-stage start-ups in the Nordic countries within various industries (fintech, proptech, and retail). In 2019, The Factory won the award "Best Accelerator/Incubator in the Nordics" in the Nordic Startup Awards, and its CEO was awarded the award "Ecosystem Hero of the Year in Norway".

The main accelerator programme runs twice a year, with 8–10 start-ups participating each time. It is a two-step programme. After the first six weeks, The Factory organises "Pitch and Selection Night," where the participants pitch their business ideas to partners. In collaboration with investors, The Factory chooses which start-ups to be included in step two. Step two, another six weeks, ends with "Demo Day", where the remaining start-ups pitch their business idea to a larger audience of investors, customers, and other players in the start-up environment. As a part of the deal, selected start-ups receive an investment from The Factory Capital. Participation is based on application or invitation, and on interviews with participants in which the relevance and potential of the start-up companies are assessed. The evaluation is based on idea/concept versus needs in the market, the entrepreneurial team, and product/solution, the entrepreneurial team being perhaps most important. Since its start, The Factory has accelerated more than 100 start-ups and invested in a portfolio of more than 40 companies.

3.2 Data collection

The data collection took place during the spring of 2020 by the last author as part of her master's thesis. Before the data collection, she spent some time in the accelerator, allowing close observation of accelerator activities and informal talks with participants.

The selection of informants was based on the following criteria: (1) they had participated in the accelerator during the last 12 months to secure a more accurate memory of the programme, (2) were one of the entrepreneurs in the start-up company, and (3) had participated actively in the accelerator programme. Of the informants identified, seven entrepreneurs (seven firms) agreed to participate in the study. To ensure consistency, a semi-structured interview guide was used (Yin, 2013). The questions encompassed how participation in the accelerator influenced the way the participants understood themselves and their firms—that is, what we are and what we do.

The interviews lasted 30–60 minutes, were recorded, and subsequently transcribed to ensure reliability (Yin, 2013). The primary data were supplemented with secondary data, such as websites, newspaper articles, and podcasts. Table 1 provides a summary of the informants and the start-ups.

Table 1: Information about informants, teams, and start-ups pre-participation

	Alpha	Beta	Cappa	Delta	Ecco	Fox	Gamma
Informant / founder	Mid-forties Entrepreneurial experience Self-confident	Early-twenties, Just left high school	Mid thirties Industry experience	Mid-twenties Just graduated from university	Mid-forties, Industry experience Entrepreneurial identity	End of twenties Business education Entrepreneurial. experience, Entrepreneurial identity	End of thirties Entrepreneurial experience, Project manager, software developer
Entrepren. team	2 founders Long-time business partners, knew each other well	3 founders Early twenties, just left high school	3 founders Work experience from the same company	2 founders + 1 employee	One founder, + three employees	Solo entrepreneur	3 founders + 5 employees
Team experience	Both with entrepren. experience	Worked on the project besides school	One with entrepren. experience	One founder with industry and entrepren. experience	Employees with industry, technical and software experience		Product development, back- and front- end developers
Team expansion	With one tech person during participation			With one person during participation	Recruited a team to enable participation	Expanded the team post-participation	
Value proposition	Laser scanner app to improve and simplify measurement of buildings/ properties	Simplify various tasks related to connections between property owner, tenants and suppliers	Develop tools to simplify/fasten sales and buying processes of private properties	Idea only Solve noise problems in society	Idea only. Simplify renovation process, digitalise connections between sub-contractors	Digitalise demonstration/ views of private properties for sale	Platform for cryptocurrency exchange

	Alpha	Beta	Cappa	Delta	Ecco	Fox	Gamma
Market	B2B and B2C — Real estate appraisers and private house owners	B2B – Commercial real estate	B2C – Private housing	The "society"	B2C — Private properties	B2C and B2B – Private properties and real estate brokers	B2C – private
Participation	Spring 2019	Autumn 2019	Spring 2019	Autumn 2019	Spring 2019	Spring 2019	Autumn 2019

3.3 Data analysis

The transcripts were coded following a thematic analysis (Braun & Clarke, 2006). To strengthen validity and reliability and reduce potential personal bias in interpretation, a researcher triangulation strategy was chosen (Miles et al., 2014, Yin, 2013). Hence, the first and the second authors performed data analysis together for the purpose of this paper, starting with reading and re-reading the interviews, taking initial notes, and then meeting for discussion and further interpretation, thus following an individual–group procedure to ensure perspective. Initial coding was based on a preconception of the initial theoretical framework. As the analysis and interpretation of the data emerged, patterns in the data were analysed, searching for categories and themes. The combination of deductive and inductive analysis resulted in a code tree consisting of three main groups and several subgroups (see Figure 2).

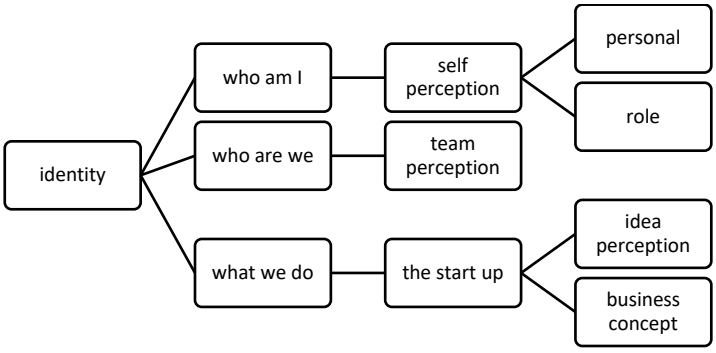


Figure 2: Code tree

4. Results and discussion

4.1 Individual and team identity

The findings indicate that participation in the accelerator influenced entrepreneurial identity at both the individual and team levels. Asking why and how, the informants pointed to the accelerator programme content of high-degree process-focused "real-world activities" that challenged them as persons but also provided positive feedback. The recognitions they received for what they did and the advice from mentors and other employees at The Factory and the fellow participants in the accelerator were valued and important for self-reflection.

Several of the informants referred to changes in identity by saying they "became more adult" or "grew as people". This is consistent with previous findings (Tobiassen et al., 2018). The change in identity was especially the case for the younger entrepreneurs, represented by the informants in Beta and Delta. They felt that they were taken seriously and received a lot of support and positive feedback in the process. This strengthened their identity as entrepreneurs (Mathias & Williams, 2017):

> *Before the accelerator, we were teenagers with no experience. We were just testing out stuff to see if it could work. But they (the accelerator) believed in us, they treated us professionally… In a way, we became more grown-ups and no longer "kids" through being part of the accelerator programme. (Beta informant)*
>
> *(…) As a team, we became a more professional, maybe, more structured. The division of roles became clearer. For me, I experienced an explosive start in my professional career. I finished my*

> *education a year ago … I have grown so much through participation; it influences everything we do. (Delta informant)*

The more experienced respondents also claimed that they grew as persons and became more aware of their own strengths and weaknesses, becoming energised in their role as entrepreneurs, which then became vital in the process of developing their firms.

> *It (participation) has formed us as persons, we have evolved considerably, and all the positive recognition we got, it is with us further, it gave us a lot of guts to continue the work. (Alpha informant)*

However, being challenged by the personal did not always come without cost. It was particularly challenging for a young solo entrepreneur who could not lean on other team members in the process:

> *I saw myself as an entrepreneur, had done that for a long time, and had started companies previously. I looked forward to being challenged. But this was hard for me. I lost confidence for a while. I felt like an idiot. I felt so alone, but I learned a lot about myself, not least to trust people. And yes, they (the accelerator) supported me all the way. (Fox informant)*

For team-based start-ups, the findings show that participation influenced the entrepreneurial team positively and that the teams became more "professional". Although becoming more aware of each team member's strengths and weaknesses, the entrepreneurs gained an increased understanding of what should be each team members' responsibility. Further, the activities in the accelerator illustrated the complexity of the resources needed to form a new venture and that different skills were needed. This was pointed out by both the Delta (above) and Beta informants.

> *We were three people before and after completing the programme. It was probably more that the three of us, who were just friends, did this because it was fun. We kind of transformed into a team where we discovered our personal strengths. (Beta informant)*

Being an entrepreneurial team is considered advantageous with regard to both potential customers and investors (Stoyanov et al., 2018). The Factory builds its activities in the programme around this, and some of the entrepreneurs were explicitly challenged by the accelerator on the lack of existing resources within the team. Responding to the challenge, some firms expanded their team during the programme.

> *So we were kind of a bit exposed to weaknesses as well, and it pushed us even harder to continue the search to find one, one last, in a way, technical person, for the team. (Alpha informant)*

Alpha expanded its team during the programme, and Cappa and Fox did so after finishing the programme. Research shows that start-ups founded by a team have a significantly increased survival probability compared to solo entrepreneurs (Box & Segerlind, 2018). This may be one reason why The Factory prefers that participating start-ups are a team of entrepreneurs.

In general, the informants from all the entrepreneurial teams reported that collaboration between team members improved during the accelerator. This may be related to the practical training in collaboration within the program, and/ or because cooperation in the team is a premise for participation in the accelerator. Improved team collaboration was particularly evident for the start-ups that had recently set up a team. This agrees with Ashforth et al.'s (2011) notion that team members who become more acquainted with each other and work closely together will simultaneously construct a sense of "who we are".

4.2 What we do: The idea or start-up identity

Regarding "what we do," the start-ups had different starting points pre-participation in the accelerator. Some had come quite far in developing their business idea and had customers; others were ready to commercialise their products; and others had vaguer ideas of what they wanted to do and wanted to be. The findings show that it is possible to separate the start-ups' starting points into three:

- 1. Start-ups with a strong perception of "what we do" and had received confirmation of their idea in the market (Beta and Gamma),
- 2. Start-ups with a strong perception of "what we do" but had not yet received confirmation in the market (Alpha, Cappa, Fox), and

- 3. Start-ups with an idea of what they wanted to do and that had not started to shape their identity at the company level pre-participation (Delta, Ecco).

The analysis indicates that for start-ups in group 1 that had a strong perception of "what we do", the accelerator's impact on identity at the start-up level was not that large. Given that these start-ups were already fairly established in the market, neither the entrepreneurs in Beta and Gamma, nor the accelerator, nor other network connections had any intention of making major changes in "what we do". It was rather a matter of small adjustments to better adapt to customers or other stakeholders, which Elfving (2015) argued is important for start-ups to succeed in their assignments.

> *We just made a few changes to simplify user features to make the product more user-friendly for our target customers. Participation made us more concerned about how to present and communicate our product to users. (Gamma informant)*

Start-ups in group 2 found it stressful to be challenged on "what we do". Taking Alpha as an example, the entrepreneurs made many changes in the concept based on feedback and suggestions from The Factory, potential partners and customers. Hence, they wanted to adapt. However, after finishing the accelerator programme, the entrepreneurs realised that the new concept did not work well for them and decided to change back to the original concept. Yet, the informant argued that the process had been valuable as the concept became more precise and clear:

> *It became clear to us that we have an "asset-as-a-service" model; we didn't understand that before participating. We learned a lot in the process. And we have become more conscious of "what we do" and not to think too complicated about it. (Alpha informant)*

The start-ups in group 3 experienced that the impact on identity at the company level was large and positive. These start-ups had not developed a strong "what we do" identity pre-participation. Thus, through participation, the entrepreneurs became more familiar with their own business and developed a strong perception of "what we do". The entrepreneurs saw that working with their start-ups based on feedback from external parties was helpful and much needed to develop the start-up's identity and clarify how they could be legitimately distinct from incumbents (Navis & Glynn, 2011). The entrepreneurs realised that a distinct understanding of "what we (want to) do" was a prerequisite for all else. This may explain why the start-ups in group 3 experienced the impact on identity at the company level as highly positive and did not experience this as a frustrating process. For example, Delta shared that:

> *We understood that our idea was naïve, solving noise problem for society was far too ambitious. The concept became more concrete and for a smaller market (B2B). (Delta informant)*

Overall, the analysis revealed that simplification—or clarification of "what we do" became clearer for most of the participating start-ups through participation in the programme, independent of how far they come in developing their business idea pre-participation.

For the start-ups in group 1, the identity at the company level was most ingrained pre-participation. This may not be surprising since the literature emphasises that identity is shaped through activities, experiences, and social processes (Ashforth et al., 2011; Lindgren & Wåhlin 2001; Read et al., 2016). The start-ups in group 1 had tested their concept in the market pre-participation.

5. Conclusion

This study contributes to an enriched understanding of how participation in accelerators influences identity at different levels, a theme not much studied from an effectuation theory perspective. Identity is one of the entrepreneurs' means (Sarasvathy, 2001) vital for start-up development. The study takes a broader perspective by including start-up identity ("what we do") with identity at the individual/team level ("who I am/who we are").

The participant entrepreneurs experienced some changes at the individual level, yet the change in self-perception seemed the largest for the youngest and less experienced entrepreneurs. Consistent with Watson et al.'s (2015) findings, the accelerator programme helped entrepreneurs become better acquainted with their identity pre- and post-participation. Both as individuals and as a team, they became more aware of their own strengths and weaknesses, became more confident, and were better able to act on their identities by dividing tasks and gathering new resources to develop their ventures. Being challenged both as persons and as a team (who I am/who we are) and on their ideas (what we do) while simultaneously experiencing support seemed vital in this process.

Due to intensive work with the start-up during the accelerator period, several entrepreneurs experienced that the accelerator made them more focused, structured, and dedicated to developing their firms. For most start-ups, this process changed the start-up's identity ("what we do") to a large or small extent. That identity at both the individual/ team and start-up level is formed through daily activities and experiences has been emphasised by previous studies (e.g., Read et al., 2016; Tobiassen et al., 2018). The findings indicate that participation in the accelerator increased the pace of development by pushing the start-ups through difficult decisions.

Adapting identity to external influence can be crucial for start-ups to succeed (Elfving, 2015; Fisher et al., 2016; Leitch & Harrison, 2016). Nevertheless, the literature points out that start-ups should be careful not to let the influence of external actors overcome their own vision for the company (Elfving, 2015), as experienced by some of the entrepreneurs.

This study has some limitations. Due to the COVID-19 situation (interviews were done during Spring 2020), and heavy workload for the start-ups, we were not able to recruit more than one informant from each start-up. This is not ideal, as the study intended to uncover how participation in an accelerator may influence team level and start-up identity. Accordingly, it would have been preferable to interview all founding team members, which should be encouraged in future studies. Further, we interviewed only one start-up within fintech, compared to six in proptech. Although differences related to industry were not found in this study, future research could emphasise potential differences in identity across industries,

References

Ahsan, M., Zheng, C., Denoble, A., & Musteen, M. (2018). From student to entrepreneur: How mentorships and affect influence student venture launch. *Journal of Small Business Management*, *56*, 76–102.

Alsos, G. A., Clausen, T. H, Hytti, U., & Solvoll, S. (2016). Entrepreneurs' social identity and the preference of causal and effectual behaviours in start-up processes. *Entrepreneurship & Regional Development*, *28*(3–4), 234–258.

Ashforth, B. E., Rogers, K. M., & Corley, K. G. (2011). Identity in Organizations, Exploring cross-level dynamics. New Perspectives in Organization Science (September-October (2011)), *22*(5), 1144–1156

Box, M., & Segerlind, T. L. (2018). Entrepreneurial teams, gender, and new venture survival: Contexts and institutions. *SAGE Open* April-June, 1–17, DOI: 10.1177/2158244018777020

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101.

Brown, R., Mawson, S., Lee, N., & Peterson, L. (2019). Start-up factories, transnational entrepreneurs and entrepreneurial ecosystems: Unpacking the lure of start-up accelerator Pprogrammes. *European Planning Studies*, *27*(5), 885–904.

Cardon, M. S., Wincent, J., Sing, J., & Drnovsek, M. (2009). The nature and experience of entrepreneurial passion. *Academy of Management Review*, *34*, 511–532.

Cohen, S. (2013). What do accelerators do? Insights from incubators and angels. *Innovations: Technology, Governance, Globalization*, *8*, 19–25.

Cruz, M. E., Verdú Jover, A. J., & Gómes Gras, J. M. (2018). Influence of the entrepreneur's social identity on business performance through effectuation. *European Research on Management and Business Economics*, 24, 90–96.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review,* 14**,** 532–550.

Elfving, J. (2015). Supporting the cause – A case study on social entrepreneurial identity at Rosenlund heritage site. *Journal of Enterprising Communities*, *9*(1), 17–30.

Farmer, S. Yao, X., & Kung-McIntyre, K. (2011), The behavioral impact of entrepreneurial experience. *Entrepreneurship Theory and Practice*, *35*, 245–273.

Fisher, G., Kotha, S., & Lahiri, A. (2016). Changing with the times: An integrated view of identity, legitimacy, and new venture life cycles. *The Academy of Management Review*, *41*(3).

Hallen, B. L, Bingham, C., & Cohen, S. (2016). Do accelerators accelerate? The role of indirect learning in new venture *Social Science Research Network. Rochester: Elsevier*, *8*(07).

Leitch, C. M., & Harrison, R. T. (2016). Identity, identity formation and identity work in entrepreneurship: conceptual developments and empirical applications, *Entrepreneurship & Regional Development*, *28*(3–4), 177–190.

Lindgren, M., & Wåhlin, N. (2001). Identity construction among boundary-crossing individuals. *Scandinavian Journal of Management*, *17*(3), 357–377.

Mathias, B. D & Williams, D.W. (2017). The impact of role identities on entrepreneurs' evaluation and selection of opportunities, *Journal of Management*, *43*(3), 892–918.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A method sourcebook*. Sage Publications.

Navis, C., & Glynn, M. A. (2011). Legitimate distinctiveness and the entrepreneurial identity: influence on investor judgments of new venture plausibility. Academy of Management Review, *36*(3).

Nielsen, S., & Lassen, A. (2012). Identity in entrepreneurship effectuation theory: A supplementary framework. *International Entrepreneurship and Management Journal*, *8*(3), 373–389.

O'Neil, U. D., & York, J. G. (2020). The evolution of founder identity as an authenticity work process. *Journal of Business Venturing*. https://doi.org/10.1016/j.jbusvent.(2020).106031

Panda, S., & Dash, S. K. (2015). Friends and strangers: Leveraging the power of networks for new venture success. *Development and Learning in Organisations*, *29*(2), 6–9.

Powel, E. E., & Baker, T. (2017), In the beginning: Identity processes and organizing in multi-founder nascent ventures. *Academy of Management Journal*, *60*(6), 2381–2414.

Read, S., Sarasvathy, S., Dew, N., & Wiltbank, R. (2016), *Effectual entrepreneurship*. Routledge.

Radojevich-Kelley, N., & Hoffman, D. L. (2012). Analysis of accelerator companies: An exploratory case study of their programs, processes, and early results. *Small Business Institute Journal*, *8*, 54–70.

Sarasvathy, S. D. (2001). Causation and effectuation: toward a theoretical shift from economic inevitability to entrepreneurial contingency. *The Academy of Management Review, 26*, 243–263.

Sarasvathy, S. (2008). *Effectuation: Elements of entrepreneurial expertise*. Edward Elgar Publishing Limited.

Sarmento, C. F. B., De Carvalho, C. A. S., & Da Rocha Dib, L. A. (2016). Effectuation and the influence of social networks on the internationalization of accelerated startups. *Internext: Revista Electrônica de Negócios Internacionais da ESPM,* 11.

Stoyanov, S., Woodward, R., & Stoyanova, V. (2018). The embedding of transnational entrepreneurs in diaspora networks: Leveraging the assets of foreignness. *Management International Review*, *58*, 281–312.

Tobiassen, A. E., Elvekrok, I., Liestol, E. J., & Lotvedt, A. (2018). The value of accelerator programs in the internationalization of Norwegian international new ventures. *Proceedings of the 13th European Conference on Innovation and Entrepreneurship.*

Tryba, A., & Fletcher, D. (2019). How shared pre-start-up moments of transition and cognitions contextualize effectual and causal decisions in entrepreneurial teams. *Small Business* Economics, *54*, 665–688

Wagenschwanz, A. M. (2021). The identity of entrepreneurs: Providing conceptual clarity and future directions *International Journal of Management Reviews*, *23*, 64–84.

Watson, K., Mcgowan, P., & Smith, P. (2015). Leveraging effectual means through business plan competition participation, Industry and Higher Education, 29 (6), 481–492, doi: 10.5367/ihe(2015).0285

Yin, R. K. (2013). *Case study research: Design and methods*. London: Sage publications.

Digitally Transforming Organisational Cultures: Ensuring Enhanced Innovation in a Remote Working World

Stephen Treacy
University College, Cork, Ireland
stephen.treacy@ucc.ie

Abstract: The Covid-19 pandemic has brought with it dramatic environmental changes, forcing organisations to adopt digital technologies on a wider scale, under significant time pressure. While the pandemic tested the agility and resilience of organisations, team dynamics and the implications of virtualisation on collaboration and creativity have become increasingly important for research (George et al., 2020) as the daily working routines in which employees have been embedded in for decades have become disrupted. The abrupt move to "working from home" that the pandemic created is arguably the most significant organisational design change in our lifetimes. Organisations are now asking how the virtualisation of work has impacted on the collaboration and communication necessary for driving innovation behaviour, and what strategies are available to develop remote innovation solutions. In this study, we explore organisational culture theory against the backdrop of digitally transforming innovation development as a result of the Covid-19 pandemic. This multi-layered model offers a useful framework for thinking about processes that foster innovation. By doing so, we investigate how organisations have adapted their approach to remote, collaborative innovation from the perspective of nineteen industry experts. The purpose of this study is to present the determinants of organisational culture to develop digital innovation in a hybrid working environment. Our findings reveal twelve distinct variables across the artifacts, values, and assumptions required to ensure digital innovation. These findings have implications for theory and practice, as it provides organisational leaders with a strategic understanding as to how a remote innovative culture can be developed, and subsequently exploited.

Keywords: digital innovation, digital transformation, organisational culture theory, remote working, Covid-19

1. Introduction

Digitalisation has been shown to blur the boundaries between management and technology, providing new tools and concepts of the digital environment that are dramatically changing how organisations innovate (Bresciani et al., 2018). This evolving digital environment requires organisations to use technologies for data collection, integration, and utilisation, adapting a platform economy (Petrakaki et al., 2018), and to find growth opportunities to remain competitive. With this in mind, a diverse set of novel and influential digital technologies, platforms, and infrastructures has emerged over the past decade or so that have transformed both entrepreneurship and innovation significant ways, resulting in broad organisational and policy implications (Nambisan et al., 2019). However, the challenge for organisations in a post Covid-19 world is not only to explore and exploit new technologies to modify existing innovation practices, but also to make the necessary organisational changes required for their success (Steiber et al., 2020).

Unfortunately, despite a diffused awareness of the unintended rigidities, changes, and vulnerabilities that digital technologies bring to the innovation process (Lu and Ramamurthy, 2011, Reibenspiess et al., 2020), several theoretical and empirical gaps remain to hinder a more complete understanding of digital innovation strategies (Appio et al., 2021), including business and operating models (Berger et al., 2021), organisational forms (Nambisan, 2017), and entrepreneurial modes (Nambisan et al., 2019). More importantly, embracing digital innovation has implications at broader levels with the potential to inform policy making entities and other stakeholders. By focusing on the socio-cultural aspects of digital innovation, this study investigates how organisational culture theory can be developed to further our understanding toward the change and innovation adaptations that came with the mandatory switch to this remote working paradigm that Covid-19 necessitated for most organisations. The main benefit to this approach is to understand change as an outcome of structures, activities, and actions at multiple levels of analysis, societal, individual, and organisational (Scott, 2013). This approach can thus produce a richness and a complexity to understanding digital innovation at the level of new processes, services and products, but also, perhaps more vitally, an emphasis on issues of digital transformation, or radical change (Greenwood and Hinings, 1996). By doing so, this study seeks to explore the artifacts, values, and assumptions required to establish a digital culture of innovation.

2. Literature review

2.1 Digital innovation

Digital innovation can be viewed as the use of digital technology during the process of innovating, and can be used to describe, fully or partly, the outcome of innovation. This perspective has fundamentally changed the nature and structure of new services and products, spawned novel value creation and value appropriation pathways, enabled innovation collectives involving various actors with distinct goals and competencies, developing a new breed of innovation processes and, more broadly, has transformed entire industries (Boudreau and Lakhani, 2013). This phrase has also pervaded contemporary business to signify the transformational, or disruptive implications of digital technologies for organisations adapting their business models, innovative products, and unique customer experiences (Rogers, 2016) in light of the Covid-19 pandemic. Within these areas, extant literature has sought to explore how digital innovation can fuel new initiatives that cross traditional industry and sectoral boundaries, integrating digital and non-digital assets, embracing networks, ecosystems and communities, while also accelerating the inception, scaling, and development of new ventures (von Briel et al., 2018).

The importance of digital innovation has led scholars to question the value of traditional innovation theory and related organisational scholarship (Barrett et al., 2015). Benner and Tushman (2015) recently observed that "*because of the shift in the locus of innovation and because some of our core organizing axioms may be challenged or fundamentally changed by the digital revolution, the nature of innovation and organisational scholarship may be at a transition point*" (p. 2). We conceptualise digital innovation therefore as per Nambisan et al. (2017), who describe it as "*the creation (and consequent change in) market offerings, business processes, or models that result from the use of digital technology*" (p. 224). Digital innovation management therefore refers to the practices, processes, and principles that underlie the effective orchestration of digital innovation. This definition captures three important phenomena. Firstly, it captures a range of innovation outcomes such as new products, services, customer experiences etc., provided these outcomes are made possible through digital technologies and digitized processes. Secondly, this definition includes a broad array of digital tools and infrastructure for making innovation possible. Thirdly, it allows the possibility that outcomes may be diffused, assimilated, or adapted to specific use contexts. This broad definition bridges a research focus on intra-organisational innovation management with research on the organisational culture required to deliver it successfully.

2.2 Organisational culture

Organisational culture can be manifested in the typical characteristics of the organisation that encompass a basic set of suppositions which have worked so well in the past that they become accepted within the organisation. These are maintained through continuous process of human interaction, and become manifested through attitudes and behaviour, (Martins and Terblanche, 2003). These attitudes and behaviours, along with values, philosophies, and feelings all form part of the organisational culture (Hellriegel et al., 1998). Several models of organisational culture have been developed including the model of organisational reality developed by Sathe (1985), which focuses on the influence of personnel, organisation systems, and leadership on the expected and actual behavioural patterns, the effectiveness therein, and the level of satisfaction brought about. Other researchers view organisational culture against the backdrop of systems theory developed by (Von Bertalanffy, 1950) and was subsequently adapted by several authors who applied the systems theory to organisations (Kast and Rosenzweig, 1985). Elsewhere, Schein's (2010) model depicts the levels of organisational culture, namely artifacts (visible organisational structures and processes), values (goals and philosophies), and assumptions (deepest underlying beliefs and perceptions) and their interactions. Artifacts can be described as the characteristics that are experienced by employees in the workplace. Although artifacts are easily recognised, they are difficult to decipher, and rely on gaining internal opinions and perspectives to achieve a greater understanding of their impacts. Literature has indicated that these artifacts enhance innovative behaviour within the organisation (Hogan and Coote, 2014). Values however can be seen as deep-rooted aspects of culture, and have been argued to be more difficult to influence (O'Donnell and Boyle, 2008). Espoused values look at goals, ideas, norms, standards, and moral principles present in the organisational setting, and can play a large role in forming a successful culture as they are flexible, internal, and controlled (Bradley and Parker, 2006). The third component, assumptions, are important boundary conditions that

surround common team effectiveness assumptions when culture is considered to be an aspect (Feitosa et al., 2018).

2.3 Research gap

While prior research has focused on how digitization can translate into innovation productivity gains, broader economic and social gains, and increased regional entrepreneurial activity (Burtch et al., 2018), the radical shift presented by Covid-19 has demanded more from organisations, challenging them to digitally transform their traditional onsite culture of innovation. Importantly, digitization not only holds implications for different levels of analysis (individual, community, societal, organisational), but importantly, across levels as well, which has received limited attention (Nambisan et al., 2019). Digitization is not just a context for entrepreneurship and innovation, as these technologies can serve as the driving factor of innovative activities (Lusch and Nambisan, 2015). It is vital that studies incorporate characteristics natural to digital technologies as key explanatory factors in theorizing the nature of digital innovation (Kallinikos et al., 2013). Furthermore, scholars argue there is a need for new theories in this age of digital transformation and digital innovation because innovation processes themselves are subject to digitization, leaving accepted theories of innovation no longer applicable (Svahn et al., 2017). Nambisan et al. (2017) state that "*there is a critical need for novel theorizing on digital innovation management*" (p. 233) that deals more adequately with the rapidly changing nature of innovation processes in a digital world. This research therefore seeks to explore this cultural shift through the theoretical lens of Schein (2010), who argues that a culture must be crafted and cannot be successfully created in the short term. It must be formed over time, continually evolving to reach the goals of the organisation. With this in mind, we state our research questions as: (i) What artifacts are required for a digital culture of innovation?; (ii) What values are required for a digital culture of innovation?; and (iii) What assumptions can be made about this digital culture of innovation? To sum up, we present an investigation into digitally transforming an organisation's innovation culture through the lens organisational culture theory from the perspective of innovation leaders.

3. Research strategy

3.1 Expert judgement study

For the purposes of this study, experts can be defined as "*persons to whom society and/or peers attributes special knowledge about matters being elicited*" (Garthwaite et al., 2005). These studies can be used both informally when no data is available, and formally to bound problems and qualitatively structure models (Wilson, 2017), through the use of semi-structured interviews. This provides the researcher with a naturalistic method to validate theoretical artifacts in real environments, or organisational contexts (Venable et al., 2016). Through integrative assessment, selected experts can communicate and synthesise understanding for societally important questions which is fundamental in achieving a detailed understanding of the topic (Knox and Burkard, 2009). This approach reinforces understanding, and aids in extracting the underlying intentions of interactions which ultimately complements the process of deriving precise findings and addressing the scope of the research problem area. Following case selection methodologies described by Yin (2008), the selection of experts ensured multiple objectives: (1) experts occupied roles that made them knowledgeable about the issues being researched; (2) a representative sample of experts were obtained; (3) useful variations of theoretical interest were achieved; and (4) experts have several years of experience working in innovation intensive organisations, offering a deeper understanding of the phenomenon of interest. Based on this selection, nineteen experts were selected across several organisations outlined below in Table 1. These experts represent several industries that are heavily engaged in continuous innovation, with the shift to remote working necessitating sweeping changes to existing practices.

Following Vaismoradi et al. (2016), data analysis consisted of four distinct stages: initialisation, construction, rectification, and finalisation. Firstly, the researcher focused on the transcripts, highlighted meaningful abstractions using thematic codes, for example, the occurrence of a potential theme, conflicting views, and wrote reflective notes. Secondly, the researcher classified, compared, and labelled the themes identified against the research instrument, while applying open, axial, and selective coding (Wolfswinkel et al., 2013). This coding process inductively established a set of main categories and sub-categories that visualised how the collected data portrays the identified research questions (Oates, 2005). Drawing explanations, re-checking data and reviewing findings amongst third parties was also performed during this stage to ensure validity. Thirdly, the researcher concentrated on streamlining themes by excluding any redundancies and relating any

potential themes to established knowledge, facilitating a matrix of categories. This allowed the researcher to reflect on the data in new ways, as well as to eliminate irrelevant, overlapping, or repetitive data. As a result, the findings from the expert studies initially consisted of eleven themes across the three research questions which was subsequently reduced to nine. Finally, the focus was to analyse the areas of commonality among the respondents and to tell the story as it was presented.

Table 1: Expert details for judgment studies

#	*Expert Role*	*Industry*
E-1	Head of Innovation	Agricultural Technology
E-2	Frontline Manager	Agricultural Technology
E-3	Financial Analyst	Agricultural Technology
E-4	Material Planning Analyst	Consulting
E-5	Senior Director	Consulting
E-6	Accountant	Consulting
E-7	Senior Manager	Consulting
E-8	Financial Controller	Manufacturing
E-9	Chief Technologist	Manufacturing
E-10	Senior Manager	Manufacturing
E-11	Global Support Manager	Manufacturing
E-12	Project Business Lead	Pharmaceutical
E-13	Associate Director	Pharmaceutical
E-14	Senior Manager	Pharmaceutical
E-15	Customer Relations	Pharmaceutical
E-16	Director of Global Support	Software-as-a-Service
E-17	Senior Operations Manager	Software-as-a-Service
E-18	Chief Architect	Software-as-a-Service
E-19	Strategy Manager	Software-as-a-Service

4. Findings

4.1 Artifacts

Three themes emerged from the collected data: time, incentives, and engagement. Firstly, interviewees agreed that "*the main thing would be time saving, or how to make the most of our time*" (E-18), but there is often a discrepancy across departments in the workplace, with some having more flexible time than others: "*The only constraint is time in certain departments*" (E-6). Interviewees highlighted the importance of allocating time for the purpose of innovation, with some stating that they have evolved their internal structures to accommodate this requirement: "*We see what we can do to make processes better, to free time for people and put a lot of the offline processes into the enterprise resource planning*" (E-15). Interviewees stressed that there is valuable innovation to be offered across each department, and the organisation should focus on freeing up resources to deliver on this promise: "*For other areas of the business, like the back office, or whether they are caught up with the service or customers, typically they may not get the time to innovate, but they are equally, if not more important in innovation*" (E-15). Allocating time away from daily roles and responsibilities to pursue innovation proved difficult for most interviewees, as several outlined that they find themselves staying beyond normal working hours already as it stands: "*A lot of our workers don't even take their 30-minute break, and still find themselves working past 5pm*" (E-17). Other interviewees agreed with this sentiment, arguing that "*there is no such thing as a 9am-5pm, or any specific working hours*" (E-15). Interviewees were unanimous however in arguing that being allocated time to tend to their own ideas or projects would increase their levels of innovation: *"If we had a scenario where we asked everyone to spend one hour a week doing nothing but creative thinking, either alone or in groups, I am sure you would get lots of ideas*" (E-1).

Secondly, incentives emerged as an important artifact, with several variations being outlined by interviewees. Most interviewees agreed that establishing innovative culture firstly relies on incentivising the levels of

engagement towards the initiative: "*It starts with engagement. Once that is embedded in the infrastructure around how you create ideas that drive the innovation is, the individuals get the reward and recognition*" (E-1). Incentives could range from a purely monetary incentive to a sense of pride for the ownership of the idea, and the resulting recognition they would achieve from it: "*When people join projects, at the end of the day they either want to get recognition, or they want to get paid. People are satisfied by different things*" (E-16). Establishing "*bonus incentives*" (E-3) was outlined as an important incentive for driving engagement when it comes to yielding higher levels of innovative activity: "*I worked in field sales for the last five years, so my approach to everything tends to be money related*" (E-16). Several experts also described how they used gamification for delivering innovation, by creating structured contests among their employees throughout the year. The winners of these contests would then be given significant funding to develop their ideas further: "*We pick monthly winners, and the monthly winners go onto quarterly competitions. The quarterly winners eventually go into an annual competition where the winner gets funded €25,000 to develop their product*" (E-15).

Thirdly, engagement was highlighted as a key objective for the success of any innovation culture. Interviewees were unanimous that natural human interaction through the "*inclusiveness of ideas and bringing everyone's ideas together*" (E-12) was vital for the level of creative and diverse thinking being sought. This was echoed through interviewees stressing the importance of establishing "*brainstorming sessions and getting everyone together*" (E-13) to promote high engagement levels, which allows "*for everyone to share their ideas, no matter whether they are good, bad, or indifferent*" (E-14). This necessitates being able to create a culture where everyone is comfortable in engaging. The interviewees stressed it is ultimately down to the employees as to whether they want to engage in the initiative: "*There is definitely a culture of if you want to get involved, you can, but you have to say I want to get involved*!" (E-16). It is up to the organisations to establish mechanisms to "*encourage people to continue to think creatively, to continue to think innovatively, to think of ways they can contribute*" (E-18). This emerged as a challenge for some organisations, whereby they admitted to "*not getting enough people involved, that's the problem. We need to invest more at the individual employee level*" (E-9).

4.2 Values

Three values were identified through this investigation: diversity, creativity, and communication. Firstly, interviewees were unanimous towards the benefits that diversity offers an innovation culture: "*diversity brings new thoughts, new experiences, new ideas into the whole company*" (E-14). Creating this level of diversity is a challenge for some organisations, with interviewees stressing that innovation comes from everywhere, across all business areas, highlighting the importance of inclusion and representation "*it's so important to have people with different backgrounds and strengths that work together*" (E-12) and how leaders can't "*discriminate based on rank or background of the employee that presents the idea*" (E-16). Interviewees agreed that the main strength of diversity came from the belief that *"people have different ways of contributing to making something move forward, and one person can't do that*." (E-18). Diversity demands a mixture of different people, across varying backgrounds, with unique approaches to any projects: "*the more variety there is, that's better*" (E-16) and to embrace innovation across the organisation, rather than focusing on distinct groups or team's individual business units: "*I see innovation coming from all over the place, not from any particular group of people*" (E-18). Employees should be encouraged to work alongside colleagues who are not part of their own business units or teams, and managers should break up structured organisational silos to promote cross pollination of ideas: "*Ideally we break those silos up completely*" (E-17). To keep this level of diversity fresh, experts recommended rotating employee responsibilities, suggested that *"people shouldn't be stuck in one role for too long. You need to rotate your roles as much as possible, it gives you a different perspective*" (E-15).

Secondly, creativity was described by interviewees as: "*The ability to look at a problem and to come up with different solutions and solve it in an efficient manner*" (E-16). Interviewees outlined that the existing culture in an organisation reflects how expressive employees are when it comes to creative thinking, with some exhibiting reservations due to: "*Fear of failure, lack of confidence, self-doubt and lack of self-belief"* (E-9). Minimizing these interferences would allow employees' natural potential to manifest in creativity: "*creative thinking for me is like confidence to have inspiration and say there's no bad idea!*" (E-15). It was argued that employees can't be just in agreement with people if they wish to be creative: "*Creative thinking for me means taking advantage of what you know, using every advantage you have, and then not be afraid to listen to others*

and make yourself think that way" (E-4). Employees often don't see themselves as being creative, and refrain from engaging due to the mindset of believing they have nothing to offer to the process: "*A lot of people just assume it's not for them*." (E-16) However, creativity can range from developing high levels of innovation aimed at tapping into new markets: "*How to reach your target demographic, or target market in a fun, creative and innovative way*" (E-12), to smaller recommendations that simply make the execution of tasks more efficient: "*Some people see creativity as being artistic, even suggesting a new tool to help an Excel sheet, that's creative thinking.*" (E-16). Indeed, many interviewees believed "*what sparks creative thinking is finding an interesting problem*" (E-17), forcing employees to "*challenge the status quo, and think outside the box*" (E-12).

Thirdly, communication was the third value revealed in the findings, not just across employees, but also employees and management, and management amongst themselves: "*You definitely need strong and timely communications regarding innovation*" (E-9). Cultivating an environment that builds relationships through effective communication is an important step to being able to offer constructive criticism towards peoples work: "*Critical thinking does prevail in an environment of mutual stimulation and feedback. What's important is constructive criticism*" (E-9). Receiving this criticism though was where effective communication was considered vital, as interviewees stressed you shouldn't discourage ideas from being offered by poorly receiving them: "*everyone should feel comfortable that they can share their ideas, and that they can share their thoughts and they won't be laughed at*" (E-14). Several interviewees highlighted that sometimes a discrepancy exists between what management believe the culture to be, rather than what it is in reality: "*People say "*all ideas are welcome*", but sometimes they are not, they get some scoffed at. It's about creating a culture where people genuinely feel they are able to challenge, come forward, and present their ideas*" (E-10). Employees must feel safe when communicating their ideas: "*What's needed is a safe space where people can suggest ideas, where people feel they aren't going to get criticized, ridiculed or mocked for some of the ideas that they do have*" (E-11). Creating this supportive environment for open channels of communication is especially important, as "*innovation doesn't just happen, you have to have the conversations, you have to spark it*" (E-4). Several mechanisms used to encourage this level of transparent communication were highlighted, ranging from "*shooting the breeze around the coffee station*" (E-12), to setting up virtual teams aimed towards creative thinking innovations where "*anyone can join and give ideas*" (E-17). Daily meetings were also identified as an important mechanism to promote high levels of communication, where employees "*meet up and discuss at high level where they are and focus on distinct innovation sections that come up*" (E-4).

4.3 Assumptions

Three assumptions were evidenced to shape digital culture: the levels of openness, leadership, and teamwork present within the environment. Firstly, interviewees highlighted the importance of establishing an open environment for employees to collaborate, encouraging employees to "*be open to ideas, and open to people having a passion that might not be in their particular area*" (E-4) by having a "*genuine open-door policy*" (E-9). This allows employees to share ideas freely among each other and save time by having multiple stakeholders tackle existing problems collaboratively earlier in the problem-solving process: "*if we shared with each other the mistakes that we had made in the previous week, it would benefit everyone. Not only that, but it would reduce the stigma of making mistakes, encouraging innovation*" (E-18). Interviewees described how some organisations cultivated an environment where employees wouldn't feel apprehensive about approaching senior management to voice their opinions: "*There is a flat hierarchy, it doesn't matter if you're a vice president or an intern, there is none of this closed-door nonsense… there's a platform for people to share their ideas and it's open*" (E-16). Interviewees acknowledged their own limitations in developing solutions individually: "*I don't have all the solutions; I like bouncing ideas off people*" (E-15). Sharing problems with peers was highlighted as a key mechanism for developing an open environment: "*from understanding a situation or problem, we can go in and decompose things, and then recompose them in a new way which helps to address the problem or the situation that we saw together.*" (E-17).

Secondly, effective leadership emerged as an assumption in a successful culture of innovation, as for any initiative to be successful, "*There has to be buy-in from the top levels*" (E-9). These leaders need to have the right balance of vision and skills to bring people out of their comfort zones and partake in innovation: "*It's more orchestrating the environment that facilitates people to have a continuous innovation process by themselves… Rather than pushing people, give them their space, give them their time, and give them the resources*" (E-17). Different leadership styles were also highlighted as being able to "*help address an employees' internal blocks that prevent potential being manifested*" (E-9) in terms of being too shy or

introverted to make their voice heard. Similarly, by leaders creating an environment where employees were confident to express their opinions in a "*a no blame culture*" (E-9), it would also encourage "*reducing the stigma of making mistakes, that would improve innovation*" (E-18). Interviewees agreed that it is the leaders who are ultimately responsible for "*creating an effective way to make operations run more efficient and precise*" (E-16). Leaders must develop necessary strategies to complete those goals, surpassing the demands of customer expectations by innovating to "*…break the mould. Once we have the physical footprint in place, we look at our strategy around innovation. What kind of workflows can we interject into this*? *Let's think how we do our everyday stuff in ways we can do better"* (E-4). It was also suggested for leaders to establish measurable goals that tie into employees' roles when it comes to incentivizing innovation: "*Are you being recognised for your idea? Is it going past a stage? Is it down on paper somewhere? Is there an idea that is boosting how quickly work is being done? That's an exact measurement, you know work is being done faster, it's saving us actual money*" (E-16).

Thirdly, teamwork was the final assumption to materialise from the findings, with interviewees describing the importance of creating "*a community where employees are all pulling together in an innovative environment*" (E-9). Interviewees agreed that innovation has a lot to do with teamwork because "*anybody can have an idea… But the only way you can do something with an idea is if you work with somebody else*" (E-18). Several benefits were described to developing a community approach to innovation, chiefly among them being a higher standard of innovative output: "*if we both let them, and allow them to collaborate, we will have a much better innovation*" (E-17). The logic here being that when engaging in a communal effort towards innovation, it instils more responsibility on employees, providing them with a greater choice and autonomy to "*inspire innovative behaviour*" (E-9). It also allows more expertise to be drawn on the problem area as opposed to approaching it from an isolated perspective: "*Innovation is a communal thing. I can be innovative on my own, but it's better when you get the feedback in a community. You get that confidence and inspiration to create a culture of innovation*" (E-15). Interviewees were adamant that establishing teams should span multiple business units, and push people out of their comfort zones to work with new people, for if organisations start saying "*there is a single main contributor, or a single group being a main contributor, or a single part of the organisation being the main contributor, we take away from all the other innovations being created*" (E-17). The purpose of establishing teams across these various positions is to "*gather all of that experience they have and pull it all together to come up with the best solutions*" (E-14).

5. Discussion, conclusions, and implications

This paper examines a well-established theoretical lens on developing an organisational culture of remote innovation against the backdrop of abrupt technological infrastructure changes due to the Covid-19 pandemic. The identification of nine themes across three organisational culture components represent the main contributions of this paper. By implementing a priori theory to a practical perspective, these findings now offer a strategic blueprint for decision makers to develop a digital culture of innovation with a hybrid work force. These findings make several contributions to innovation, digital transformation, and organisational culture research streams, while also offering distinct managerial implications. Firstly, we expand Schein's (2010) organisational culture theory framework by outlining the key roles of these themes through the lens of focused innovation and remote working. These results reveal the importance of a digital culture of innovation and considering the lack of empirical studies that seek to explore how these environments are shaped in a post Covid-19 world, these findings make a novel contribution to the organisational culture and innovation literature. Secondly, we contribute to existing literature by providing a clearer understanding between the distinct layers of an organisations culture and innovative behaviours in a remote working environment, revealing key insights to developing new methods of digital innovation. These findings reveal the crucial role organisations have in encouraging behaviours that are appropriate, valuable, and desirable when establishing a culture of innovation their remote work force. Building on our findings, future research could more fully explore organisational behaviours and management practices that influence the development and adoption of values and norms that support innovation. Given the approach of this research, a relatively small population size of qualitative interviewees was pursued which might present generalizability limitations. While this study offers an initial exploration, future studies are now advised to track the implementation progress and measure the impact of incorporating this framework. This can be achieved through large scale quantitative investigations aimed at larger population sizes. We would also encourage future studies to empirically explore these findings further through various lines of enquiry including, but not limited to intervention functions for adapting existing strategies and behaviour change techniques. In conclusion, this research delivers a strategic

framework for digital innovation to entrepreneurs and practitioners, making them capable of immediately constructing approaches to deliver on the inherent value that a successful culture for digital innovation possesses. As such, this is a subject area that represents a continually evolving landscape, and one that is rich for future investigations.

References

Appio, F. P., Frattini, F., Petruzzelli, A. M. & Neirotti, P. 2021. Digital Transformation And Innovation Management: A Synthesis Of Existing Research And An Agenda For Future Studies. *Journal Of Product Innovation Management,* 38**,** 4-20.

Barrett, M., Davidson, E., Prabhu, J. & Vargo, S. 2015. Service Innovation In The Digital Age: Key Contributions And Future Directions. *Mis Quarterly,* 39**,** 135-154.

Benner, M. J. & Tushman, M. L. 2015. Reflections On The 2013 Decade Award—"Exploitation, Exploration, And Process Management: The Productivity Dilemma Revisited" Ten Years Later. *Academy Of Management Review,* 40**,** 497-514.

Berger, E. S. C., Von Briel, F., Davidsson, P. & Kuckertz, A. 2021. Digital Or Not – The Future Of Entrepreneurship And Innovation: Introduction To The Special Issue. *Journal Of Business Research,* 125**,** 436-442.

Boudreau, K. J. & Lakhani, K. R. 2013. Using The Crowd As An Innovation Partner. *Harvard Business Review,* 91**,** 60-69.

Bradley, L. & Parker, R. 2006. Do Australian Public Sector Employees Have The Type Of Culture They Want In The Era Of New Public Management? *Australian Journal Of Public Administration,* 65**,** 89-99.

Bresciani, S., Ferraris, A. & Del Giudice, M. 2018. The Management Of Organizational Ambidexterity Through Alliances In A New Context Of Analysis: Internet Of Things (Iot) Smart City Projects. *Technological Forecasting And Social Change,* 136**,** 331-338.

Burtch, G., Carnahan, S. & Greenwood, B. N. 2018. Can You Gig It? An Empirical Examination Of The Gig Economy And Entrepreneurial Activity. *Management Science,* 64**,** 5497-5520.

Feitosa, J., Grossman, R. & Salazar, M. 2018. Debunking Key Assumptions About Teams: The Role Of Culture. *American Psychologist,* 73**,** 376.

Garthwaite, P. H., Kadane, J. B. & O'hagan, A. 2005. Statistical Methods For Eliciting Probability Distributions. *Journal Of The American Statistical Association,* 100**,** 680-701.

George, G., Lakhani, K. & Puranam, P. 2020. What Has Changed? The Impact Of Covid Pandemic On The Technology And Innovation Management Research Agenda. *Journal Of Management Studies*.

Greenwood, R. & Hinings, C. R. 1996. Understanding Radical Organizational Change: Bringing Together The Old And The New Institutionalism. *Academy Of Management Review,* 21**,** 1022-1054.

Hellriegel, D., Slocum, J. W. & Woodman, R. W. 1998. *Organizational Behavior*, South-Western College Pub.

Hogan, S. J. & Coote, L. V. 2014. Organizational Culture, Innovation, And Performance: A Test Of Schein's Model. *Journal Of Business Research,* 67**,** 1609-1621.

Kallinikos, J., Aaltonen, A. & Marton, A. 2013. The Ambivalent Ontology Of Digital Artifacts. *Mis Quarterly,* 37**,** 357-370.

Kast, F. & Rosenzweig, J. 1985. Organization And Management: A Systems And Contingency Approach, 4 Th Edn, Mcgraw-Hill, New York.

Knox, S. & Burkard, A. W. 2009. Qualitative Research Interviews. *Psychotherapy Research,* 19**,** 566-575.

Lu, Y. & Ramamurthy, K. 2011. Understanding The Link Between Information Technology Capability And Organizational Agility: An Empirical Examination. *Mis Quarterly***,** 931-954.

Lusch, R. & Nambisan, S. 2015. Service Innovation: A Service-Dominant Logic Perspective. *Mis Quarterly,* 39**,** 155-175.

Martins, E. & Terblanche, F. 2003. Building Organisational Culture That Stimulates Creativity And Innovation. *European Journal Of Innovation Management,* 6**,** 64-74.

Nambisan, S. 2017. Digital Entrepreneurship: Toward A Digital Technology Perspective Of Entrepreneurship. *Entrepreneurship Theory And Practice,* 41**,** 1029-1055.

Nambisan, S., Lyytinen, K., Majchrzak, A. & Song, M. 2017. Digital Innovation Management: Reinventing Innovation Management Research In A Digital World. *Mis Quarterly,* 41.

Nambisan, S., Wright, M. & Feldman, M. 2019. The Digital Transformation Of Innovation And Entrepreneurship: Progress, Challenges And Key Themes. *Research Policy,* 48**,** 103773.

O'donnell, O. & Boyle, R. 2008. *Understanding And Managing Organisational Culture,* Dublin, Ireland, Institute Of Public Administration

Oates, B. 2005. *Researching Information Systems And Computing,* Great Britain, Sage Publications.

Petrakaki, D., Hilberg, E. & Waring, J. 2018. Between Empowerment And Self-Discipline: Governing Patients' Conduct Through Technological Self-Care. *Social Science & Medicine,* 213**,** 146-153.

Reibenspiess, V., Drechsler, K., Eckhardt, A. & Wagner, H.-T. 2020. Tapping Into The Wealth Of Employees' Ideas: Design Principles For A Digital Intrapreneurship Platform. *Information & Management***,** 103287.

Rogers, D. 2016. *The Digital Transformation Playbook*, Columbia University Press.

Sathe, V. 1985. *Culture And Related Corporate Realities: Text, Cases, And Readings On Organizational Entry, Establishment, And Change*, Richard D Irwin.

Schein, E. H. 2010. *Organizational Culture And Leadership*, John Wiley & Sons.

Scott, W. R. 2013. *Institutions And Organizations: Ideas, Interests, And Identities*, Sage Publications.

Steiber, A., Alänge, S., Ghosh, S. & Goncalves, D. 2020. Digital Transformation Of Industrial Firms: An Innovation Diffusion Perspective. *European Journal Of Innovation Management*.

Svahn, F., Mathiassen, L. & Lindgren, R. 2017. Embracing Digital Innovation In Incumbent Firms: How Volvo Cars Managed Competing Concerns. *Mis Quarterly,* 41.

Vaismoradi, M., Jones, J., Turunen, H. & Snelgrove, S. 2016. Theme Development In Qualitative Content Analysis And Thematic Analysis.

Venable, J., Pries-Heje, J. & Baskerville, R. 2016. Feds: A Framework For Evaluation In Design Science Research. *European Journal Of Information Systems,* 25**,** 77-89.

Von Bertalanffy, L. 1950. The Theory Of Open Systems In Physics And Biology. *Science,* 111**,** 23-29.

Von Briel, F., Recker, J. & Davidsson, P. 2018. Not All Digital Venture Ideas Are Created Equal: Implications For Venture Creation Processes. *The Journal Of Strategic Information Systems,* 27**,** 278-295.

Wilson, K. J. 2017. An Investigation Of Dependence In Expert Judgement Studies With Multiple Experts. *International Journal Of Forecasting,* 33**,** 325-336.

Wolfswinkel, J. F., Furtmueller, E. & Wilderom, C. P. 2013. Using Grounded Theory As A Method For Rigorously Reviewing Literature. *European Journal Of Information Systems,* 22**,** 45-55.

Yin, R. 2008. *Case Study Research: Design And Methods 4th Edition*, London: Sage Publisher.

A Network Approach to the Digital Innovation Hub as an Ecosystem Supporting the Digital Transformation of Enterprises in a Region

Anna Ujwary-Gil[1,2] and Anna Florek-Paszkowska[2,3]
[1]Institute of Economics, Polish Academy of Sciences, Poland
[2]Network Analysis Laboratory, Cognitione Foundation, Poland
[3]CENTRUM Católica Graduate Business School and Pontificia Universidad Católica del Perú
ujwary@inepan.waw.pl
aflorekpaszkowska@pucp.edu.pe

Abstract: The study aims to examine the two-mode network of digital innovation hubs (DIH) operating in Poland, understood as ecosystems and competence centers, to support the digital transformation of enterprises in a region. Digital Innovation Hub is also one of the S3 Smart Specialization Platform mapping tools and identifying areas of economic specialization of regions, aimed at facilitating interregional cooperation and creating partnerships between different actors across Europe. While the functions and goals of DIH are more and more often presented in national and regional development documents, little is known about the network structure of DIHs operating in a given country (region) and in the European Union. The study used structured and secondary Smart Specialization Platform data, which allows the creation of two-mode relationship networks and shows how interrelated the studied DIHs and digital technologies they use are. Based on the social network analysis and network metrics (centrality, density, and network projection) integrated into programs such as UCINET and ORA-PRO, the visualization and measurement of the network structure of two-mode networks (actor x technology AT_{ij}) as well as its projection into actor x actor (AA_{ij}) and technology x technology (TT_{ij}) networks were created. The results show 15 DIHs or actors (A) and 29 technologies (T), each of which a given DIH offers to show primarily influential DIHs and digital technologies as well as the areas of cooperation. DIHs are a promising and still little explored area of interest for researchers worldwide. The article is the first attempt to investigate the network structure of DIHs operating in Poland and their relations to technologies.

Keywords: digital innovation hub, DIH, two-mode network, digital transformation, enterprises, social network analysis, density, technology, cooperation, region

1. Introduction

Network approach, in the sense of identifying, assessing and measuring relations, interdependencies and interactions between entities within technology parks (Martin-Rios, 2014; Padilla-Meléndez et al., 2013), industrial clusters (Biggeri et al., 2021), regional or national innovation systems (Arranz et al., 2020; Pinto et al., 2021) is one of the most interesting approaches to the functioning of enterprises[1] in connection with the emerging network paradigm (Capello, 1996; Cooke and Morgan, 1993; Cravens et al., 1996). This paradigm distinguishes the applied research approach, including collecting and managing network data, features of network data, the level of analysis, and network variables taking the form of a matrix. The network approach allows you to look at entities from a multimodal (meta-network) perspective, including not only social actors (organizations, enterprises, institutions, research units, etc.) but also the acquisition and use of knowledge and skills, technologies, or resources that are decisive for their competitiveness (Ashworth and Carley, 2006; Ujwary-Gil, 2020). The meta-network allows for the simultaneous analysis of enterprises' heterogeneous and interrelated elements. However, this is not a commonly used approach because it requires the construction of the so-called two-mode networks and their projections (Borgatti and Everett, 1997; Everett and Borgatti, 2013). While the parks, as mentioned above, clusters and innovation systems have gained the interest of researchers, a relatively new concept - digital innovation hub (DIH) - is currently in the exploration phase. To the knowledge of the article's authors, the network approach to study and measure DIHs of a given region has not been applied so far.

The network is made up of a group of interconnected enterprises and their stakeholders based on formal and informal types of relationships between them within a defined network boundary. The boundary may be a technology park, an industrial cluster, or a region where DIHs operate. The network approach focuses on relationships, interaction patterns and not on the individual characteristics of individual enterprises (Barnes and Harary, 1983). The network approach allows you to model the structure of the network of inter-organizational relations, examine the impact of this structure on the functioning of enterprises and the possibilities or

[1] In the article, enterprises will be referred to interchangeably as actors, digital innovation hubs, or DIHs.

limitations of individual activities in the network (Ujwary-Gil et al., 2022). The network understood in this way is one-mode. Two-mode networks called affiliation networks (Everett, 2016; Jasny, 2012; Ujwary-Gil, 2017) take place in the case of relationships between two different sets of nodes. The network theory should be seen as the basis for interpreting the behavior of social actors and understanding the interdependencies occurring in the network of relations (Borgatti and Halgin, 2011; Salancik, 1995). In line with the assumptions of network theory, the actor's position in the network determines its limitations and possibilities in terms of its achievements or behavior (Borgatti et al., 2013). The creation of technologies, key practices and processes, the services offered depend on the individual actions of social actors, however, conditioned by the actions of others in a given ecosystem. Thus, enterprises are embedded in relationships that influence the behavior of actors and their similarities or differences.

The Digital Innovation Hub (DIH) is a relatively new area of research and a concept of the European Commission. It is designed to build an ecosystem of digital innovation by uniting different environments and sectors, exchanging knowledge, experiences, and technologies (Hervas-Oliver et al., 2021). The European Union dedicated the Digital Europe Program's (DEP) financial perspective for 2021-2027 to the digital competences, making enterprises' digital transformation towards Industry 4.0 a reality (Florek-Paszkowska et al., 2021; Gancarczyk and Ujwary-Gil, 2021). The DEP intends to provide DIHs with access to technological knowledge and experiments to better assess digital transformation projects' viability. The testing and experiment services provided by DIHs may also include other enabling technologies contributing to the implementation of new solutions. The DEP focuses on several priorities: 1) building and strengthening EU capabilities in the field of High-Performance Computing; 2) research and development of artificial intelligence; 3) strengthening cybersecurity due to its importance for European democracy and the EU economy; 4) developing digital competences so that the knowledge and skills to use the latest digital technologies become more and more common; 5) implementing interoperable solutions in areas of public interest and facilitating entrepreneurs, especially small and medium-sized enterprises, to access digital technologies and specialist knowledge (Mărcuț, 2020).

The idea of DIH is to support and improve the competitiveness of enterprises using digital technologies dedicated to the digital development of activities, business models, production, services, and business processes. DIH's offer is addressed to enterprises where the level of digital technology applications is low and whose potential currently does not allow them to meet the challenges posed by the rapid technological development based on the use of microelectronics, photonics, and digitization (Georgescu et al., 2021; Ujwary-Gil and Potoczek, 2020). Therefore, the Digital Innovation Hub is a one-stop shop where start-ups can get help in improving their business, manufacturing processes, products, business models, and services through digital technologies.

There is currently no systematic analysis of DIHs related to digital technologies. In this study, a two-mode social network model was used to examine the impact of enterprises (DIHs) operating in Poland on digital technologies that DIHs use in the products and services they provide. Analyzing the impact of DIHs acting through a network of relationships is crucial as it can differentiate the importance of DIHs in a given region. So far, no research has been conducted that would allow the identification of influential DIHs and technologies in the region. To establish effective collaboration, it is imperative to explore the power of DIHs in controlling the impact of technology.

Three research goals (RG) were formulated:

RG1) Defining the network boundary, DIHs, and digital technologies.
RG2) Developing a two-mode network describing the relationship of DIHs with digital technologies and its projections.
RG3) Examining the DIHs network structure and digital technologies in the region.

This research contributes to the management of digital technologies by identifying potential areas for collaboration, revealing the complex relationships between DIHs that are interconnected through technologies understood as a common area of activity.

2. Methodological approach

2.1 Network boundary and population

The research subject is digital innovation hubs operating in Poland and digital technologies that Polish DIHs offer to enterprises for their digital transformation dedicated to services, products, or the reinvention of business models. Data on DIHs was obtained thanks to the Smart Specialization Platform tools (S3 Tools and Data Sources, accessed in March 2022). The network elements are formed by the following nodes: 15 actors (A), i.e. DIHs, and 29 technologies (T) (Table 1).

Table 1: DIHs operating in Poland and digital technologies (sorted alphabetically)

ID	DIH name (A)	ID	Technology (T)	ID	Technology (T)
A01	Centre for Advanced Manufacturing Technologies, Wroclaw University of Science and Technology	T01	Additive manufacturing	T16	Logistics
A02	CYBERSEC HUB	T02	Advanced, or high performance computing	T17	Micro/nano electronics
A03	DIH4.AI	T03	Artificial intelligence	T18	Mobility & location based technologies
A04	Emerging Transactional and Financial Technology Hub (ETFTH)	T04	Big data, data analytics, data handling	T19	Nanotechnology
A05	HPC4Poland	T05	Cloud computing	T20	New media technologies
A06	Institute of Electron Technology (ITE)	T06	Communication networks	T21	Organic and large area electronics
A07	IoT Poland Foundation Hub	T07	Cyber physical systems	T22	Photonics and imaging technologies
A08	IT and Expert Hub Supporting Biomedical Research, Technology and Education (BioMedHub)	T08	Cyber security	T23	Quantum computing
A09	Krakow Technology Park	T09	Distributed ledger technology	T24	Robotics
A10	Lublin Medicine Cluster	T10	Gamification	T25	Screens and display technologies
A11	NASK National Research Institute	T11	Industrial biotechnology	T26	Sensory systems
A12	PIAP HUB	T12	Interaction technologies	T27	Simulation, modelling and digital twins
A13	Poznan Science and Technology Park of Adam Mickiewicz University Foundation	T13	Internet of things	T28	Software as a service and service architectures
A14	Regional Digital Innovation Hub related to Internet of Things (IoT North Poland HuB)	T14	Internet services	T29	Virtual, augmented and extended reality
A15	Silesia Smart Systems	T15	Laser based manufacturing		

Source: Based on S3 Tools and Data Sources: Digital Innovation Hubs (accessed 29 March 2022).

The DIHs listed have the following attributes (S3 Tools and Data Sources, accessed March 2022). The oldest DIH was established in 1965 (A12). Industrial Research Institute for Automation and Measurements (PIAP), from the very beginning, research work on new technologies carried out at the Institute is usually combined with designing equipment and production lines to enable direct implementation of research achievements in industry. The youngest DIH was founded in 2019 (A03) in Gdańsk. DIHs locations are the main national metropolises, such as Warsaw (A04, A08, A11, A12), Kraków (A02, A09), Wrocław (A01), Gdańsk (A03), Poznań (A05, A13), Lublin (A07, A10), Toruń (A14), and Gliwice (A15). The turnover of DIHs ranges from 0-250.000 (A02, A04, A07, A14, A15), 250.000-500.000 (A08), 1.000.000-5.000.000 (A01, A03, A05, A09, A12, A13) up to over 5.000 .000 (A06, A10, A11). Such DIHs employ the number of employees in the range of 1-9 as A02, A03, A04, A07, A14, A15. In the range of 10-25 employees - A08; 50-100 (A01, A09), and over 100 employees - A05, A06, A10, A11, A12, A13. The geographical scope of DIHs is mostly national (A02, A03, A05, A06, A07, A08, A10, A11, A12, A13); European (A01); regional (A04, A09, A14, A15).

2.2 Social network analysis techniques and visualization

The methodology of network research was used based on the fundamental assumption, which is the interdependence of the analyzed elements of the two-mode DIHs approach, which distinguishes this approach from other methods used in social research, where the observations are independent of each other. The main premise for undertaking this research is to understand the functioning of enterprises that play the digital innovation hub role in the region, connected with a set of interdependent networks of technological relations. For this purpose, we used the inner-dot product where the matrix is multiplied by its transposition, also known as a projection, and obtained the two one-mode matrices: technology similarity shared by actors and actors similarity shared by technology. We transformed the two-mode matrix analogically to Jasny (2012) into the following one-mode projection P (1) of network G and its transposition G^T in which rows (n) and columns (m) are replaced, creating a network $G_{ij} = G_{ji}^T$ for each pair of actors (A) $_{ij}$. The projection creates a new network whose links record the commonalities of nodes. It means a two-mode valued network where relation (i,j) is the number of neighbors that nodes i and j have in common.

$$G = \begin{bmatrix} A_{11} & \cdots & A_{1m} \\ \vdots & \ddots & \vdots \\ A_{n1} & \cdots & A_{nm} \end{bmatrix}, G^T = \begin{bmatrix} A_{11} & \cdots & A_{n1} \\ \vdots & \ddots & \vdots \\ A_{1m} & \cdots & A_{mn} \end{bmatrix}, P = G \times G^T = \begin{bmatrix} P_{11} & \cdots & P_{n1} \\ \vdots & \ddots & \vdots \\ P_{1n} & \cdots & P_{nn} \end{bmatrix} \quad (1)$$

For this purpose, two network programs were used: UCINET (Borgatti et al., 2002) and ORA PRO (Altman et al., 2017). The network approach allows for associating a given DIH with the technology (c.f., Ujwary-Gil, 2019). In the ATij two-mode network (actor x technology), the actor i is related to technology j if the actor i uses or offers technology j. Then the cell in the matrix between the elements ij = 1. Otherwise ij = 0, which means no relation (Table 2). Figure 1 is a visualization of the ATij two-mode matrix shown in Table 2. In the case of a two-mode matrix projection using the formula (1), at the intersection of rows and columns is the number of technologies shared by DIHs in the case of row-by-row projection (Table 3) and the number of actors shared by technologies when projecting through columns (Table 4).

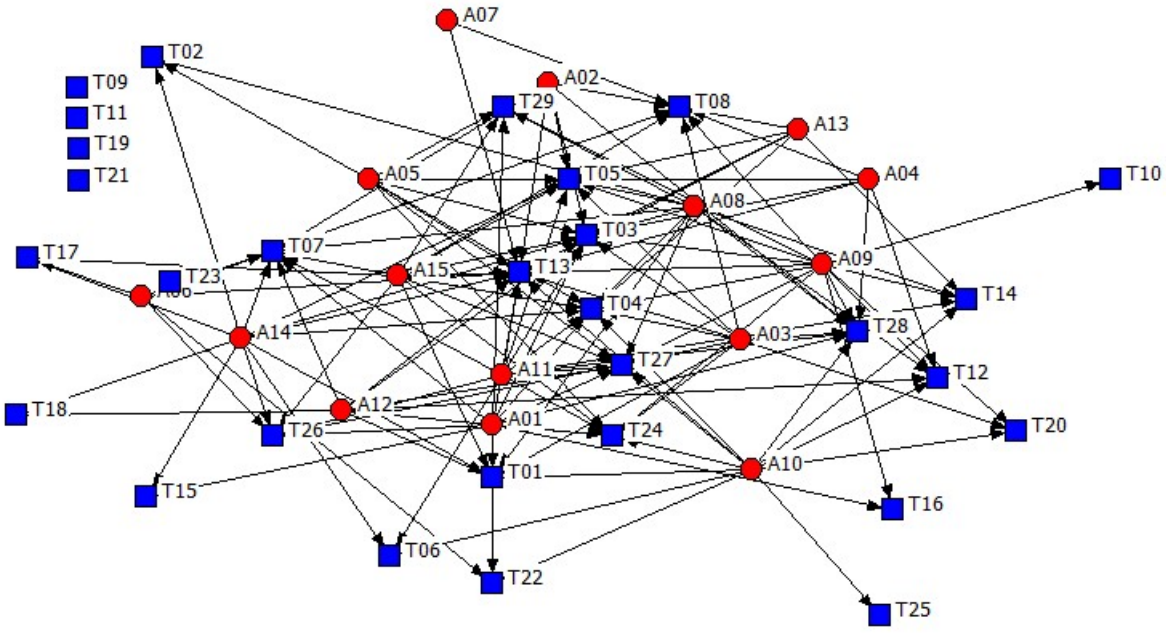


Figure 1: Two-mode network of DIHs and digital technologies

3. Results and data analysis

Table 2 shows the two-mode and affiliation network (actor x technology). On the one hand, the sum of each line represents the number of technologies that the DIH uses to provide services or products. On the other hand, the sum of the columns determines the number of actors associated with the given technologies. The degree of centrality of a node in one set (actor) corresponds to the ratio of the number of links to the total number of nodes in the other set (technology). Hence, in a network of actors, a given DIH with a high degree of centrality has greater authority to deal with the technologies, and the technologies with high centrality may be provided

by more DIHs. The results show that the technologies are offered by 0 - 14 DIHs, thus showing the potential of cooperation in the field of technology development. Actors A01, A09, A10, A14, and A15 are the most influential DIHs with the highest degree of centrality (number of technologies used between 12-14). The least influential DIH is A07 (2 technologies).

Table 2: Actor x technology matrix

	T01	**T02**	**T03**	**T04**	**T05**	**T06**	**T07**	**T08**	**T09**	**T10**	**T11**	**T12**	**T13**	**T14**	**T15**
A01	1		1	1			1						1		1
A02			1		1		1	1					1		
A03	1		1	1	1			1					1		
A04			1		1			1				1	1		
A05		1	1	1	1								1		
A06							1	1					1		
A07								1					1		
A08	1	1	1	1	1		1					1		1	
A09			1	1	1			1		1		1	1	1	
A10	1			1		1						1	1	1	
A11			1	1	1	1	1						1	1	
A12	1		1				1					1	1		
A13			1	1	1			1					1	1	
A14	1	1	1	1	1	1	1						1		1
A15	1		1	1	1		1	1					1		
SUM (A01-A15)	**7**	**3**	**12**	**10**	**10**	**3**	**8**	**8**	**0**	**1**	**0**	**5**	**14**	**5**	**2**

Table 2: Actor x technology matrix (continued)

	T16	**T17**	**T18**	**T19**	**T20**	**T21**	**T22**	**T23**	**T24**	**T25**	**T26**	**T27**	**T28**	**T29**	**SUM (T01-T29)**
A01	1						1		1		1	1	1	1	13
A02													1		6
A03					1				1		1		1		10
A04													1		6
A05									1			1		1	8
A06		1					1				1				6
A07															2
A08												1	1	1	11
A09	1				1				1			1	1	1	14
A10					1		1		1	1		1	1		12
A11									1		1	1	1		11
A12			1						1			1			8
A13															6
A14		1	1								1				12
A15		1							1		1	1		1	12
SUM (A01-A15)	**2**	**3**	**2**	**0**	**3**	**0**	**3**	**0**	**8**	**1**	**6**	**8**	**8**	**5**	

In turn, artificial intelligence (T03), big data, data analytics, data handling (T04), cloud computing (T05), and internet of things (T13) are the most influential technologies offered by DIHs. With an interaction density of 0.315, actors (A01, A09, A10, A14, A15) and technologies (T03, T04, T05, T13) have intense relationships, which may suggest potential cooperation between these actors (DIHs) for technology development. The most central DIHs in the network are more capable of digital technology because they have the potential to work with a broader range of actors (DIHs) and identified digital technologies.

In Table 3, the horizontal and vertical dimensions refer to technology, which means that if a given technology (T) can be supported by a given DIH, then at the intersection of rows and columns there is a number of actors offering a specific technology. For example, two DIHs (A08 and A14) offer T02 and T07. Thus, at the intersection of the row and column, the entry is 2. Interestingly, many cells in the technology matrix are 0, which means that

out of all 29 technologies offered by DIHs in a given region, as many as five are not provided by any DIH. They are T09 (distributed ledger technology), T11 (industrial biotechnology), T19 (nanotechnology), T21 (organic and large area electronics), and T23 (quantum computing).

Conversely, the technologies of T13 (internet of things) and T03 (artificial intelligence) have the greatest similarity of resources because they can be addressed by the largest number of actors (11 DIHs). Wherever the number in the cells is 1, then the selected two technologies (dyad) are supported by one DIH. Accordingly, it has the least similarity of resources with others. To deal with this problem, it is possible to initiate closer cooperation between DIHs in the area of identified digital technologies.

Table 3: Technology x technology matrix

	T01	T02	T03	T04	T05	T06	T07	T08	T09	T10	T11	T12	T13	T14
T01	7													
T02	2	3												
T03	6	3	12											
T04	6	3	9	10										
T05	4	3	10	8	10									
T06	2	1	2	3	2	3								
T07	5	2	7	5	5	2	8							
T08	2	0	6	4	6	0	3	8						
T09	0	0	0	0	0	0	0	0	0					
T10	0	0	1	1	1	0	0	1	0	1				
T11	0	0	0	0	0	0	0	0	0	0	0			
T12	3	1	4	3	3	1	2	2	0	1	0	5		
T13	6	2	11	9	9	3	7	8	0	1	0	4	14	
T14	2	1	4	5	4	2	2	2	0	1	0	3	4	5
T15	2	1	2	2	1	1	2	0	0	0	0	0	2	0
T16	1	0	2	2	1	0	1	1	0	1	0	1	2	1
T17	2	1	2	2	2	1	3	2	0	0	0	0	3	0
T18	2	1	2	1	1	1	2	0	0	0	0	1	2	0
T19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T20	2	0	2	3	2	1	0	2	0	1	0	2	3	2
T21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T22	2	0	1	2	0	1	2	1	0	0	0	1	3	1
T23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T24	5	1	7	7	5	2	4	3	0	1	0	3	8	3
T25	1	0	0	1	0	1	0	0	0	0	0	1	1	1
T26	4	1	5	5	4	2	5	3	0	0	0	0	6	1
T27	5	2	7	7	5	2	5	2	0	1	0	4	7	4
T28	4	1	7	6	6	2	4	4	0	1	0	4	7	4
T29	3	2	5	5	4	0	3	2	0	1	0	2	4	2

Table 3: Technology x technology matrix (continued)

T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29
2														

T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29
1	2													
1	0	3												
1	0	1	2											
0	0	0	0	0										
0	1	0	0	0	3									
0	0	0	0	0	0	0								
1	1	1	0	0	1	0	3							
0	0	0	0	0	0	0	0	0						
1	2	1	1	0	3	0	2	0	8					
0	0	0	0	0	1	0	1	0	1	1				
2	1	3	1	0	1	0	2	0	4	0	6			
1	2	1	1	0	2	0	2	0	7	1	3	8		
1	2	0	0	0	3	0	2	0	5	1	3	5	8	
1	2	1	0	0	1	0	1	0	4	0	2	5	3	5

Figures 2 and 3 show Tables 3 and 4 respectively.

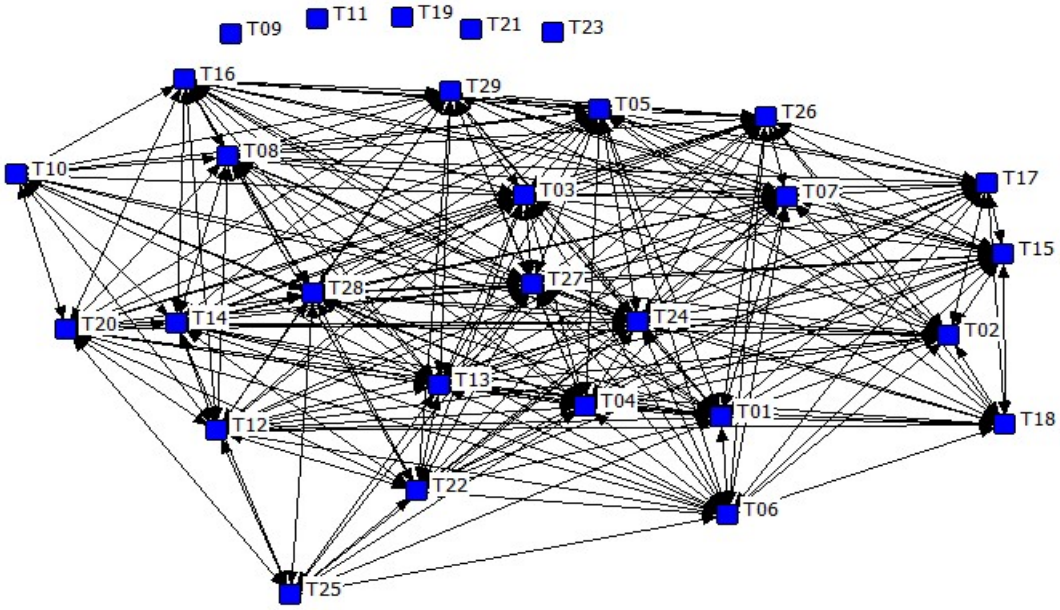


Figure 2: Technology x technology network

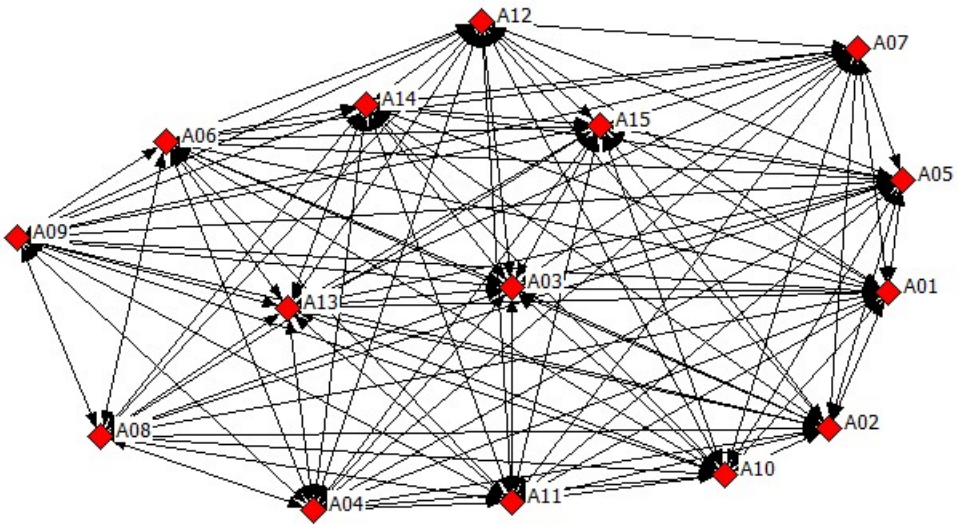


Figure 3: Actor x actor network

The matrix actor x actor indicates the number of technologies each pair of DIHs can offer together (Table 4). The horizontal and vertical dimensions indicate the actors (DIHs). The number on the diagonal of the adjacency matrix indicates how many technologies are offered by DIHs. The matrix shows the dyad A01 and A15, i.e. the DIH pair with the greatest similarity in the power of 31% (i.e., 9/29 technologies). An actor with greater access to digital technology can have more influence by offering competing services and products. All DIHs must pay attention to a minimum of 1 technology, a maximum of 9. High centrality technologies tend to target critical actors and have a high network impact.

Table 4: Actor x actor matrix

	A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13	A14	A15
A01	13														
A02	4	6													
A03	7	5	10												
A04	3	5	5	6											
A05	6	3	5	3	8										
A06	4	3	3	2	1	6									
A07	1	2	2	2	1	2	2								
A08	7	4	5	4	6	1	0	11							
A09	8	5	8	6	7	2	2	8	14						
A10	7	2	6	3	4	2	1	6	8	12					
A11	8	5	7	4	6	3	1	7	8	7	11				
A12	6	3	4	3	4	2	1	5	5	5	5	8			
A13	3	4	5	4	4	2	2	4	6	3	5	2	6		
A14	7	4	6	3	5	4	1	6	4	4	7	5	4	12	
A15	9	5	8	4	7	5	2	7	8	5	8	6	5	8	12

4. Conclusion

A network approach was used to analyze digital innovation hubs understood as an ecosystem supporting the digital transformation of enterprises in a given region. In the Introduction section, three research goals (RG) were set, which were achieved as follows:

RG1) The boundary of the network was determined, which is a given region (in this case Poland as one of the European Union countries), in which at least 15 DIHs are located. The DIHs are listed in Table 1, as well as 29 advanced digital technologies that have been identified for all regions. The technologies a given DIH creates and uses depend on its specialization, investment conditions, and demand for services or products.

RG2) A two-mode relationship network was developed based on the linkages between DIHs and digital technologies. The network analysis shows that the network density in this two-mode network was 0.315 (137 links out of 435 possible). So DIHs are associated with technologies in approx. 32%. A projection was performed, transforming a two-mode matrix (also known as a network) into a one-mode matrix containing respectively shared technologies or actors (DIHs). The projection made it possible to indicate the similarity in terms of resources (technology) and subject (organization), showing the potential for institutional and technological cooperation and pointing to technological gaps in a given region. All relationship matrices are graphically presented in Figures 1, 2, and 3.

RG3) The structure of the two-mode network indicates the average level of the density (with reservations, which will be discussed below in the research limitations), which may mean the unused technological potential offered by Polish DIHs. A deeper analysis would determine the resource (technological) similarity of each DIH. In general, the greater the number of shared technologies, the greater the similarity between the DIH pair. Also, the greater the number of shared actors, the more technologies each DIH pair can offer together. The analysis of all three matrices allows for initial recognition of the distribution of DIHs and technologies in relationship networks, indicating a technological gap and the least influential (in terms of connections) DIHs. All the above mentioned technologies can be developed and used by one or more DIHs, showing the potential of cooperation in the field of digital technology management in the region. The two-mode matrix and its variances developed as part of this study provide guidance on where to pay more attention to the cooperation of DIHs and what is the technological potential of the region.

This study is the first to use a two-mode network approach to analyzing DIHs and digital technologies. Hence, no unequivocal conclusions can be drawn, as there is no reference to other similar studies in this area. The relationship density in different European regions is not known to indicate the level of cross-linking of DIHs and technologies. This is the first attempt and, at the same time, a promising start to further research, much more advanced, using DIH attributes (i.e., year of establishment, turnover, number of employees, or organizational form), exploring existing network dependencies as well as much more advanced social network analysis techniques.

References

Altman, N., Carley, K.M. and Reminga, J. (2017), ORA User's Guide 2017, Carnegie Mellon University, School of Computer Science, Institute for Software Research, Pittsburgh, Pennsylvania, Technical Report CMU-ISR-17-100.

Arranz, N., Arroyabe, M.F. and Schumann, M. (2020), "The role of NPOs and international actors in the national innovation system: A network-based approach", *Technological Forecasting and Social Change*, Vol. 159, available at: https://doi.org/10.1016/j.techfore.2020.120183.

Ashworth, M.J. and Carley, K.M. (2006), "Who you know vs. what you know: The impact of social position and knowledge on team performance", *Journal of Mathematical Sociology*, Vol. 30 No. 1 pp. 43–75.

Barnes, J.A. and Harary, F. (1983), "Graph theory in network analysis", *Social Networks*, Vol. 5 No. 2, pp. 235–244.

Biggeri, M., Braito, L., Caloffi, A. and Zhou, H. (2021), "Chinese entrepreneurs and wo,rkers at the crossroad: the role of social networks in ethnic industrial clusters in Italy", *International Journal of Manpower*, available at: https://doi.org/10.1108/IJM-04-2021-0232.

Borgatti, S.P. and Everett, M.G. (1997), "Network analysis of 2-mode data", *Social Networks*, Vol. 19 No. 3, pp. 243–269.

Borgatti, S.P., Everett, M.G. and Freeman, L.C. (2002), "UCINET 6 for Windows: Software for Social Network Analysis User's Guide", Analytic Technologies.

Borgatti, S.P., Everett, M.G. and Johnson, J.C. (2013), Analyzing Social Networks, SAGE Publications.

Borgatti, S.P. and Halgin, D.S. (2011), "On Network Theory", *Organization Science*, Vol. 22 No. 5, pp. 1168–1181.

Capello, R. (1996), "Industrial enterprises and economic space: The network paradigm", *European Planning Studies*, Vol. 4 No. 4, pp. 485–198.

Cooke, P. and Morgan, K. (1993), "The network paradigm: new departures in corporate and regional development", *Environment & Planning D: Society & Space*, Vol. 11 No. 5, pp. 543–564.

Cravens, D.W., Piercy, N.F. and Shipp, S.H. (1996), "New organizational forms for competing in highly dynamic environments: The network paradigm", *British Journal of Management*, Vol. 7 No. 3, pp. 203–218.

Everett, M.G. (2016), "Centrality and the dual-projection approach for two-mode social network data", Methodological Innovations, SAGE Publications Ltd, Vol. 9, p. 2059799116630662.

Everett, M.G. and Borgatti, S.P. (2013), "The dual-projection approach for two-mode networks", *Social Networks*, Vol. 35 No. 2, pp. 204–210.

Florek-Paszkowska, A., Ujwary-Gil, A. and Godlewska-Dzioboń, B. (2021), "Business innovation and critical success factors in the era of digital transformation and turbulent times", *Journal of Entrepreneurship, Management and Innovation*, Vol. 17 No. 4, pp. 7–28. https://doi.org/10.7341/20211741

Gancarczyk, M. and Ujwary-Gil, A. (2021). "Entrepreneurial cognition or judgment: The management and economics approaches to the entrepreneur's choices", *Journal of Entrepreneurship, Management and Innovation*, Vol. 17 No. 1, pp. 7-23. https://doi.org/10.7341/20211710

Georgescu, A., Avasilcai, S. and Peter, M.K. (2021), "Digital Innovation Hubs—The present future of collaborative research, business and marketing development opportunities", *Smart Innovation, Systems and Technologies*, Vol. 205, pp. 363–374.

Hervas-Oliver, J.-L., Gonzalez-Alcaide, G., Rojas-Alvarado, R. and Monto-Mompo, S. (2021), "Emerging regional innovation policies for industry 4.0: Analyzing the digital innovation hub program in European regions", *Competitiveness Review*, Vol. 31 No. 1, pp. 106–129.

Jasny, L. (2012), "Baseline models for two-mode social network data", *Policy Studies Journal,* Vol. 40 No. 3, pp. 458–491.

Mărcuț, M. (2020), "Evaluating the EU's role as a global actor in the digital space", *Romanian Journal of European Affairs*, Vol. 20 No. 2, pp. 79–85.

Martin-Rios, C. (2014), "Why do firms seek to share human resource management knowledge? The importance of inter-firm networks", *Journal of Business Research*, Vol. 67 No. 2, pp. 190–199.

Padilla-Meléndez, A., Del Aguila-Obra, A.R. and Lockett, N. (2013), "Shifting sands: Regional perspectives on the role of social capital in supporting open innovation through knowledge transfer and exchange with small and medium-sized enterprises", *International Small Business Journal,* Vol. 31 No. 3, pp. 296–318.

Pinto, H., Nogueira, C., Cruz, A.R. and Uyarra, E. (2021), "The social shaping of innovation: Networks and expectations as connecting dynamics in regional innovation systems", *International Review of Sociology,* Vol. 31 No. 3, pp. 410–431.

S3 Tools and Data Sources (2022), Digital Innovation Hubs, available at: https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool

Salancik, G.R. (1995), "Wanted: A good network theory of organization", *Administrative Science Quarterly*, Vol. 40 No. 2, pp. 345–349.

Ujwary-Gil, A. (2017), "Intra-organizational two-mode networks analysis of a public organization", *Economics & Sociology,* Vol. 10 No. 3, pp. 192–205.

Ujwary-Gil, A. (2019), "Organizational network analysis: A study of a university library from a network efficiency perspective", *Library & Information Science Research*, Vol. 41 No. 1, pp. 48–57.

Ujwary-Gil, A. (2020), Organizational Network Analysis: Auditing Intangible Resources, 1 edition., Routledge, New York.

Ujwary-Gil, A. and Potoczek, N.R. (2020), "A dynamic, network and resource-based approach to the sustainable business model", *Electronic Markets*, Vol. 30, pp. 717–733.

Ujwary-Gil, A., Lo Re, M. and Parente, F. (2022), "The actor-network model of economic networks in a geo-economic context: The conceptual considerations", *Forum Scientiae Oeconomia,* Vol. 10, No. 1, pp. 10-28. https://doi.org/10.23762/FSO_VOL10_NO1_1.

Start-up Performance: Looking for an Explanation in Entrepreneurial Characteristics and Financing Choice

Ine Umans[1], and Nadine Lybaert[1,2]
[1]UHasselt, Research Center for Entrepreneurship and Family Firms, Diepenbeek, Belgium
[2]University of Antwerp, Antwerp, Belgium
ine.umans@uhasselt.be
nadine.lybaert@uhasselt.be

Abstract Although start-ups are gaining popularity and are known to have an important influence on the economy, surprisingly little research is available on these enterprises. One of the topics which remain to be explored concerns the performance of start-ups. So as to gain some insight into this phenomenon, we investigate the influence of characteristics of both the entrepreneur and the start-up (namely gender, age, education, experience, and start-up size). Thereby we base our arguments on the literature of SMEs and large companies, taking into account that start-ups behave differently than SMEs. Based on the translations of these arguments, we come to 5 hypotheses. However, since literature for SMEs and large companies is mixed and finds no unambiguous effect for these characteristics, this focus might limit to an incomplete overview. Therefore, we integrate the use of outside finance as a moderator, so as to find out whether the relations are influenced (strengthened or weakened) by the used financing source. The integration of this moderator is justifiable based on previous studies, where associations can be found between entrepreneurial characteristics and financing decisions on the one hand, but in addition, between financing decisions and performance on the other hand. So, it has been found that a firm's success or failure depends heavily on its initial financing decision. Concerning the population of start-ups, studies show that the use of debt or any other form of external financing is associated with a better start-up performance. Based on a dataset of 117 Belgian start-ups, and making use of quantitative research, only the expected results concerning the level of education and gender could be confirmed. So, it is found that higher levels of education lead to better start-up performance, while no difference is found in the performance of start-ups led by female versus male entrepreneurs. At the same time, no significant interaction between any of the investigated characteristics and outside finance could be found. As such, it could not be confirmed that for start-ups using outside finance, the effect of the characteristics on performance will be different, compared to when they don't use any form of outside finance.

Keywords: start-ups, entrepreneurial characteristics, performance, financing choice

1. Introduction

Since 2015 the number of start-ups in Belgium is increasing, with an absolute record of 100.113 new start-ups established in 2018 (Unizo, 2019). So as to define a start-up, the following three criteria are commonly referred to: (1) the venture's age has to be less than five or ten years, depending on the sector; (2) the venture has to strive for innovation, not only in its products but also in its business model; (3) the venture should have the aim to scale: they need to have the intention to grow their number of employees and the markets they operate in. Notwithstanding their small size, start-ups create more new jobs than existing companies, and they appear to have higher median growth than their more mature counterparts (Bokhari et al., 2018).

Although start-ups are gaining popularity and are known to have a fundamental impact on the overall productivity of our economy, there is surprisingly little research available on start-ups (Nofsinger and Wang, 2011). A lot of research focuses on small and medium-sized enterprises (SMEs) and on large corporations, but these findings might not be the same when applied to start-ups. Especially when looking at literature on firm performance, much remains to be explored concerning the performance of start-ups. Thereby, results from previous research concerning SMEs are useful to translate some expectations to start-ups.

This paper contributes to the literature about start-ups by not only trying to find factors that are directly associated with start-up performance, but also to look at the moderating effect that outside finance might have on these associations. The access to entrepreneurial finance and the choice between different financing forms are crucial factors for start-ups (Vaznyte and Andries, 2019). Little is known about any specific relation between these new financing sources and the performance of the start-up.

2. Literature review and hypotheses development

2.1 Characteristics of the entrepreneur and the start-up in relation to start-up performance

Both the personal characteristics of the entrepreneur and the size of the start-up itself may have an impact on the start-up's performance.

***Gender*.** Prior studies concerning the effect of gender on firm performance show mixed results. Some studies find that female-owned firms are less profitable, less likely to grow and thus have worse average outcomes than male-owned firms (Robb and Robinson, 2014). Other studies however find that female-owned firms are just as likely to survive as male-owned firms and argue that previous studies did not control for important factors that do differ between male and female entrepreneurs, like size, risk and the sector in which the business operates. As such, female-owned start-ups do not underperform male-owned start-ups (Robb and Watson, 2012; Sabarwal and Terrell, 2008).

***Age*.** Previous research shows that there exists a positive relation between the age of the entrepreneur and the success of the business (Alharbi et al., 2018). Some argue that age is positively related with knowledge rather than with business success directly, but this knowledge in turn contributes to a successful business as well (Bosma et al., 2000). Other studies show that with increasing age, the entrepreneur's skills might improve since they learn to manage time more effectively. So it can be concluded that the entrepreneur's human capital (i.e. entrepreneurial age, skills and knowledge) is positively associated with survival and success of the start-up (Fried and Tauer, 2015; Sajilan et al., 2015).

***Education*.** The literature in general provides strong evidence for a positive relationship between the entrepreneur's level of education and the firm's performance (Alharbi et al., 2018). Education provides entrepreneurs with more knowledge and skills which makes the business more successful (Sajilan et al., 2015; Waleczek et al., 2018). Indeed, entrepreneurs with a higher level of education seem to enhance the growth and the success of the business, appear to be less risk averse and will survive longer in the market (Achleitner et al., 2011; Alharbi et al., 2018; Zhang, 2008).

Experience. The evidence on the effect of experience on the performance of start-ups is mixed. Some studies argue that both new and experienced entrepreneurs have similar firm closure speed (Gottschalk et al., 2017). Other studies however show that firms established by industrial experienced entrepreneurs are less likely to go bankrupt and thus appear to survive longer (Alharbi et al., 2018; Cassar, 2014; Gottschalk et al., 2017).

***Size*.** Prior studies show mixed results concerning the relationship between the size of a firm and its performance. Some studies found that the start-up size is statistically related to the chance of survival, or found a positive relation with its profitability (Robb and Watson, 2012). On the contrary, other studies that did control for factors like market structure, entry barriers or firm strategies found a rather ambiguous support for the relation between a firm's size and performance (Lee, 2009). Robb and Watson (2012) state that smaller firms are more likely to be more profitable. Ha-Brookshire (2009) finds that smaller firms have more advantages with speed and flexibility in the fast-changing market environment and therefore survive longer than larger firms.

Based on these findings, we come to the following five hypotheses:

> *Hypothesis 1A: There is no difference in performance between female-owned and male-owned start-ups.*
>
> *Hypothesis 1B: The age of the entrepreneur is positively related to the performance of the start-up.*
>
> *Hypothesis 1C: The level of education of the entrepreneur is positively related to the performance of the start-up.*
>
> *Hypothesis 1D: The entrepreneur's previous experience is positively related to the performance of the start-up.*
>
> *Hypothesis 1E: The start-up size is negatively related to the performance of the start-up.*

2.2 Financing forms of start-ups in relation to start-up performance

Entrepreneurs need capital, not only to convert their ideas into reality by starting a venture, but also for their venture to eventually grow. However, for start-ups, it is unlikely to easily raise external funding since they have no or little collateral, and they lack internal cash flows. Besides, start-up's underlying market imperfections are related to significant information asymmetries between the entrepreneur and the firm's financiers, which causes agency problems, like moral hazard and adverse selection (Cole and Sokolyk, 2018; Waleczek et al., 2018). As a result, capital markets only provide little capital to entrepreneurs (Qorraj, 2017).

Entrepreneurs can make use of a funding source that is not provided in the market. This pre-market funding source is called 'bootstrapping' (Alemany and Andreoli, 2018). It refers to a self-starting process that proceeds without external input. In addition, many start-ups are forced to rely on an informal network of family, friends and other financing sources for their initial funding (Achleitner et al., 2011; Robb and Robinson, 2014; Waleczek et al., 2018).

These financing constraints limit the growth of the start-ups and threaten their survival. Capital decisions and the use of debt and equity at start-up appear to have important implications for the operations of the business, risk of failure, firm performance and the expansion potential of the company (Cassar, 2004). More and more financing sources are emerging to overcome these difficulties. Lately, and especially in the wake of the 2008/2009 financial crisis, new finance providers have emerged because of the difficulties faced by entrepreneurs to raise funds for their start-ups (Block et al., 2018).

The following paragraphs summarize what is known about the relation between the use of these new financing sources that are provided in the market and the performance of the start-up, which is still a somewhat overlooked topic in finance literature.

Incubator and accelerator. An incubator is an organization that provides start-ups with a shared operation space, networking opportunities, mentoring resources and access to shared equipment. Incubators support the search for funding from the start of the seed stage, but provide no or a small amount of money. An accelerator is an organization that offers start-ups support services and funding opportunities in intense programs that last several months. These programs include mentorship, office space and access to capital and investment in return for start-up equity (Alemany and Andreoli, 2018).

Regarding the incubators, there is a common assumption that they promote firm growth (Rothaermel and Thursby, 2005), although some research does not support this assumption (Schwartz, 2011). Regarding accelerators, the presence of an accelerator appears to increase the performance of the start-up (Bokhari et al., 2018; Qian, Mulas, and Lerner, 2018) and helps the entrepreneur to attract funding from venture capitalists and business angels (Fraser et al., 2015).

Crowdfunding. Crowdfunding connects those who can give, lend or invest money directly with those who need financing for a specific project. It primarily uses the internet to connect investors with entrepreneurs. The effect of crowdfunding on the performance of start-ups is inconclusive. Some studies (2018) find that equity-crowdfunded firms have a higher failure rate than non-equity-crowdfunded firms, which can be caused by adverse selection problems (Walthoff-Borm, Vanacker, and Collewaert, 2018). Other studies find that survival rate, sales growth, employment growth and revenues are higher for start-ups with a successful crowdfunding campaign than for companies with failed crowdfunding (Cho, Park, and Sung, 2019).

Business angels. Another funding source is business angels, being private individuals that are primarily experienced entrepreneurs who sold their ventures. They then invest their own money in new and early-stage businesses and draw upon their own business experience and expertise to support these ventures in various ways. With regard to business angels, the lack of available data causes problems in assessing the impact of business angels on firm growth. The studies that have been conducted, may be biased due to the use of convenience samples (Fraser et al., 2015).

***Venture capital and private equity*.** The last funding sources are venture capital and private equity, both temporary equity investors. They provide capital to non-listed companies in exchange for equity in the form of shares. Evidence from several countries shows a positive relationship between venture capital-backed firms and

their performance. Venture capitalists are active in providing added value services, which causes these firms to grow faster, have better financial and operating performance, be more innovative, and be more likely to go public than their non-venture capital-backed peers (Fraser et al., 2015). Companies backed by more reliable venture capitalists are more likely to exit successfully, access public markets faster, and have higher asset productivity at IPOs (Cumming and Groh, 2018). In contrast, other studies found no effect of venture capital backing on post-IPO growth (Fraser et al., 2015).

Private equity investors appear to have positive effects on firm performance. Studies show that private equity-backed firms grow faster, have higher productivity, sales, and profitability, have better long-run market returns and operating performance, and are more likely to go public (Battistin et al., 2017). Meles et al. (2014) find that private equity-backed firms outperform their matched firms over the post-exit period but their evidence appears to be confined to venture capital-backed firms. Explanations for this outperformance are that the private equity investors execute an ex-ante screening in which they create value by reducing the agency costs. Private equity investors add value to firms by monitoring them closely (Fraser et al., 2015; Meles, Monferrà, and Verdoliva, 2014).

***Debt financing*.** The new financing forms discussed above are not used very often (Cole and Sokolyk, 2018). Bank lending, on the other hand, appears to be the most common source of external financing for many SMEs and entrepreneurs (Andries, Rijssegeme, and Roelandt, 2019; Deloof and Vanacker, 2018; Robb and Robinson, 2014). Entrepreneurs choose external debt to keep ownership and control of their firms, or they choose external equity to help share the risk with less risk-averse investors. Overall, debt financing in start-ups is associated with higher success in terms of survival, employment growth, and revenue growth and with better subsequent performance (Cole and Sokolyk, 2018; Cumming and Groh, 2018).

In sum, start-ups that use debt or any other form of external financing are expected to perform better than start-ups that do not use external finance, while the use of any bootstrapping appears to be negatively related to performance (Cole and Sokolyk, 2018; Waleczek et al., 2018). Based on these findings, we come to the following hypothesis:

> *Hypothesis 2: There is a positive relation between the use of outside finance and the performance of the start-up.*

2.3 The moderating role of the financing choice

While prior studies showed a relationship between the entrepreneur's and start-up's characteristics, and the performance of SMEs (as discussed in section 2.1), results are mixed and the effects are not crystal clear. A possible reason for these ambiguous results is that the relationship between the characteristics and performance is affected by unobserved moderating factors. Given the expected positive relationship between the use of outside finance and performance, we argue that the use of outside finance is a potential moderator affecting the relationship between the characteristics and the start-up performance. The use of outside finance can strengthen or weaken this relationship.

As we expect no difference in start-up performance between male and female entrepreneurs (see hypothesis 1A), we do not expect a moderating effect from the use of outside finance on this relationship.

As discussed in section 2.1, we expect start-ups with older entrepreneurs (*age*), entrepreneurs with a higher level of education (*education*), and more experienced entrepreneurs (*experience*) to show better performance. Additionally, the use of outside finance appears to have a positive effect on the performance of the start-up (e.g. Battistin et al., 2017). We, therefore, expect that the use of outside finance will strengthen the positive relationship between age, education, and experience on the one hand and performance on the other hand. Regarding the size of the start-up (*size*), we expect larger start-ups to be less profitable than smaller start-ups (as discussed in section 2.1). However, given that the use of outside finance might lead to better start-up performance, we argue that the use of outside finance can weaken the expected negative relationship between start-up size and performance.

These arguments lead to the following four hypotheses:

Hypothesis 3B: The financing choice moderates the relation between the entrepreneur's age and the start-up's performance such that the choice for outside finance strengthens this positive relationship.

Hypothesis 3C: The financing choice moderates the relation between the entrepreneur's education and the start-up's performance such that the choice for outside finance strengthens this positive relationship.

Hypothesis 3D: The financing choice moderates the relation between the previous experience of the entrepreneur and the start-up's performance such that the choice for outside finance strengthens this positive relationship.

Hypothesis 3E: The financing choice moderates the relation between the size of the start-up and its performance such that the choice for outside finance weakens this negative relationship.

3. Methodology

3.1 Sample

To empirically test the moderation model, data is combined from two different sources. So as to collect the data concerning the characteristics of the entrepreneur and their chosen financing forms, use was made of an existing database of the Research Center for Entrepreneurship and Family firms (RCEF). The respondents in this dataset are 225 entrepreneurs that founded a start-up in the Flemish region of Belgium between 2015 and 2019. This dataset is supplemented by linking performance measures from the Belfirst database. Since the financial statements were not available for some start-ups, 98 cases had to be deleted, which reduced the total number of start-ups to 127. Furthermore, 10 start-ups were excluded because of outliers for the dependent variable ROA ending up with a dataset of 117 start-ups to conduct the further analyses.

3.2 Measurements

***Dependent variable*.** The return on assets (ROA) - the ratio of the net income for a particular year divided by the total assets at the end of that year – is used as the measure for start-up performance, as it is the most accepted measure for firm performance in the literature (Meles et al., 2014; Robb and Watson, 2012; Saidu, 2019).

***Independent variables*.** Respondents had to indicate whether they are male or female (gender), what age category they are in (age), the highest degree they attained (education), whether they have previous experience in establishing a startup (experience), and the number of employees that work in the start-up (as an expression for the size of the start-up which is in line with prior studies, Sabarwal and Terrell, 2008). The latter is a continuous variable, while the personal characteristics are categorical variables.

Moderator. The moderator OutsideFinance has value 1 if the entrepreneur used at least one form of outside finance (any form of inside finance can supplement this) and 0 otherwise. Outside finance is defined as a cluster of all financing forms provided in the market, including a bank loan, a PMV loan, cash credit, risk capital, a bullet loan, a government-guaranteed PMV, leasing, a win-win loan, a vendor loan, a subordinated loan and others.

***Control variables*.** The analysis further includes two control variables, being the sector and the year in which the start-up was established. It is known from previous research that the sector in which the start-up operates influences the performance of the start-up (Lee, 2009; Sabarwal and Terrell, 2008). Also, the start-up's age is found to be related to its performance (Sajilan et al., 2015). Since both the sector and the firm's age are categorical variables with more than three categories, these variables are transformed into dummy variables.

4. Results

4.1 Descriptive statistics

The descriptive statistics indicate that 74.5% of the entrepreneurs are male, 51.4% are between 30 and 45 years old, 30.9% have a master degree, for 66.7% it is the first time they establish a start-up, and 93.8% of the entrepreneurs have no or less than 10 employees.

Concerning the financing sources, 85.1% of the respondents use their own savings, which is a form of bootstrapping. This appears to be the most preferred source of financing in our sample. The second most used financing source is a bank loan, used by 30.9% of the respondents, followed by borrowing money from family or friends.

When looking at the moderator, it is found that 54.3% of the respondents use some form of outside finance (this however might be complemented by inside finance). The other 45.7% of the respondents use only inside financing (i.e., own savings or money from family and friends).

Multicollinearity is not a problem in our data, as no correlation is above 0.80, and the highest VIF is 3.643.

4.2 Regression results

To test hypothesis 1A, a univariate analysis was performed between the gender of the entrepreneur and the ROA by using the independent sample t-test. Based on the absence of significant results, hypothesis 1A is confirmed.

To test hypotheses 1B to 1E, a multivariate regression analysis is executed between the four independent variables and the dependent variable ROA. The binary control variables are also included in this regression, but these results are not mentioned in Table I, as no results were significant.

As can be concluded from model A in Table I, the relation between the level of education of the entrepreneur and the ROA is positive and statistically significant at the 5% level. Therefore, hypothesis 1C -saying that start-ups of entrepreneurs with a higher level of education have a higher ROA- can be accepted. There is no statistically significant relation between any of the other independent variables and the ROA, so hypotheses 1B, 1D, and 1E cannot be accepted.

Table 1: Regression results

	Model A		Model B	
Variable	*Beta*	*SE*	*Beta*	*SE*
Age	0.026	2.644	0.074	4.014
Education	0.230	2.228 *	0.276	3.188 †
Experience	-0.160	4.088	0.017	6.757
Size	0.082	1.016	0.127	1.467
OutsideFinance			0.528	18.806
Age * OutsideFinance			-0.087	5.330
Education * OutsideFinance			-0.087	4.589
Experience * OutsideFinance			-0.502	9.078
Size * OutsideFinance			-0.016	2.154
	R^2 = 0.244 Adjusted R^2 = 0.112 F = 1.846; p = 0.046		R^2 = 0.276 Adjusted R^2 = 0.088 F = 1.468; p = 0.124	

Dependent variable = ROA
N = 117
† p < .10. * p < 0.05. ** p < 0.01
SE = standard error

To test the moderating effects in hypotheses 3B to 3E, model A is expanded by adding the moderator OutsideFinance and the corresponding interaction terms (formed by multiplying the moderator with every independent variable included in the model).

As can be concluded from model B in Table 1, the ordinary least squares (OLS) regression results show that the relation between the level of education and the ROA is statistically significant, again confirming hypothesis 1C. Next, model B shows that moderator OutsideFinance is not statistically significant. Therefore, hypothesis 2, which expected a positive relation between the use of outside finance and the performance of the start-up, cannot be accepted. Furthermore, there is no significant interaction between any of the independent variables and the moderator. So, none of the hypotheses 3B to 3E can be accepted.

5. Discussion and conclusions

For our economy, start-ups are crucial. To guide these companies in their process to success, insight into this group is necessary. However, this target group has received little attention in the literature. Therefore, this research focuses on the determinants of their success.

This study examines relations between the characteristics of the entrepreneur and the start-up (gender, age, education, experience and start-up size) and the performance of the start-up and whether these relations are influenced (strengthened or weakened) by the use of outside finance as a financing source. The main findings of this study are (1) a positive relation between the level of education of the entrepreneur and the performance of the start-up and (2) no difference in start-up performance between male or female entrepreneurs.

This lack of results might be due to some limitations, which provide interesting suggestions for future research. We suggest future studies to focus on recruiting larger datasets, on performing a longitudinal follow-up, to focus on the start-up team or potential start-up investors… so as to stress the importance of the start-up's financing choices for their performance. Furthermore, we encourage future research to investigate the studied phenomena in different countries to grasp potential cultural differences that might impact the start-up's performance such as the extensiveness of the financial ecosystem. Also, cultural value differences on the individual level such as risk averseness and assertiveness might interact with the use of outside finance and influence the start-up's performance.

References

Achleitner, A., Braun, R. and Kohn, K. (2011) "New venture financing in Germany: Effects of firm and owner characteristics", *Zeitschrift für Betriebswirtschaft*, Vol 81, No. 3, pp 263-294.

Alemany, L. and Andreoli, J. (2018) *Entrepreneurial finance: the art and science of growing ventures*, Cambridge: Cambridge University Press.

Alharbi, R., Yahya, S. and Ahmed, E. (2018) "Characteristics of manager's and SMEs performance: the role of access to finance as a moderator", *International Journal of Engineering and Technology*, Vol 7, No. 4, pp 5115-5119.

Andries, P., Rijssegeme, L. and Roelandt, J. (2019) *De financiering van jonge ondernemingen in Vlaanderen 2019*, Steunpunt Economie en Ondernemen.

Battistin, E., Bortoluzzi, P., Buttignon, F. and Vedovato, M. (2017) "Minority and majority private equity investments: firm performance and governance", *Journal of Management and Governance*, Vol 21, No. 3, pp 659-684.

Block, J., Colombo, M., Cumming, D. and Vismara, S. (2018) "New players in entrepreneurial finance and why they are there", *Small Business Economics*, Vol 50, No. 2, pp 239-250.

Bokhari, S., Chegut, A., Frenchman, D. and Tausendschoen, I. (2018) *Is innovation really in a place? Accelerator program impacts on firm performance,* MIT Center for Real Estate Research Paper No. 21/13

Bosma, N., Van Praag, M. and De Wit, G. (2000) *Determinants of successful entrepreneurship,* EIM Zoetermeer.

Cassar, G. (2004) "The financing of business start-ups", *Journal of Business Venturing*, Vol 19, No. 2, pp 261- 283.

Cassar, G. (2014) "Industry and startup experience on entrepreneur forecast performance in new firms", *Journal of Business Venturing*, Vol 29, No. 1, pp 137-151.

Cho, Park and Sung (2019) "The Study on the Difference in Corporate Performance and Employment Outcomes According to the Results of Equity-Based Crowdfunding Investment", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol 5, No. 4, p 83.

Cole, R. and Sokolyk, T. (2018) "Debt financing, survival, and growth of start-up firms", *Journal of Corporate Finance*, Vol 50, pp 609-625.

Cumming, D. and Groh, A. (2018) "Entrepreneurial finance: Unifying themes and future directions", *Journal of Corporate Finance*, Vol 50, pp 538-555.

Deloof, M. and Vanacker, T. (2018) "The recent financial crisis, start-up financing and survival", *Journal of Business Finance and Accounting*, Vol 45, No. 7-8, pp 928-951.

Fraser, S., Bhaumik, S. K. and Wright, M. (2015) "What do we know about entrepreneurial finance and its relationship with growth?", *International Small Business Journal*, Vol 33, No. 1, pp 70-88.

Fried, H. and Tauer, L. (2015) "An entrepreneur performance index", *Journal of Productivity Analysis*, Vol 44, No. 1, pp 69-77.

Gottschalk, S., Greene, F. and Müller, B. (2017) "The impact of habitual entrepreneurial experience on new firm closure outcomes", *Small Business Economics*, Vol 48, No. 2, pp 303-321.

Ha-Brookshire, J. (2009) "Does the firm size matter on firm entrepreneurship and performance?: US apparel import intermediary case", *Journal of Small Business and Enterprise Development*, Vol 16, No. 1, pp 132-145.

Kautonen, T., Down, S. and Minniti, M. (2014) "Ageing and entrepreneurial preferences", *Small Business Economics*, Vol 42, No. 3, pp 579-594.

Lee (2009) "Does Size Matter in Firm Performance? Evidence from US Public Firms", *International Journal of the Economics of Business*, Vol 16, No. 2.

Meles, A., Monferrà, S. and Verdoliva, V. (2014) "Do the effects of private equity investments on firm performance persist over time?", *Applied Financial Economics*, Vol 24, No. 3, pp 203-218.

Nofsinger, J. and Wang, W. (2011) "Determinants of start-up firm external financing worldwide", *Journal of Banking and Finance*, Vol 35, No. 9, pp 2282-2294.

Qian, K., Mulas, V. and Lerner, M. (2018) *Supporting Entrepreneurs at the Local Level: The Effect of Accelerators and Mentors on Early-Stage Firms,* World Bank, Washington.

Qorraj, G. (2017) "Entrepreneurial ventures under information asymmetry in countries", *Dynamic Relationships Management Journal*, Vol 6, No. 1, pp 27- 34.

Robb, A. and Robinson, D. (2014) "The Capital Structure Decisions of New Firms", *Review of Financial Studies*, Vol 27, No. 1, pp 153-179.

Robb, A. and Watson, J. (2012) "Gender differences in firm performance: Evidence from new ventures in the United States", *Journal of Business Venturing*, Vol 27, No. 5, pp 544-558.

Rothaermel, F. and Thursby, M. (2005) "University-incubator firm knowledge flows: Assessing their impact on incubator firm performance", *Research policy*, Vol 34, No. 3, pp 305-320.

Sabarwal, S. and Terrell, K. (2008) *Does Gender Matter for Firm Performance? Evidence from Eastern Europe and Central Asia,* World Bank Policy Research.

Saidu, S. (2019) "CEO characteristics and firm performance: focus on origin, education and ownership", *Journal of Global Entrepreneurship Research*,Vol 9, No. 1, pp 1-15.

Sajilan, S., Hadi, N. and Tehseen, S. (2015) "Impact of Entrepreneur's Demographic Characteristics and Personal Characteristics on Firm's Performance Under the Mediating Role of Entrepreneur Orientation", *Review of Integrative Business and Economics Research*, Vol 4, No. 2, p 36.

Schwartz, M. (2011) "Incubating an Illusion? Long-Term Incubator Firm Performance after Graduation", *Growth and Change*, Vol 42, No. 4, pp 491-516.

Unizo (2019) *Starters atlas 2019* [Press release, online] https://graydon.be/downloads/report-startersatlas-2019.

Vaznyte, E. and Andries, P. (2019) "Entrepreneurial orientation and start-ups' external financing", *Journal of Business Venturing*, Vol 34, No. 3, pp 439-458.

Waleczek, P., Zehren, T. and Flatten, T. (2018) "Start-up financing: How founders finance their ventures' early stage", *Managerial and Decision Economics*, Vol 39, No. 5, pp 535-549.

Walthoff-Borm, X., Vanacker, T. and Collewaert, V. (2018) "Equity crowdfunding, shareholder structures, and firm performance", *Corporate Governance: An International Review*, Vol 26, No. 5, pp 314-330.

Zhang, G. (2008) "The choice of formal or informal finance: Evidence from Chengdu, China", *China Economic Review*, Vol 19, No. 4, pp 659-678.

Cascade Funding as an Alternative Funding Source for Innovative Investments

Margherita Volpe[1], Iñigo Gonzalez Rojas[1], Omar Veledar[2] and Simona Cavallini[3]
[1]Zabala Innovation Europe, Brussels, Belgium
[2]AVL List GmbH, Graz, Austria
[3]Progress Consulting S.r.l., Reggello (Florence), Italy
mvolpe@zabala.eu
igonzalez@zabala.eu
scavallini@progresscons.com
omar.veledar@avl.com

Abstract: Although promoting an innovation ecosystem is a core priority of the European Commission (EC), evidence indicates that innovation within start-ups and Small and medium-sized enterprises (SMEs) is still constrained by the lack of funding opportunities. Consequently, their capability to realise proofs of concepts or launch new risky business lines is limited. This paper aims to comparatively assess cascade funding initiatives against more traditional funding approaches as relevant alternatives for financing innovation. SMEs and start-ups most commonly fund innovative projects through business angels or venture capital. The disadvantages of risk capital include complex administrative procedures, loss of ownership and control over the strategic decision, etc. Other relevant funding is commonly sourced from private bank loans. In addition to discouraging bureaucracy, prior guarantee or collateral required, longer timing and extended terms, these investors are often reluctant to fund innovation due to their high risk. Preference is usually given to safer investments in which assets can be easily valued and sold in case of failure. In addition, financing opportunities from banks do not include an assessment of the return opportunities of innovative businesses. Out of the traditional schemes for financing innovation, cascade funding is a promising alternative, especially in highly innovative sectors. Cascade funding provides small grants issued by the beneficiaries of projects funded by the EC, typically under the Horizon 2020 (H2020) framework (>800 M€ allocated since 2014). As the EC delegates the selection and monitoring of innovative projects to consortiums, the funding is provided via open calls for proposals, which can provide start-ups and SMEs with grants for an experiment between €50,000 and €150,000. This mechanism also enables applicants to benefit from the technical and/or business expertise of leading European enterprises, universities and technology centres. While focusing on exploitable innovation, cascade funding has also proven to be a more agile financing method with respect to the classical ones. Here, DigiFed project is analysed as a Case Study for cascade funding, as it came to allocate over €3M via three open calls for proposals since 2020. Evidence of the advantages of this funding source for innovative businesses with respect to risk capital and bank debt is the core output of this paper.

Keywords: cascade funding, SMEs/start-ups, innovation ecosystem, innovation financing, DigiFed

1. Introduction

The European Union (EU) has set out innovation as a clear priority for the coming years, especially regarding the energy transition and digitalisation, while considering SMEs and start-ups as the main backbones with the potential to drive it. Nevertheless, they often fall behind when it comes to receiving financial support for their innovative projects since traditional funding mechanisms have been tailored to the specific needs of large companies, disregarding the particularities that innovative SMEs and start-ups entail. In this matter, a relevant research question arises concerning the current need for alternative sources of funding for SMEs and start-ups when developing innovation in contrast to traditional funding sources. Throughout the paper, key information on cascade funding as a potential source of funding for SMEs is retrieved from the experience of the DigiFed project, which was funded by the EC under the H2020 program. The ultimate objective of the paper is to discuss the effectiveness and advantages of cascade funding as a feasible and efficient alternative source of innovation funding for SMEs and start-ups. Firstly, innovation funding challenges will be outlined from a literature perspective, followed by an insight into the EU's priorities regarding innovation. Afterwards, the limitations and obstacles that start-ups and SMEs currently must face when seeking funding for innovative projects are presented. Indeed, traditional funding schemes favour big companies and disincentive the funding of innovation as it is usually riskier and harder to monetize in case of failure. By contrast, cascade funding is a realistic source of funding for innovative start-ups and SMEs that entails several advantages, such as less bureaucracy and greater efficiency, while enhancing collaboration and mutual learning between highly innovative European companies and research centres. The DigiFed case study is presented as a real success story of cascade funding in the EU projects framework.

2. Context

2.1 Innovation funding challenges

Innovation and entrepreneurship have been associated with funding needs from external sources since the early works of Schumpeter (Schumpeter, 1934). Modigliani and Miller (Modigliani and Miller, 1958) highlighted the lack of influence of the source of funding on investment decisions taken at the firm level. However, in the real world, asymmetric information between the actors providing funding (firm outsiders) and entrepreneurs (firm insiders) is the rule. Information asymmetry between outsiders and insiders leads to a "financing hierarchy" for firms *"in which internal funds have a cost advantage over new debt or equity finance"* (Fazzari, Hubbard and Petersen, 1988). The "pecking order theory" postulates that the cost of financing increases with asymmetric information. As *"management is assumed to know more about the firm's value than potential investors"* (Myers and Majluf, 1984), firms give priority to internal financing. When enterprises are small, young and innovative, asymmetric information is more severe and it affects the financing hierarchy until excluding access to specific external sources of funding and reversing the pecking order (Mina and Lahr, 2018).

In relation to SMEs, and regardless of their innovative component, they may encounter more obstacles when looking for funding compared to larger firms. This effect results from SMEs most likely being unlisted, not having clear track records or performing activities that are difficult to value, which are considered as risk increasing factors (Mina et al., 2021). Consequently, access to external capital is restricted and becomes only possible for SMEs if an extra premium is paid (OECD, 2018). As a result, some projects do not get to be funded, since enterprises might not have enough internal capital to do so (Cosh et al., 2009). In this context, innovation activities entail an additional set of obstacles (Coleman and Robb, 2012) since innovation investments usually imply a higher level of uncertainty and are often related to intangible capital, which tends to be easier to monetise. Thus, the innovative component implies an increase in asymmetric information between the enterprise and potential investors, which accentuates the enterprises' financial constraints (Bond et al., 2003).

Beyond the financial aspects, organisations must consider eventual technical and business support associated with the funds and how it complements the organisation's innovation strategy (Macher and Veledar, 2021). In addition, the question of integrity can be raised if there is a lack of shared values between the funding organisation and the funded enterprises, which is particularly coming into prominence with the rise of Society 5.0, where the economic advancement is balanced with the resolution of social problems (Gladden, 2019). To determine the suitability of the funding model, the funded organisation must consider its organisational design aspects, such as business models, structure, values etc. In an ideal scenario, a high level of information symmetry speeds up innovation through the funding mechanism and other forms of support.

2.2 EU priorities regarding innovation

From the First Framework Programme (1984-1987), research and innovation have been considered by the EC as top investment priorities. Nowadays Horizon Europe made available 95.5 billion euros over the period 2021-2027. Within H2020, the establishment of the SMEs Instrument and the introduction of a new type of action (i.e., innovation action) in the *Industrial Leadership* pillar and in the *Societal Challenge* pillar have widened the opportunities for European SMEs to fund their innovative projects. Horizon Europe has further improved these opportunities through the evolution of the SMEs instrument: the European Innovation Council (EIC) Accelerator.

Moreover, the Strategic Plan 2020-2024 issued by DG Research and Innovation includes several targets related to innovation in the General Objective 2 – *A Europe fit for the Digital Age*. Indeed, it sets that the EIC along with relevant clusters and a new wave of public-private partnerships will enhance innovative industries in all Member States, with special support to SMEs (EC, 2020). Furthermore, a third of the 1.8 trillion-euro investments from the NextGenerationEU Recovery Plan will fund innovative solutions in the European Green Deal framework and the Innovation Fund (European Commission, 2019) will provide around €10 billion in funding during the 2020-2030 period for commercial demonstration projects involving innovative low-carbon technologies. Furthermore, compared to the former mechanism, the EIC Accelerator introduced several changes regarding the application process and the type of funding offered for applicants. Data from the results of the first cut-off that took place in June 2021, to which over 2000 start-ups and SMEs applied for funding, was released last December. Out of all the companies that applied, only 65 were granted funding, 22 of them were enterprises in the health field, followed by Engineering and Technology (10 companies) and ICT (7 companies) (EIC Accelerator Data Hub, 2021).

The available data indicates that the success rate of the EIC Accelerator program is less than 3%, which evidences that it is not a reliable alternative for SMEs and start-ups seeking funding.

The prioritisation of the current EU innovation policies is set to accelerate the modernisation of relevant industrial sectors and to reach high exploitation levels through uptake and usage of innovative assets. The intention is to go beyond the classic view of innovation and the associated emergence of novel technologies and to reach higher societal goals by utilizing the innovation outcomes and their exploitation through novel business models. These activities are broadly supported by policies that enable and speed up the execution of the go-to-market strategies, especially for SMEs through cascade funding. The aim is to lift complete industrial sectors to a level that is appropriate for meeting social needs, expanding social relationships, and forming new collaborations.

2.3 Traditional funding schemes for small, young and innovative enterprises

Small, young and innovative enterprises face additional challenges when raising external funds due to their own structural characteristics, as they are considered riskier by providers of funding. First, they are at the early stages of the business and have no track records, reputation, cash flows or collateral. Secondly, innovation leads to something new on the market that can be disruptive and have a long-term impact on societies, as well as can be, a simple failure for the entrepreneur. As the ideas behind innovation are new by default, and often dependent on the adoption of advanced technologies, the assessment of the "goodness" of the enterprise and of the risk associated with a potential investment remains difficult for external investors to estimate and endorse. *"It is indeed well known that high-tech start-ups need large investments to initiate projects offering high potential but also high risk"* (Boccard, 2001). Hence, while innovation needs important investments (e.g., for applied research, testing, prototyping), the intrinsic uncertainty of any innovation directly affects the financial reliability of the enterprises that are promoting it. Indeed, *"…potential investors may shy away from the riskiness of supporting innovation and prefer to invest in routine production"* (Wang and Schøtt, 2022).

According to Rajan (Rajan, 1992), banks' debt, as an external source of financing, provides a concrete answer to the demand of enterprises. The focus is on the type of debt on which enterprises can rely according to the level of information shared: the *informed debt* or the *arm's length debt*. In the first case, banks take the role of investors willing to reduce the agency costs associated with the lending activities. The screening of enterprises and the threats to cut off credit in case of hasty investments are examples of ways that banks can use to reduce adverse selection (e.g., proving funds to the enterprises that prove to be more reliable) and moral hazard (e.g., proving funding to the enterprises for which they can control the investment strategy). Ex-ante sharing of (soft and hard) private information is needed for entrepreneurs to get informed debt. On the contrary, the arm's-length debt essentially relies on information on the enterprise that is essentially publicly available. The main difference between these two types for the entrepreneur lies in the debt cost: higher in the case of arm's-length debt due to its higher uncertainty for the bank.

The work carried out by Rajan (Rajan, 1992) highlights how the relevance of information sharing affects the costs of debt for an enterprise that needs external funding. When such an enterprise is small, young and innovative, its intrinsic features limit the entrepreneur's opportunity to share information in advance with the bank and its possibility to access funds (Petrella, 2001). Taking into account all the potential sources of funding for these enterprises, starting from Rajan (Rajan, 1992), Cavallini (Cavallini, 2002) distinguishes between *informed capital* and *not informed capital* arguing that the absence of ex-ante information to be shared with credit institutions creates information barriers that make risk capital the most suitable private source for funding innovation in the initial business phases (i.e. from the seed phase to the early-growth phase). In the last three decades, business angels and venture capitalists have demonstrated to be effectively informed actors for financing SMEs due to their better reactiveness and reduced asymmetry of information (Ueda, 2000).

In the seed phase and the start-up phase, the entrepreneur of an innovative firm owns the most complete information set about the innovation potential and the growth opportunities of the business. On one side, the entrepreneur can reduce the cost of funding and increase accessibility to funds by sharing information about its innovation, but on the other side, it may lose the competitive advantage in disclosing information that can be exploited by other entrepreneurs (Petrella, 2001). For this reason, entrepreneurs need trusted investors. Business angels are non-institutional investors that mainly support innovative ideas with a limited amount of capital and focus on the seed stage. The financing provided by venture capitalists (i.e., institutional risk capital

investors) usually addresses the most demanding funding needs of innovative firms already established and in the start-up and early-growth phases (Gompers, 1995). Economies of scale prevent venture capitalists to contribute to innovative firms at the seed stage, thus, leaving room for other sources of funding, including, among the private ones, business angels. Nevertheless, business angels' investments are increasingly also addressing the start-up phase (Lerner and Nanda, 2020). To the entrepreneur, both offer business governance competencies, management expertise and networks of contacts to favour the high growth of the business (e.g., clients and suppliers). Risk capital investors carefully select innovation projects to be sustained, based on initial evidence which may consider the innovativeness of the idea (e.g., through a business plan), the business opportunities on the market, and the entrepreneur's commitment (Fried and Hisrich, 1994). Risk capital investors have usually professional experience in business and in the sector of reference of the proposed innovative idea. These investors share the business risk with the entrepreneur and, consequently, apply a *hands-on* approach, but they also participate in the strategic decision-making process of the firm (e.g., selection of the top management), reducing the control of the entrepreneur on its own business (Lerner, 1995). Business angels and venture capitalists reduce the information asymmetries with the firm that they are funding, but also apply strategies to diversify the risk that they are facing. As the failure of the funded business is not remote, they are used to diversifying their investment portfolio and, in some cases, to sharing the risk of the same firm with other risk capital investors to reduce potential adverse selection problems (i.e., syndicate) (Lerner, 1994).

Although these mechanisms proved to be highly effective, information opacity of SMEs can be so relevant that adverse selection problems cannot be solved. Two are the main alternatives: the fragmentation of the risk among a huge number of private investors through, for example, equity crowdfunding (Yasar, 2021) or the establishment of approaches providing publicly funded informed risk capital relying on the assumption that any innovation provides a societal return in addition to the private profits for the entrepreneur. The cascade funding piloted by the EC in H2020 actions is an example of this alternative way to sustain innovative ideas.

3. Cascade funding key elements and benefits

Cascade funding is a specific mechanism that facilitates the delivery of public funds to smaller organisations, which are innovating in the fields that are considered to be of high strategic importance by the EC. The target organisations are predominantly SMEs and mid-caps that focus on digitalisation that can benefit, via open calls for proposals of grants for an experiment between €50,000 and €150,000 (typically corresponding to 70% of the total experiment cost). The financial support is usually equity-free.

One of the key characteristics of this mechanism is a simplified administrative procedure. That makes the scheme more attractive to smaller organisations that are normally not capable of handling high overheads associated with the administrative workload of public-funded projects, such as those funded by H2020 or the Horizon Europe framework programmes. The simplification is generally done by EU-wide collaborations across the network of Digital Innovation Hubs (DIHs) (Volpe et al., 2021) on behalf of the EC. These Horizon funded projects are empowered to issue open calls for funding and consequently monitor and control the cascaded projects. The relationship is built between the funded third parties and the funding consortia, hence keeping the administrative aspect of the Horizon framework at an arm's length from the small organisations. As funding consortia aim to leverage created solutions to generate assets suitable for industrial application, the focus is placed on successfully formulating and implementing go-to-market strategies based on expressed customer needs (Volpe et al., 2021). Hence, the funding consortia often offer exclusive technical and/or business support to aid the development and speed up the industrialisation process. It is the benefits brought by this cooperation that are often more advantageous than the financial aspect of typical funding activities. The key support activities include:

- Facilitation of the submission process and supporting the third-party candidates to formulate their projects adequately, hence indirectly providing a form of training in proposal preparation.
- Provision of constructive feedback resulting from the selection process, hence adding value to the applicants in terms of potential improvements on a technical basis, but also in terms of proposal presentation.
- Technical support through the project implementation phase.
- Practical innovation management and business development training and support throughout the project implementation. The aim is to secure the sustainable success of the generated assets in the post-project phase, which ought to be the target for each applicant, as it is an added contribution towards the existence of the company.

In the whole process, the consortia also act as liability buffers between the small organisations and the EC, as they are accountable for the performance of the third-party projects.

The potential drawback of the mechanism is that the open calls are generally very competitive. Also, some of the consortia and associated open calls address a rather niche industrial sector or request usage of specific technology that is not necessarily familiar to the prospective applicants.

Considering the number of cascade funding consortia and the funded third-party projects, the mechanism is already relatively mature, with continual cyclic improvements in progress. A case study resulting from the DigiFed consortia is presented in the next section. Since 2014 cascade funding has provided small grants under the H2020 framework for more than €800 M.

4. DigiFed case study

DigFed – DIHs federation for large scale adoption of digital technologies by European SMEs is a concrete case of a cascade funding project financed under the H2020 programme and kicked off in January 2020. The project forms part of the Smart Anything Everywhere (SAE) initiative aimed at testing innovative tools to support start-ups, SMEs and midcaps in terms of digitisation while fostering cross-border open collaboration with the support of DIHs (European Commission, 2018). Specifically, in the framework of DigiFed, three innovation funding pathways have been implemented i.e., Application Experiment (AE), Generic Experiment (GE) and Digital Challenge (DC). Under all the 3 pathways, financial support is combined with technical expertise provided by the partnering research organisations (RTOs) of the DigiFed consortium, and innovation management and business support.

AE pathway has been the main instrument for DigiFed implementation, as well as possibly the most classical one as it aimed at financing the initial prototyping of Cyber-Physical Systems (CPS) with up to €55,000 per applicant (typically corresponding to 70% of the total experiment cost). This instrument foresaw two applicant types. The TWIN AE enables 2 SMEs to jointly propose a project, while SINGLE AEs enable a single SMEs to seek the support of a selected DigiFed technical partner whose competencies and facilities are made available to the AE beneficiary. In both cases, beyond the most innovative (in terms of scientific excellence and market potential) prototypes, DigiFed also includes a mandatory requirement to establish cross-border collaboration among the partners. DigiFed has successfully launched 3 Open Calls for proposals for AEs, selecting for funding 46 AEs which involved 71 companies located in 23 EU and associated states, for an overall investment of €3.6 M. At the time of writing this document, approximately a third of the AEs have been completed. The final monitoring interviews of the completed experiments have so far generated positive feedback from beneficiaries. In particular, the trade-off between limited funding and contained administrative burden (both in the application and implementation phases) was appreciated, as well as the possibility to collaborate with the atypical partners, either referring to the cross-border peer collaboration or to the opportunity to collaborate with DigiFed technical partners (otherwise difficultly reachable).

The other funding pathway, GE, fosters collaboration among SMEs, Mid-Caps and DigiFed partners (GE owner) around the definition of a specific technical topic of investigation, creating thematic collaborative communities (supported with a small budget for participation expenses) and leveraging European and regional funding, where possible. In this framework, the community members have direct access to the GE owner technical experts, share their requirements and use cases and contribute to the technology roadmap of a leading research centre. This instrument proved to be very effective in attracting the interest of SMEs, in particular on secure Internet of Things (IoT), digital asset management, energy-efficient smart LED lighting and IoT for agriculture, and enable collaboration among them and with the GE owner. Overall, the four DigiFed GEs account for 51 members in 15 member states and leverage €280,000 of regional co-funding.

Finally, the DC pathway involves directly a major large enterprise (DC owner) with an unsolved need (challenge) that requires tailored prototyping. Once defined in its technical terms, the challenges (three in total) are promoted to prospective SMEs to be solved. Unlike a hackathon, in this case, the applicants are selected primarily based on their competencies, expertise and experience, in order not to disclose publicly sensitive details about the technical need of the DC owner. Yet, once selected, the beneficiaries are requested to prototype a very concrete solution tailored to the needs and requirements specified by the DC owner, which serves as an early adopter and accelerator of innovation within the SME itself. In this scheme, SMEs get access

to funding for the development of the prototype (50% DigiFed investment-50% DC owner), to innovation support (provided by DigiFed partners) and to pilot sites and specific information provided by the DC owner.

5. Conclusion

Accessing innovation funding still poses several challenges, most of them related to the asymmetric information between SMEs and firms, which commonly results in the former having to pay a prime to access the needed funding. However, the EC is aware of the relevance of innovation as the main driver to address its key priorities, such as digitalisation and energy transition, and the significant role that SMEs and start-ups will have. At the same time, traditional funding schemes have proven to have several shortcomings when it comes to funding innovative SMEs and start-ups, as their requirements do not typically match the situation of smaller companies, often having little or no experience in the market and developing products and services with a high-risk component. Hence, many such organisations limit their innovation scope because of an inadequate level of financial support. In this framework, cascade funding complements other possibilities, not necessarily excluding other forms of funding. In particular, the reduced administrative complexity, ability to retain equity, low level of interference in key strategic decisions, and invaluable level of cooperation that would otherwise not be reachable make this funding mechanism an attractive proposition for many smaller organisations. Cooperation is what drives the implementation of the go-to-market strategies and has the potential to speed up access to the markets and deliver improved final assets that are more likely to generate sustainable impact. Hence, cascade funding is a viable and efficient alternative innovation funding option for SMEs and start-ups that should be considered for adoption when experiencing funding needs for the development of highly innovative solutions. The three DigiFed pathways previously presented (namely AE, GE and DC) provide different options for innovative SMEs and start-ups seeking funding. The advantages of three DigiFed's mechanisms are:

- AE: prototype and cross-border collaboration with not traditional partners (going beyond own comfort zone)
- GE: to offer low effort-high level networking opportunities among peers and with the experiment owner
- DC: to provide funding for risky prototyping (highly innovative but very specific to a single client) and an opportunity to kick-start collaboration with major companies.

To sum up, cascade funding is a feasible and efficient way for SMEs and start-ups to access funding, as the DigiFed case study has proven. As stated above, it entails numerous advantages that make it suitable and appealing for young, small and innovative firms while in parallel enhancing collaboration and mutual learning between European stakeholders.

References

Boccard N. 2001, 'Financing Start-ups: Advising Vs Competing', *CSEF Working Paper*, n. 64, Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy. Persistent link: https://EconPapers.repec.org/RePEc:sef:csefwp:64.

Bond, S., Elston, J.A., Mairesse, J., Mulkay, B. 2003, 'Financial factors and investment in Belgium, France, Germany, and the United Kingdom: a comparison using company panel data', The Review of Economics and Statistics, vol. 85, no. 1, 2003, pp. 153–65. JSTOR, http://www.jstor.org/stable/3211629. Accessed on 6 Jun. 2022.

Cavallini, S. 2002, 'Il finanziamento dell'innovazione e il ruolo del venture capital', *Faculty of Economics, University of the Eastern Piedmont.*

Coleman, S., Robb, A. 2012, 'Capital structure theory and new technology firms: is there a match', *Int. J. Manage. Res. Rev*. 35, pp. 106–120, DOI:10.1108/01409171211195143.

Cosh, A., Cumming, D., Hughes, A. 2009, 'Outside entrepreneurial capital', *Econ. J.* 119(540), pp. 1494–1533, DOI: 10.1111/j.1468-0297.2009.02270.x.

European Commission 2018, SAE *Smart Anything Everywhere, Digital Innovation Hubs, Accelerators for the Broad Digital Transformation of the European Industry*, available at https://smartanythingeverywhere.eu/wp-content/uploads/2020/07/SAE_BROCHURE_2018b-1.pdf.

European Commission 2019, 'Towards a climate-neutral Europe: EU invests over €10bn in innovative Technologies', *European Commission Press release*, available at https://ec.europa.eu/commission/presscorner/detail/es/IP_19_1381.

European Commission 2020, *Strategic Plan 2020-2024 – Research and Innovation,* Brussels.

EIC Accelerator Data Hub 2021, *Online database*, available at: https://sme.easme-web.eu/# (last access 06/06/2022).

Fazzari S. M., Hubbard R. G., Petersen B. C. 1988, 'Financing Constraints and Corporate Investments', *Brookings Papers on Economic Activity*, vol. 19, pp. 141-206.

Fried, V., Hisrich, R. 1994, 'Toward a Model of Venture Capital Investment Decision Making', *Financial Management*, 23:3, Autumn, pp. 28-37.

Gladden, M.E. 2019, 'Who Will Be the Members of Society 5.0? Towards an Anthropology of Technologically Posthumanized Future Societies', *Social Science*, vol. 8, pp. 148. https://doi.org/10.3390/socsci8050148.

Gompers, P. 1995, 'Optimal Investment, Monitoring and Staging of Venture Capital', *Journal of Finance*, 50:5, pp. 1461-1489.

Lerner, J. 1994, 'Venture Capital and the Decision to Go Public', *Journal of Financial Economics*, 34 (3), pp. 293-316.

Lerner, J. 1995, 'Venture Capitalist and the Oversight of Private Firms', *Journal of Finance*, 50:1, March, pp. 301-318.

Lerner, J., Nanda, R. 2020, 'Venture Capital's Role in Financing Innovation: What We Know and How Much We Still Need to Learn', *Journal of Economic Perspectives,* 34 (3): pp. 237-261.

Macher, G., Veledar, O. 2021, 'Balancing Exploration and Exploitation Through Open Innovation in the Automotive Domain – Focus on SMEs', vol 1442. *Springer*, Cham.

Mina, A., Lahr, H. 2018, 'The pecking order of innovation finance', *LEM Working Paper Series*, No. 2018/31, Scuola Superiore Sant'Anna, Laboratory of Economics and Management (LEM), Pisa.

Mina, A., Di Minin, A., Martelli I., Testa, G., Santoleri, P. 2021, 'Public funding of innovation: Exploring applications and allocations of the European SME Instrument', *Research Policy*, Volume 50, Issue 1.

Modigliani, F., Miller, M. H. 1958, 'The cost of capital, corporation finance and the theory of investment', *American Economic Review*, vol. 48, no. 3, pp. 261-97.

Myers, S., Majluf, N. S. 1984, 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics* 13 (2), pp. 187–221.

OECD 2018, *'Enhancing SME access to diversified financing instruments', SME Ministerial Conference, Mexico City*, available at https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-Ministerial-Conference-Plenary-Session-2.pdf.

Petrella, G. 2001, 'Sistemi Finanziari e Finanziamento delle Imprese Innovative: Profili Teorici ed Evidenze Empiriche dall'Europa', *Quaderni Ref.*, n. 4.

Rajan, R. 1992, 'Insiders and Outsiders: the Choice between Informed and Arm's-length Debt', *Journal of Finance*, 47, (4), pp. 1367-1400.

Schumpeter, J. A. 1934, *The Theory of Economic Development*, Oxford University Press, London.

Ueda, M. 2000, 'Bank Versus Venture Capital', Department of Economics and Business, Universitat Pompeu Fabra, Working Paper 522.

Volpe, M., Veledar O., Chartier I., Dor I., Ríos Silva F., Trilar J., Kiraly C., Gaffuri G., Hafner-Zimmermann S. 2021, *'Experimentation of Cross-Border Digital Innovation Hubs (DIHs) Cooperation and Impact on SME Services*', *PRO-VE 2021, IFIP Advances in Information and Communication Technology*, vol 629. Springer, Cham.

Yasar, B. 2021, 'The new investment landscape: Equity crowdfunding', *Central Bank Review*, Volume 21, Issue 1, 2021, pp. 1-16.

Wang, D., Schøtt, T. 2022, 'Coupling between financing and innovation in a startup: embedded in networks with investors and researchers', *International Entrepreneurship and Management Journal*, volume 18, pp. 327–347.

The Role of Crowdfunding in Delivering Entrepreneurship Within the Hospitality Sector: A Case Study Analysis

Kelly Wang and Kate Johnston
Dundalk Institute of Technology, Ireland
Kate.johnston@dkit.ie
kelly.wang@dkit.ie

Abstract: Over the last decade, crowdfunding, has emerged as a hugely disruptive force within the financial landscape worldwide. Crowdfunding, the process of raising relatively small sums of money from the crowd, via the internet, enables entrepreneurs, particularly at the innovative and new start-ups stage, to access much needed funding, overcoming a "funding gap". The growth of crowdfunding has been phenomenal. In 2019, an estimated €14 billion was crowdfunded worldwide (Statistia 2020) and the forecast is for the sector to grow to €30 billion by 2025 (Mordo Intelligence, 2020). Initially, crowdfunding gained prominence through funding creative and artistic projects, but over the last number of years, this appeal has spread across a diverse range of businesses and sectors (Bradford 2012 and Research and Markets 2022). In the wake of the 2007-2008 financial crisis and more recently the COVID-19 pandemic, crowdfunding offers entrepreneurs and businesses access to much needed seed funding, but also non-financial benefits in the form of market and product testing, media exposure and customer feedback. Crowdfunding is a relatively new domain for businesses in the hospitality sector. As noted by Belavin, Marinesi and Tsoukalas (2020), crowdfunding offers huge potential for the sector, who often face funding challenges thereby limiting new innovative start-ups, critical for the sector's long term viability. This case study examined how one entrepreneur in the hospitality sector, successfully crowdfunded an innovative business idea in the midst of the COVID-19 pandemic. The case traces the idea and the factors that shaped the decision to crowdfund. Additionally, the case examines the benefits and challenges involved in successfully crowdfunding the business idea and closes with the entrepreneur reflecting on the key learning from the experience. The contribution of this case study is twofold. Firstly, it serves to highlight the potential of crowdfunding as a funding source of enterprise development, particularly among new, innovative businesses. Secondly, it adds to the current debate, as noted by Belavin, Marinesi and Tsoukalas (2020), of the potential crowdfunding in fostering entrepreneurship and economic development within the hospitality sector.

Keywords: crowdfunding, entrepreneurship, hospitality sector, challenges and benefits

1. Introduction and research context

In October 2020, amidst the Covid-19 pandemic, the hospitality and wider tourism sector worldwide, suffered unprecedented losses. DigiTally, a new technology start-up business in the catering and hospitably sector successfully launched a crowdfunding campaign, raising over €285,000. The timing of the crowdfunding campaign could have been a disaster. Instead, the funding target was exceeded, resulting in the business securing vital seed capital.

Crowdfunding is a relatively new concept, the first incidence of modern crowdfunding occurred in 1997 (Hemer, 2011). However, in the wake of the 2008 financial crisis, crowdfunding has emerged as an important funding mechanism for entrepreneurs and businesses worldwide. According to Massolution (2013), the sector raised an estimated $5.1 billion in 2013. In 2015, the global crowdfunding market was valued at $34.2 billion. The most recent figure as reported by Technavio (2021), forecast that the crowdfunding market is expected to grow to $196.36 billion, equivalent to a CAGR of almost 15% in the next five years.

Crowdfunding involves using the internet or an online platform to raise money from a large, often diverse number of individuals to fund a business or a cause (Chan Parhankangas, Sahaym and Oo, 2020; Ivanovici, 2019). Post 2008, there has been a growth in crowdfunding platforms leading to a significant body of academic research on the subject. This research has documented the use of crowdfunding in overcoming the so called "funding gap" faced by entrepreneurs worldwide (Roggan, 2015; Estrin, Gozman and Khavul, 2018; and Ellman and Hurkens, 2019), particularly for new, high risk, innovative start-ups (Schwienbacher and Larralde, 2010 ; Belleflamme, Lambert and Schwienbacker, 2013; Baskerville and Cordery, 2014; and Sassoon and Duggal, 2015; Burger and Kleinert, 2020; Brown, Mason, Rowe and Mason, 2018). While providing seed funding, research also identifies non-financial benefits in terms of market validation (Zimmer, 2018). Through harnessing the 'crowd' (Clauss et al, 2018) and connecting with the 'public' (Petruzzelli et al, 2019), a crowdfunding campaign can identify product validation (Junge, Laursen and Nielsen, 2021), social proof (Wessel, Adam and Benlian, 2019) and generate presale options (Stofa and Soltes, 2021, Wang, Johnston and Caraher 2021) as well as building brand awareness through social media, news press, blogs and so on (Nevin, Gozman and Khavul, 2018).

However, crowdfunding is not without its challenges. Within the last ten years, there has been a proliferation of crowdfunding platforms available to entrepreneurs. Each platform containing certain conditions (Cruz, 2015; Estrin, gozman and Khavul, 2018, Saluzzo and Alegre, 2021) and studies cite challenges in terms of the time and work involved in launching and managing a successful campaign (Lim and Busenitz 2020 and Stanko and Henard 2017), managing the product offering (Song et al, 2020), developing the promotional videos and stories (Ferreira, Papaoikonomou, andTerceño, 2022) and engaging with the crowd (Junge, Laursen and Nielsen, 2021). There is also risks involved in crowdfunding; as 'an open call' (Belleflamme, Lambert and Schwienbacker, 2014; Delivorias, 2017) entrepreneurs face risks, in terms of disclosing sensitive and business details (Agrawal, Catalini and Goldfarb, 2013) leading to risks of imitation (Wang, Xu, Wu and Goh, 2022). For example, entrepreneurs often need to disclose information publicly on their products early on. This may increase the risk of product imitation (Cowden and Young 2021). Moreover, there is the relatively high failure rates in campaigning, with some studies citing failure rates as high as 75% (Bidaux 2018) in some campaigns.

While research into the potential of crowdfunding has been explored in various sectors (Research and Markets Report 2022), to date, the use of crowdfunding by entrepreneurs within the hospitality and tourism sector has not attracted considerable attention. As noted by Belavina (2020), COVID-19 had a devastating impact on the hospitality sector, with many independent businesses closing. As such, as noted by Belavin, Marinesi and Tsoukalas (2020), crowdfunding could offer the sector vital funding access, particularly, for innovative, start-ups, vital for ensuring entrepreneurship and economic growth within the sector.

In light of the above, this case study examines crowdfunding a highly innovative business idea in the hospitality and catering sector. The case is organised as follows. The case briefly reviews the rationale for adopting a case study approach and then examines the background to the business idea and the decision to crowdfund. The campaign is reviewed followed by an analysis of the key benefits and challenges involved. The case closes with the key learning and insights from the entrepreneur in terms of advice for other entrepreneurs in the sector.

2. Methodological approach

This study involves an exploratory case study, focusing on the launch of a successful crowdfunding campaign for a new technology start-up company. Case study research is a widely adopted approach within the social science research (Stake (1995, 2006); Green and Thorogood, (2009); Yin, (2014); Stewart (2014) and Kitsios (2022). Case study analysis offers researchers a unique approach in that it involves an in-depth and multi-dimensional analysis that relies on multiple sources of data and methods (Merriam, 2009; Stake, 2006; Yin, 2014). As noted by Crowe et al, (2011), the case study approach is particularly useful to employ "when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context" (p 1). As Baxter and Jack (2008) argue, the case study approach allows the researcher to explore the event "not through one lens but rather a variety of lens" (2008 p 544), thereby allowing for a deeper understanding of the phenomenon or event to be revealed.

For the purposes of this exploratory case study, the information was obtained from both primary and secondary sources. Consistent with Kitsios (2022), a series of semi-structured (formal) interviews, as well as unstructured (more informal) conversations, were conducted with the CEO of the company, Patrick McDermott. The CEO was interviewed several times during the research process. Theses interviews were conducted online via zoom. Further, additional information was collected from a range of sources including the crowdfunding platform and the company's social media pages and additional media and newspaper articles.

3. History of the company and the entrepreneur

Irish entrepreneur Patrick McDermott came up with the idea behind DigiTally in 2016. Patrick spent two years developing the idea which led to the company securing their first paying customer in 2018. Over the next few years, the company secured a growing number of Irish customers (approx. 100 customers in total). Encouraged by this early success, they decided to consider expansions into the larger and more lucrative UK and US market. This would require significant funding. In early 2020, amidst the global pandemic, DigiTally began looking at funding options and in late 2020, the company successfully launched their first crowdfunding campaign. The campaign target was €200,000. The campaign, which lasted four weeks, attracted considerable attention eventually raising over €285,000.

Originally from Co. Louth, Ireland, Patrick McDermott had worked in the hospitality and catering sectors since leaving second level education. Patrick spent his early career working in the hotels in Ireland before moving overseas and working as a restaurant manager on a number of international cruise ships. During this time, he became acutely aware of the problem in managing and controlling stock. Patrick recalls that at that stocktaking was a "paper and pen process" and relied on several people counting stock and "inputting data into an excel spreadsheet". The process, according to Patrick was "time consuming" and subject to "human error".

In 2004, he returned to Ireland where he met his future business partner, Artur Leonowicz. The two set up Stocktaking.ie, offering businesses, in the catering, hospitality and retail sectors, an outsourced service to manage stock levels and give owners "a more formal and correct method of valuing stock". The business was not an immediate success. Indeed, over the next 18 years, Stocktaking.ie continued to trade, but things were changing in the food and hospitality sectors. As Patrick recounts, working with customers in the fast moving consumer goods sector (such as convenience stores and forecourts) he noticed a shift towards fresh food offerings. Patrick recounts "businesses were taking out retail and putting in more fresh food, more deli, and more baked products". The two business partners sensed an opportunity and began looking at offering a stock solution that was more technology based. Up until this point, their business was a service based approach to managing stock. They realised that if the business was to expand, they would need to "expand through technology". In 2008, they began exploring the idea of developing a "technology based solution" . DigiTally was born.

4. Setting up DigiTally

Initially, the entrepreneurs began exploring the development of an App to manage and control stock. Arthur, who had a technology background, began the development of the App. At the same time, Patrick began focusing on the business side. According to Patrick, they had very little market knowledge. He recalls, "we had no idea who our customers were, what the market needed, what would be the best approach". However, initial field research, talking to business owners, they quickly realised "stock control was a huge problem for the whole hospitality sector". Patrick recounts that, 'the idea came from speaking with food retailers who had difficulty counting their stock partly because it had no barcodes". Talking to food businesses, they realised that the real benefit that customers were looking for was not the counting of stock but "the reports and the information generated". This feedback was crucial. The business idea shifted completely towards a "cloud based software platform for managing, tracking and analysing stocktaking". The platform would allow food businesses to complete stocktaking quicker and more accurately, resulting in improved gross profit margins and reduced food waste. He explains, the platform uses a "single dashboard" that allows a manager access to a "one stop platform, with the aid of an App to check stock". The benefit of DigiTally, is that multiple people can use the platform to count stock at the same time, using a mobile device. With information gathered in one place, it was easy for a manager to "identify, monitor and support stock effectively and accurately". As Patrick states, 'the real beauty of the system is the single dashboard that allows a manager to see exactly what's going on with stock at a glance'.

5. The funding dilemma and the decision to crowdfund

The challenge of securing funding for any business, particularly for new innovative or technology based businesses is well documented (Beaver and Prince, 2002 and Noelia and Rosalia, 2020). In Ireland, despite having a dynamic and supportive entrepreneurial culture, securing funding is still a major issue for Irish entrepreneurs and businesses. Research from the Central Bank of Ireland SME Market Report (2019) reported that the three main Irish banks controls over 90% of new lending to businesses and that interest rates on small loans in Ireland are on average 2.5% higher than similar size loans in Europe. The research also suggests that Irish SMEs are 50% less likely to apply for bank funding than their EU counterparts. While, enterprise support agencies, such as Local Enterprise Offices (LEOs) and Enterprise Ireland, (EI) the national agency for promoting "high potential start-ups", are increasingly pro-active in providing start-up funding in the form of grants and vouchers (such as innovation voucher, for example, which provide grant funding of €5000 at the start-up stage), the funding options offered to start-ups, particularly innovative businesses, with no prior trading history, means, traditional bank funding is not always an option. Other funding sources, such as venture capitalist (VCs) and business angels, typically associated with high growth seed funding, while increasingly available, are not always suitable (Hellman, 1998; Meena, Kumar, Meera Sailabala and DeiShow, 2018). For example, while VCs can provide seed funding to high potential, high risk businesses, this comes at a cost; in terms of considerable time and energy and loss of control for entrepreneurs (Harvard Business Review 2014).

Until this point, Patrick's experience of securing external funding was relatively limited. His first business was self-funded and had little or no starting capital, relying on internal and customer funding. His experience of securing external funding, was largely in the form of enterprise support grants. As Patrick recounts, in the early stages "we accessed local funding through the LEOs and Enterprise Ireland" in the form of capital grant assistance and employment grants. They had applied and received funding of €30,000 from the NDRC's programme in 2019. However, by 2020, the business needed a sizeable injection of funding to develop the DigiTally platform and to grow and launch internationally into the UK and the US market. Their initial market research indicated that there was significant opportunity for DigiTally in the US, with an estimated 1.2 million food businesses and a market valued at over €1 billion.

In early 2020, the entrepreneurs began exploring various funding options. Patrick recounts there were various options available to them, including venture capitalist and business angels. They began exploring the VC option, however, soon realised that this form of funding was problematic. In some cases, having "conversations with different investors", they realised that investors were either "not ready to invest" or in reality "were not in a rush to part with their money". They quickly made the decision that "he didn't want to go down that route" and began exploring Crowdfunding. In the New Frontier Enterprise Program, Patrick recalls that while VCs and business angel were mentioned, crowdfunding was "not really discussed". However, after some initial research, he soon realised that "this was the right way to go". According to Patrick, entrepreneurs and businesses "spend a lot of time and effort on raising funding. Time spent working on raising funds, is taking you away from growing the business". The appeal of crowdfunding was that it gave Patrick a specific timeframe to raise the money. According to Patrick, "we were looking to put all our efforts into raising funds, but we want to do it in a specific timeframe". The appeal of crowdfunding was that there was a clear "start and an end date".

6. Getting started

The crowdfunding market in Ireland is relatively small, although there are a growing number of platforms. These include, Fundit, a crowdfunding website for Irish creative projects, Kickstarter.ie. (which launched their Irish website in 2014) and Indiegogo, a global platform set up in 2008. Kickstarter and Indiegogo are among the most established and largest crowdfunding sites in the world. Kickstarter, for example launched in 2009, has raised more than $6.5 billion (€5.51 billion) to date with over 20 million investors. A relatively new platform, Spark Crowdfunding was established in 2018, is an equity crowdfunding platform (FORA, 2018) and is based in Dublin, Ireland. Faced with a range of crowdfunding platforms, the business opted for Spark Crowdfunding. The decision to go with SparkCrowdfunding was primarily based on the fact that this was their first campaign and they "wanted to keep the process as simple and as clean as possible". Moreover, Spark crowdfunding, according to Patrick, had "a proven track record", and although a relatively new platform, Patrick felt that it was better "to have a local platform". He recounts that "when you find someone in Dublin at the end of the day, that's handy".

7. Understanding and launching the campaign

A crowdfunding campaign has a number of core elements or stages– the prelaunch stage, the launch and the closing stage. The pre-launch and launch stage, ares considered critical to the success of the campaign, (Jovanovic, 2018; Horisch, 2019 and Dushnitsk and Fitza, 2018) and involves considerable effort and work. In the case of DigiTally, the campaign was officially launched in early October 2020 with a funding target of €200,000 of which the company was offering an equity stake of 11.76%. Table 1. below presents the key stages in the history of DigiTally and the key aspects of the campaign. The campaign was launched in early October 2020, in the midst of Covid-19 pandemic, when the hospitality sector in Ireland was effectively closed. The campaign lasted four weeks and ended on the 31st of October 2020, at which point the company exceeded its funding goal, raising €285,989.

Table 1: Details of the DigiTally Crowdfunding Campaign

Team size	Five staff: CEO Patrick McDermott
Trading history	Two years (2018-2020)
Customer base	Over 100 paying sites in Ireland
Awards	NDRC investor showcase winner, All Ireland Business "Excellence in Start-Up" award, finalist in Galway Chamber Best Emerging enterprise, listed as a Top 100 Hot Start-ups in Irish Times 2020
Growth	A 300% increase between 2019 to 2020
Key Value Proposition	Robust sales pipeline potential ; In-depth market knowledge with a strong management team ; market ready IT product, ready to scale /grow

Campaign Target	€200,000
Proposed	Grow staff and team and target UK and US food sector
Campaign Video	https://youtu.be/_OBISZ16AU4

8. Understanding the factors in launching a successful crowdfunding campaign

As noted above, research into success rates into crowdfunding indicates that failure rates are high. Research by Bidaux (2018) suggests that during the period 2015 -2016, failure rates for Kickstarter, the industry leader, were in the region of 75%. Failure rates for Indiegogo, the second largest crowdfunding platform, as of 2015, were significantly higher, (Zhao, Chen, Wang and Chen, 2017). Due to the high failure rates, a number of studies have sought to examine the factors behind the success or failure of crowdfunding campaign (Li, Jarvenpaa and Pattan 2016; Alvarez 2019; among others). This research points to a variety of factors, including the importance of finding the right platform (Paschen 2017), having a credible product (Song et al, 2020), developing a convincing promotional video and story (Ferreira, Papaoikonomou, and Terceño, 2022), entrepreneurship qualities (Lin and Pursiainen 2021), successfully engaging with the crowd (Junge, Laursen and Nielsen, 2022), and the effective use of social media (Sahaym, Datta, and Brooks, 2021). Indeed, the volume of time and effort required (Lim and Busenitz 2020 and Stanko and Henard 2017) and a failure to plan and manage the campaign (Sassoon and Duggal 2015) have been cited as critical. As noted by Sasson and Duggal, 'entrepreneurs considering the use of crowdfunding should be aware that it can constitute more than just raising funds, and that planning and managing a campaign requires considerable effort' (p.2).

9. Success factors in Crowdfunding Campaigns

By way of exploring the key factors behind the success of the crowdfunding campaign, Patrick identified a number of elements that he felt were really important. A summary of the benefits, challenges and key factors identified as crucial to the success of the campaign are summarised below in Table 2 and discussed in detail in the following section.

Table 2: Summary of key findings from the case study

The Business	Start-up Technology company in the catering/hospitality sector
Business Life Stage	Start-up – Growth stage
Perceived benefits of Crowdfunding	Time-efficient form of funding
Perceived challenges of crowdfunding	Limited/No prior knowledge of crowdfunding Volume of work involved in terms of energy, time and resources
Factors identified as critical to the success of the campaign	Planning and preparation at the pre-launch stage Harnessing the crowd /engaging with investors during launch stage Confidence and self-belief of entrepreneur Prior product and market validation

There are two key parts to a crowdfunding campaign and getting both right is essential. He makes the point that in terms of workload 60% of your time is in the pre-launch stage and 40% during the launch. Patrick states, that they spent "three months before the campaign pulling everything together and making sure everything was covered". Patrick acknowledges that this stage is quite straightforward but intensive. "Spark give you a list of what's needed and then you just work your way through the list and get it all ready. So that's quite simple". However, the pre-launch stage is intensive in terms of workload and involves making sure that the "financials are right, your route to market, your market validation, value proposition all have to be put together" Moreover, this is the stage where entrepreneurs develop the social media and video promotion material. Patrick recounts that "it was intensive, making the video, changing, tweaking and editing it for the upcoming launch".

The second stage – the launch stage was, according to Patrick, "where the real work began". According to Patrick, one of the key benefits of working with Spark Crowdfunding was that "they had the connections with the investors". As Patrick recounts,' Spark provided us with a vast community of investors'. However, he makes the point that equally important was conversing "with his network and using social media". Before and during the campaign Patrick went back to people he had spoken to years before and said, "remember me". He makes the point that "engaging with the crowd", engaging with investors and "using your network connections" is crucial. According to Patrick, from an investment perspective, one of the benefits of crowdfunding was that they could say "all the information is there (on the crowdfunding platform)".

The Third key element is self-confidence and market validation. Patrick acknowledges that his prior business experience meant he had "confidence in his own ability" plus a strong belief in the business offering. "We knew we have some very strong customers on board, and we validated our product". DigiTally had secured two major catering firms prior to the campaign. This market validation was hugely important in terms of attracting investors. He recounts one investor contacting him, and said "look if you can sell to those businesses, then you're well on the way". The investor, pledged €75,000.

10. Key Insights from the experience

Patrick makes the point that the public nature of crowdfunding is that "it is not for everyone". "If you're a little bit shy, don't use crowdfunding. Angel or others might be better for you'. According to Patrick, "you gotta put yourself out there, you gotta hustle, you gotta talk to people".

One of the key insights Patrick was keen to stress was the amount of work involved in preparing and running a campaign. According to Patrick, 'Don't underestimate the amount of work it takes to put it together'. While Patrick acknowledged that the process was relatively straightforward, "there is a significant amount of work and energy in putting a campaign together".

Looking back on the experience, Patrick was overwhelmingly in favour yet realistic about crowdfunding. From his perspective the appeal of crowdfunding is that "it is convenient". Unlike bank and VCs funding, raising funding through crowdfunding is much more 'immediate' and 'timely'. As he stated, 'I get to decide when to raise the funding and how much I want to get'.

11. Conclusion and discussion

Using an exploratory case study, this paper examines the experience of a new technology company in the catering/hospitably sector crowdfunding in 2020. Consistent with prior research, this study supports crowdfunding as an important source of capital for innovative start-ups (Baskerville and Cordery, 2014; and Sassoon and Duggal, 2015) but reveals that one of the benefits of crowdfunding is as an efficient funding source. In terms of challenges, the study concurs with the literature in terms of work involved (Lim and Busenitz 2020, Papaoikonomou, andTerceño, 2022) and the importance of managing the crowd (Junge, Laursen and Nielsen, 2021) and the entrepreneur (Lin and Pursiainen 2021). However, the study indicates that having prior product validatation is important in the campaign success. In terms of practical insights from this study, the paper makes two contributions. Firstly, it provides further insights into how entrepreneurs can launch a successful crowding campaign. Secondly, in the context of Belavin, Marinesi and Tsoukalas (2020), it is hoped that this study will help broaden the appeal of crowdfunding for start-ups in the hospitality but also other sectors.

A limitation of this paper is that it is based on the experience of one entrepreneur so the results cannot be generalised. Hence, a multi-case analysis involving several crowdfunding campaigns would provide important insights in this regard. Moreover, employing quantitative analysis using a larger data set would be an interesting avenue for future research to explore the impact of these factors on the decision and success of a crowdfunding campaign.

References

Agrawal, A., Catalini, C. and Goldfarb, A. (2015) "Crowdfunding: geography, social networks, and the timing of investment decision", Journal of Economics & Management Strategy, Vol 24, No. 2, pp 253-274.

Arroyo, J., Corea, F., Jimenez-Diaz, G. and Recio-Garcia, J.A. (2019) "Assessment of Machine Learning Performance for Decision Support in Venture Capital Investments", in IEEE Access, Vol 7, pp 124233-124243.

Arundale, K. and Masson, C. (2020) "Private equity and venture capital: riding the COVID-19 crisis". In: Billio, M. and Varotto, S. (eds.) A New World Post COVID-19: Lessons for Business, the Finance Industry and Policy Makers. Edizioni Ca' Foscari- Digital Publisher: Venice, pp 193-204.

Baxer, P. and Jack, S. (2008) "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers", The Qualitative Report, Vol 13, No. 4, pp 544-559.

Baskerville, R. and Cordery, C. (2014) "Crowdfunding: A Threat or Opportunity for University Research Funding?", [Online], SSRN,www.ssrn.com/abstract=2458638.

Beaver, G. and Prince, C. (2002) "Innovation, entrepreneurship and competitive advantage in the entrepreneurial venture", Journal of Small and Enterprise Development, Vol 9, No. 1, pp. 28-37.

Belavina, E. (2020) "Crowdfunding for Hospitality Ventures", [Online], Cornell University, www.ecommons.cornell.edu/haqndle/1813/70209.

Belavina, E., Marinesi, S. and Tsoukalas, G. (2020) "Rethinking Crowdfunding Platform Design: Mechanisms to Deter Misconduct and Improve Efficiency", Managemenr Science, Vol 66, No.11, pp 4921-5484.

Belleflamme, P., Lambert, T. and Schwienbacher, A. (2014) "Crowdfunding: Tapping the right crowd", Journal of Business Venturing, Vol 29, No.5, pp 585-609.

Bidauz, T. (2018) "Games and Crowdfunding in 2018", [Online], www.gamastutra.com/blogs/thomasBidau/20190115/334360/Games_and_crowdfunding_in-2018.php.

Bradford, C.S. (2012) "Crowdfunding and Federal Securities Laws", [Online], University of Nebraska, www.digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1118&context=lawfacpub.

Brown, R., Mawson, S., Rowe, A. and Mason, C. (2018) "Working the crowd: Improvisational entrepreneurship and equity crowdfunding in nascent entrepreneurial ventures", International Small Business Journal, Vol 36, No.2, pp 169-193.

Bürger, T. and Kleinert, S. (2020) "Crowdfunding cultural and commercial entrepreneurs:an empirical study on motivation in distinet backer communities", Small Business Economics, Vol 57, pp 667-683.

Chan, C. R., Parhankangas, A., Sahaym, A. and Oo, P. (2020) "Bellwether and the herd? Unpacking the u-shaped relationship between prior funding and subsequent contributions in reward-based crowdfunding", Journal of Business Venturing, Vol 35, No. 2, pp 1-24.

Clauss, T., Breitenecker, R.J., Kraus, S. and Brem, A. (2018) "Directing the wisdom of the crowd: the importance of social interaction among founders and the crowd during crowdfunding campaigns", Economics of Innovation and New Technology, Vol 27, No. 8.

Cowden, B. J. and Young, S. L. (2020) "The copycat conundrum: The double-edged sword of crowdfunding", Business Horizons, Vol 63, No. 4, pp 541-551.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A. and Sheikh, A. (2011) "The case study approach", BMC Medical Research Methodology, Vol 11, Artical 100.

Cruz, J. V. d. (2015) "Competition and Regulation of Crowdfunding Platforms: a Two-sided Market", Communications & Strategies, Vol 99,pp 33-50.

Delivorias, A. (2017) "Crowdfunding in Europe Introduction and State of Play",[Online], Policy Commons, www.policycommons.net/artifacts/2060002/crowdfunding-in-europe/2813093/.

Dushnitsky, G. and Fitza, M. A. (2018) "Are we missing the platforms for the crowd? Comparing investment drivers across multiple crowdfunding platforms" Journal of Business Venturing Insights, Vol 10, pp 1-10.

Efrat, K. and Gilboa, S. (2019) "Relationship approach to crowdfunding: how creators and supporters interaction enhances projects' success", Electronic Markets, Vol30, pp 899-911.

Ellman, M. and Hurkens, S. (2019) "Optimal crowdfunding design", Journal of Economic Theory, Vol 184.

Estrin, S., Gozman, D. and Khavul, S. (2018) "The Evolution and Adoption of Equity Crowdfunding: Entrepreneur and Investor Entry Into A New Market", Small Business Economics, Vol 51, pp 425-439.

Ferreira, V., Papaoikonomou, E. and Terceño, A. (2022) "Unpeel the layers of trust! A comparative analysis of crowdfunding platforms and what they do to generate trust", Business Horizons, Vol 65, No. 1, pp 7-19.

FORA (2018) "Ireland its first equity crowdfunding platform for startups", [Online], www.fora.ie/spark-crowdfunding-ireland-4158959-Aug2018.

Gelfond, S.H. and Foti, A.D. (2012) "US$500 and a click: investing the "crowdfunding" way", Journal of Investment Compliance, Vol 13, No. 4, pp 9-13.

Green, J. and Thorogood, N. (2009) Qualitative Methods for Health Research, Sage, Los Angeles.

Hellman, T. (1998), "The Allocation of Control Rights in Venture Capital Contracts", The RAND Journal of Economics, Vol. 29, No. 1, pp 57-76.

Hemer, J. (2011) "A Snapshot on Crowdfunding", [Online], Econster, www.hdl.handle.net/10419/52302.

Horisch, J. (2019), "Take the money and run? Implementation and disclosure of environmentally-oriented crowdfunding projects", Journal of Cleaner Production, Vol 223, pp 127-135.

Ivanovici, M. F. (2019) "Filmmaking and Crowdfunding: A Right Match?", Sustainability, Vol 11, No. 3, Article 799.

Junge, L. B., Laursen, I. C. and Nielsen, K. R. (2022) "Choosing crowdfunding: Why do entrepreneurs choose to engage in crowdfunding?", Technovation, Vol 111.

Jovanovic, T. (2019) "Crowdfunding: what do we know so far?", International Journal of Innovation and Technology Management, Vol 16, No. 1.

Kitsios, F., Kyriakopoulou, M. and Kamariotou, M. (2022) "Exploring Business Strategy Modelling with ArchiMate: A Case Study Approach", Information, Vol 13, No. 31.

Lee, C.H. and Chiravuri, A. (2019), "Dealing with initial success versus failure in crowdfunding market: Serial crowdfunding, changing strategies, and funding performance", Internet Research, Vol 29, No. 5, pp 1190-1212.

Li, Z., Jarvenpaa, S. L. and Pattan, N. (2016), "Cinetics: Fueling Entrepreneurial Innovations through Crowdfunding", The Journal of Information Technology Teaching Cases, Vol. 6, No. 2, pp 75-83.

Lim, J.Y.K. and Busenitz, L. W. (2020) "Evolving human capital of entrepreneurs in an equity crowdfunding era", Journal of Small Business Management, Vol 58, No.1, pp 106-129.

Lin, T.C. and Pursiainen, V. (2021) "The round number heuristic and entrepreneur crowdfunding performance", Journal of Corporate Finance, Vol 68.

Lin, Z., Jarvenpaa, S. L. and Pattan, N. (2016) "Cinetics: Fueling Entrepreneurial Innovations through Crowdfunding", The Journal of Information Technology Teaching Cases , Vol 6, No. 2, pp 75-83.

Massolution (2013) The Crowdfunding Industry Report.

Meinshausen, S., Schiereck, D., and Stimeier, S. (2012) "Crowdfunding als Finanzierungsalternative-Innovative Ansa¨tze in der Unternehmensfinanzierung", [Online], www.ideas.repec.org/p/dar/wpaper/59836.html.

Merriam, S. B. (2009) Qualitative research: A guide to design and implementation, Jossey-Bass, San Francisco.

Mochkabadi, K. and Volkmann, C. K. (2020) "Equity crowdfunding: a systematic review of the literature", Small Business Economics, Vol 54, pp 75-118.

Mordor Intelligence, 2020. CROWDFUNDING MARKET - GROWTH, TRENDS, AND FORECASTS (2020-2025, [Online], www.mordorintelligence.com/industry-reports/crowdfunding-market.

Moritz, A., Block, J. and Lutz, E. (2015) "Investor communication in equity-based crowdfunding: a qualitative-empirical study", Qualitative Research in Financial Markets, Vol 7, No. 3, pp 309-342.

Nevin, S.,Gleasure, R.,O'Reilly, P.,Li, S. and Christoforo, J. (2018) "Jumping the Fence: How Consumer Sentiment on Social Media Changes after Crowdfunding", paper read at ECSM 5th European Conference on Social Media, 2018.

Noelia, F. L. and Rosalia, D. C. (2020) " A dynamic analysis of the role of entrepreneurial ecosystems in reducing innovation obstacles for startups", Journal of Business Venturing Insights, Vol 14.

Paschen, J. (2017) "Choose wisely: Crowdfunding through the stages of the startup life cycle'', Business Horizons, Vol 60, No. 2, pp 179-188.

Petruzzelli, A. M., Natalicchio, A., Panniello, U. and Roma, P. (2019) "Understanding the crowdfunding phenomenon and its implications for sustainability", Technological Forecasting and Social Change, Vol141, pp 138-148.

Research and Markets (2022) "Global Crowdfunding Market (2022 to2027)-Industry Trends, share, Size, Growth, Opportunity and Forecasts", [Online], www.globenewswire.com/en/news-release/2022/04/08/2419116/28124/en/Global-Crowdfunding-Market-2022-to-2027-Industry-Trends-Share-Size-Growth-Opportunity-and-Forecasts.html.

Roggan, J. (2015) "Motivation of German Entrepreneurs to Seek Equity via Crowdfunding: An Exploratory Study", [Online], FGV, www.bibliotecadigital.fgv.br/dspace/handle/10438/13623.

Rossi, M. (2014) "The new ways to raise capital: an exploratory study of crowdfunding", International Journal of Financial Research, Vol 5, No. 2.

Sahaym, A., Datta, A. and Brooks, S. (2021) "Crowdfunding success through social media: Going beyond entrepreneurial orientation in the context of small and medium-sized enterprises", Journal of Business Research, Vol 125, pp 483-494.

Saluzzo, F. M. and Alegre, I. (2021) "Supporting entrepreneurs: The role of third-party endorsement in crowdfunding platforms", Technological Forecasting and Social Change, Vol 162.

Sassoon, D. and Duggal, S. (2015) "Crowdfunding: Insights Into The Motives That Influence Entrepreneurs When Launching A Successful Campaign", [Online], Lund University, www.lup.lub.lu.se/luur/download?func=downloadFile&recordOId=7511194&fileOId=7511198.

Schwienbacher, A. and Larralde, B. (2010) "Crowdfunding of Small Entrepreneurial Ventures", [Online], SSRN, www.papers.ssrn.com/sol3/papers.cfm?abstract_id=1699183.

Song, C.,Luo, J.,Holtta-Otto, K.,Seering, W. and Otto, K. (2022) "Crowdfunding for Design Innovation: Prediction Model With Critical Factors", IEEE Transactions on Engineering Management , pp 1-12.

Stake, R. E. (2006) Multiple Case Study Analysis, Guilford, New York.

Stanko, M. A. and Henard, D. H. (2017) "Toward a better understanding of crowdfunding, openness and the consequences for innovation", Research Policy, Vol 46, No. 4, pp 784-798.

Statista, (2020) "Market size of crowdfunding worldwide 2019 and 2026", [Online], www.statista.com/statistics/1078273/global-crowdfunding-market-size/#StatisticContainer

Stewart, A. (2014) "Case study". Mill, J. and Birks, M., Qualitative methodology: A practical Guide, Thousand Oaks, CA: Sage, pp 145-159.

Stofa, T. and Solters, M. (2021) "Maximising the Chances of Success in Reward Crowdfunding", Finance a Uver; Prague, Vol 70, No. 1, pp 80-94.

The Central Bank of Ireland (2018) SME Market Report 2018, [Online], www.centralbank.ie/docs/default-source/publications/sme-market-reports/sme-market-report-2018.pdf?sfvrsn=6

Technavio (2021) Crowdfunding market by type and geography-Forecast and analysis 2021-2025, [Online], www.technavio.com/report/crowdfunding-market-industry-analysis

Wang, C., Johnston, K. and Caraher, M. (2021) "A Case Study into the Motivations, Challenges and Opportunities in Crowdfunding: An Entrepreneurial Perspective", International Journal of Management and Applied Research, Vol 8, No. 1, pp 1-17.

Wang, W., Xu, Y., Wu, Y. J. and Goh, M. (2022) "Linguistic understandability, signal observability, funding opportunities, and crowdfunding campaigns", Information & Management, Vol 59, No. 2.

Wessel, M., Adam, M. and Benlian, A. (2019) "The impact of sold-out early birds on option selection in reward-based crowdfunding", Decision Support Systems, Vol 117, pp 48-61.

Yin, R. K. (2014) Case study research: Design and methods, Saeg, Los Angeles.

Zhao, Q., Chen. C.D., Wang, J.L. and Chen, P.C. (2017) "Determinants of backers' funding intention in crowdfunding: social exchange theory and regulatory focus", Telematics and Informatics, Vol 34, No. 1, pp 370-384.

Zimmer, L. (2018) "Crowdfunding, is money just the tip of iceberg? Does the non-financial added value of crowdfunding create sustainable competitive advantage for entrepreneurs?", [Online], Dublin Business School, www.esource.dbs.ie/handle/10788/3512.

The use of Algorithm-Assisted Feeding for Innovation and Increased Productivity in Aquaculture

Knut Ingar Westeren[1], Morten Helbæk[2] and Øyvind Korsøen[3]
[1]Nord University, Faculty of Social Sciences, Levanger, Norway
[2]Nord University, Nord Business School, Levanger, Norway
[3]Bluegrove A/S, Norway
knut.i.westeren@nord.no
morten.helbak@nord.no
oyvind.korsoen@bluegrove.com

Abstract: The need for innovation in aquaculture has escalated in tandem with the use of advanced production equipment and high-level biological competence. A Norwegian company, NorseAqua A/S, produces sonar equipment that provides both images and data on how the salmon are distributed in the cage. The sonar data provides a basis for calculating algorithms between the depth of salmon in the cage and other key factors used to make decisions about how the salmon should be fed. The first aspect of the project was to investigate how the equipment was working and verify that the sonar data was readable. The second aspect was to analyze the relationships between important variables of significance for the feeding process of the salmon (including the sonar measurements). A third aspect was determining what understanding the feeding operators gained from the information produced. The results show that it is possible to develop algorithms based on the sonar data that improve feeding efficiency.

Keywords: aquaculture, artificial intelligence, sustainability, innovation

1. Introduction

There has been a rapid and significant development towards professionalism, advanced technology developments, and extending the knowledge base of Norwegian aquaculture over the past decade. In addition, it has been in the industry's self-interest to develop sustainable solutions due to the limited number of suitable locations along the coast. The sustainability arguments are specifically aimed at the requirements for fish health, escape safety, and improvement of feeding efficiency. From a nutritional perspective, it is desirable to increase in production based on FAO projections, FAO (2018; 2020; 2021). The Norwegian authorities, Nærings- og fiskeridepartementet (2015), along with industry experts, believe this may be possible under given conditions. To be achievable, the sustainability requirements must be met and this project focuses on more efficient utilization of the feed and thus reduced feed spill. The aquaculture producers also want to increase productivity and income by increasing feeding efficacy so that environmental and corporate interests are aligned. This has stimulated supplier companies like NorseAqua to develop products that can contribute to more efficient production.

NorseAqua produces sonar equipment that provides both images and data on how the salmon are distributed in the cage. The sonar data in turn provides a basis for calculating relationships (algorithms) between how deep the salmon swim in the cage and other key factors used to make decisions about how they should be fed. The first innovative aspect of the project was to check that the equipment was working and that the data streams from it were readable. The second was what relationships can be established between important environmental variables, feeding of the salmon, and the sonar measurements. A third aspect was what understanding was acquired by the feeding operators from the information produced. The most important innovative and competitive aspect NorseAqua has in this context, is the construction of the sonar itself and the software designed to turn the sonar measurements into readable data that can both be used to create images of the distribution of the salmon in the cages and to calculate numbers like average depth of the salmon in the cage.

The research questions for the project were formulated in the following way:

R1: How to develop new and innovative technologies based on hydroacoustics to reduce feed spill and what parameters should be selected to create algorithm-assisted feeding?
F2: How can algorithm-assisted feeding programs using hydroacoustic equipment be integrated in the firm's operations?

F3: How can equipment from NorseAqua contribute so salmon producers better can comply with the environmental restrictions and increase productivity?

2. Innovations in aquaculture and the hydroacoustic (sonar) project from NorseAqua

There have been many contributions to innovation research literature in aquaculture in recent years, and much of this has been summed up by Joffre et al (2017).

Joffre et al (2017) suggests that we analyze innovations in aquaculture based on the following categories:

- Technology driven
- Systemic
- Based on business needs

Our analysis shows that it is essential to look at how these three categories play together. The hydroacoustic project clearly has a technology-based starting point. The sensors and the software must be able to detect the salmon in the cage and produce readable data. The systemic perspective is related to the integration of the use of the results in the organization and how NorseAqua interacts in the supply chain. The business need revolves around how NorseAqua can contribute so salmon producers better can comply with the environmental restrictions and increase their productivity. The sonar results must therefore be integrated in the salmon producer's feeding programs to reduce the spill of feed. There is limited research literature on the use of hydroacoustic technologies for improving feeding operations in marine aquaculture. Bjordal et al (2020) and Winfield et al (2012) give an overview of different ways to use hydroacoustic techniques in salmon production. Orduna et al (2021) look at how hydroacoustic equipment can be used for monitoring and estimation of biomass in freshwater aquaculture. This is important because estimation of change in biomass as the fish grow is a weak link in the analysis of productivity in aquaculture. Føre et al (2017) use hydroacoustics to study tagged fish in salmon aquaculture. We see progress in using hydroacoustics in salmon production based on different approaches where most of them put emphasis on the integration of the three factors mentioned by Joffre et al (2017).

The need for innovations linked to environmental considerations has been a topic of focus for quite some time in the aquaculture sector, Corallo et al (2020), Galappaththi et al (2020) and Bartley (2022), and the reports from FAO (2018; 2020; 2021). Most of the projects mentioned above and the sonar equipment from NorseAqua in particular have an environmental and sustainability aspect and fit into the potential development of a positive solution to sustainability challenges. But they must be seen together with a large number of complementary innovative developments for more complete solutions.

3. The sonar equipment from NorseAqua

Sonars used by fishing boats have a well-known technology. To further develop the equipment for use in aquaculture it was necessary to produce new circuit boards to create new transponders. Unique and innovative aspects of the sonar equipment from NorseAqua are the circuit boards (hardware) and the new signal processing software. For NorseAqua's sonars they had to find a solution to the technologically advanced problem of surface detection. A common sonar discover easily when the signal reaches the bottom, but when we send sonar signals upwards, it needs a completely different technology for the system to detect the surface of the water. The research development over the last 20 years has, in principle, solved this technological problem. NorseAqua has put this technology into operating equipment both for the hardware and software so that we get detection of fish in all levels of the cages. This development has gone through several "generations". In the project we have used generation 4, called NA_G4. At the beginning of 2022 the company has reached NA_G6 and the system is now stable and reliable.

When the system is in operation, there are four sonar signals (beams), two sent downwards and two sent upwards, see Figure 1, from two sensors, one mounted at the top of the cage and one lower down in the cage. These signal flows are transformed into readable data, which can be turned into images displaying how the salmon are distributed in the cage. (The source of all information in figures and tables are project data, see Westeren (2022)). The data streams are in real time and a dataset/image is created every 12 seconds. This gives 7200 observations per hour and each observation set/image contains information about fish distribution, in depth meter intervals, for the site of Storskjeret from 1 – 25 meters. In total, this yields 180,000 observations per hour.

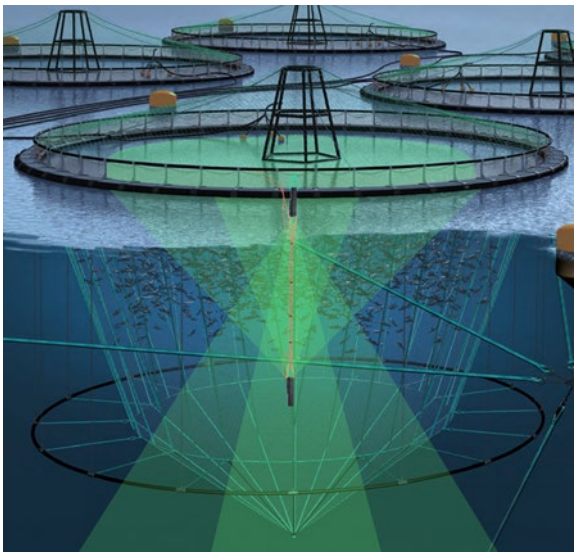




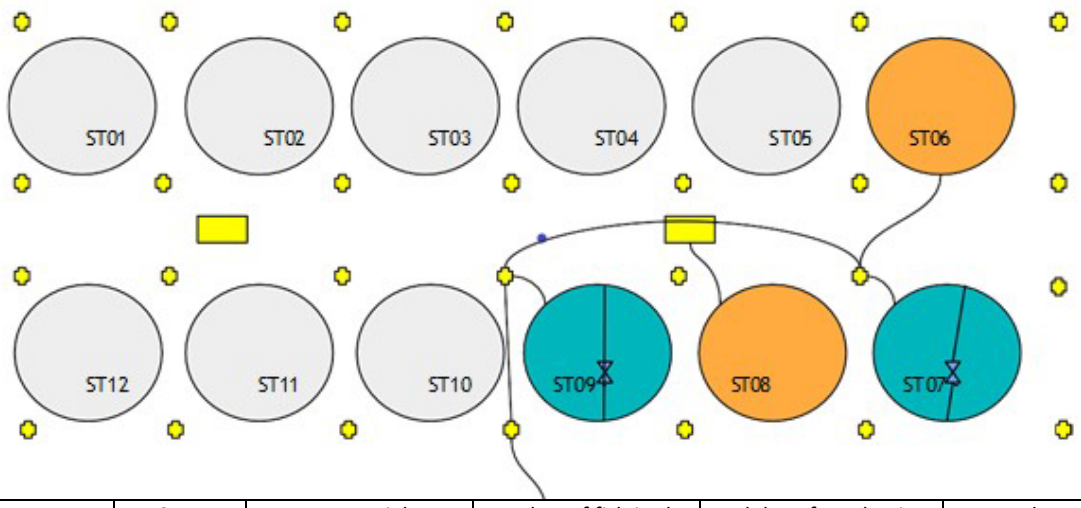
Figure 1: The sonars and their position in the cage

In the project we use the term algorithm-assisted feeding, which uses algorithms (software-based computational methods) computing at two levels:

- (1) The algorithms in the hydroacoustic equipment NA_G4 at the site Storskjeret.
- (2) The algorithms necessary to compress, adapt and compile data so that they become operational in connection with all other data.

4. Analysis of hydroacoustic data based on data from Storskjeret

Storskjeret is a salmon aquaculture production site belonging to the company Salmar A/S and it is located on the south side of Smøla in Mid-West Norway. It has 12 cages and the fish group we have analysed in this project is R-22.01.20-2. This group of fish was launched in Cage 9 and production took place in the period from 22.01.2020 to 27.04.2021. The key element of the research is that we have followed this fish group throughout the production cycle, see Figure 2. During the production cycle, the company also did additional tests of some characteristics of cages 6-8, but those are not reported in this project.



Fish group	Cage	Average weight at start (g)	Number of fish in the cage at start	End day of production	Number of production days
R-22.01.20-1	ST06	162,8	197 696	14.01.2021	358
R-22.01.20-4	ST07	177,6	196 342	21.04.2021	455
R-22.01.20-3	ST08	186,3	197 784	17.03.2021	420
R-22.01.20-2	ST09	163,8	197 757	27.04.2021	458

Figure 2: Data from Storskjeret

We received data from the sonars (hydroacoustic measurements) from 01.04.2020 to 22.01.2021. Due to interruptions in connection with delousing, we lack data for a few days (a total of 9 days) and for most of December 2020, but this has not had any influence on the results since we have large amounts of data from the production cycle. All the hydroacoustic data we received had date, hour, and minute identification. The first thing we did was to turn the data into hourly data. We collected data for each depth from 1 to 25 meters in the cage. To get comparable data we had to calculate the average depth for each hour, which was challenging.

In Figures 3 and 4 and in Table 1 we display data from the sonars for 30.09.2020 at 0:00 (Serie 1) and for 30.09.2020 at 1:00 a.m. (Serie 2), that is, midnight and an hour after at the end of September. As can be seen from Figure 3, indicator values (on the Y-axis) are given for how salmon are distributed in the cage (depth on the Y-axis). We must "normalize" the observations so that the area under the curve is = 1. The average depth then becomes the number of the X axis that divides the area under the curve into two equal parts. We created a computer program to do this. Furthermore, it is interesting to get a measure of the extent to which the fish are evenly distributed throughout the cage or whether the fish swim together around the average depth. We have calculated the standard deviation around the average as a measure of this. Large standard deviations tell us that the fish are distributed evenly across all depths, while small standard deviations say that most fish are around the average depth.

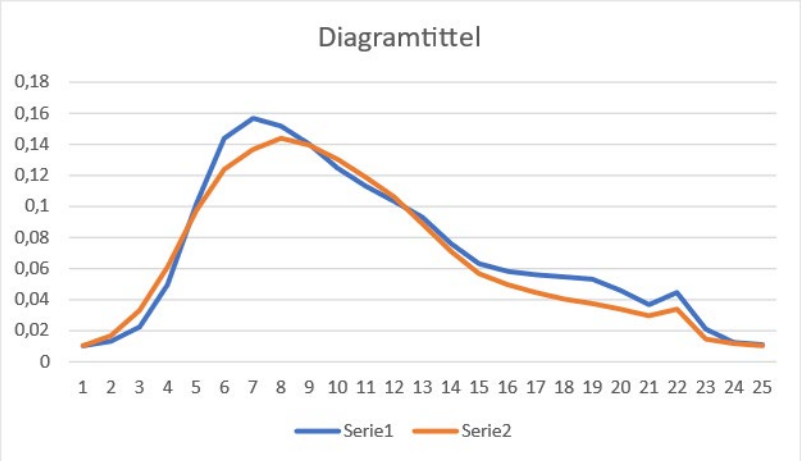


Figure 3: Acoustic data directly from the sonars, depth on the X-axis and indicator value on the Y-axis

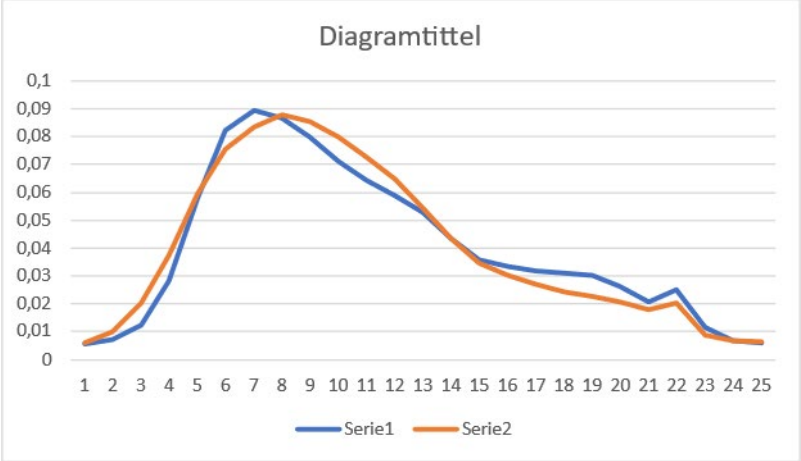


Figure 4: Acoustic data "normalized" so that the area under the curve =1

Table 1: Calculated values from the acoustics data for two hours

Time		Average Depth	Standard deviation of the observations
30.09.20 0:00	Serie 1	11,26175235	0,026608553
30.09.20 1:00	Serie 2	10,82282911	0,027627425

As can be seen from the example in Figure 4 and Table 1, the fish distribute a little deeper at midnight than one hour later, but the difference is very small. Because the depth distribution is very similar, the standard deviations are virtually identical.

In Figure 5, we see observations directly from the sonars every 12 seconds for October 26, 2020. This day the average depth of the salmon was about 7.5 meters. The sonar picture runs from 00:00, midnight to midnight. Feeding goes from approximately 08:00 to 10:30 and from 14:00 to 15:30 as can be seen from the pillars.

Figure 6 shows calculated hourly values for the period from 02.08.20 to 05.08.20. The hourly calculations compress the data, but the structure of salmon behavior is shown reasonably well. The general pattern of the salmon during the entire production period has some structural results, Westeren (2022). The salmon are deeper in the daytime than at nighttime and the variation in the depth of the salmon is greater in the first half of the production cycle than in the second which indicates that larger salmon have more stable behaviour than smaller salmon.

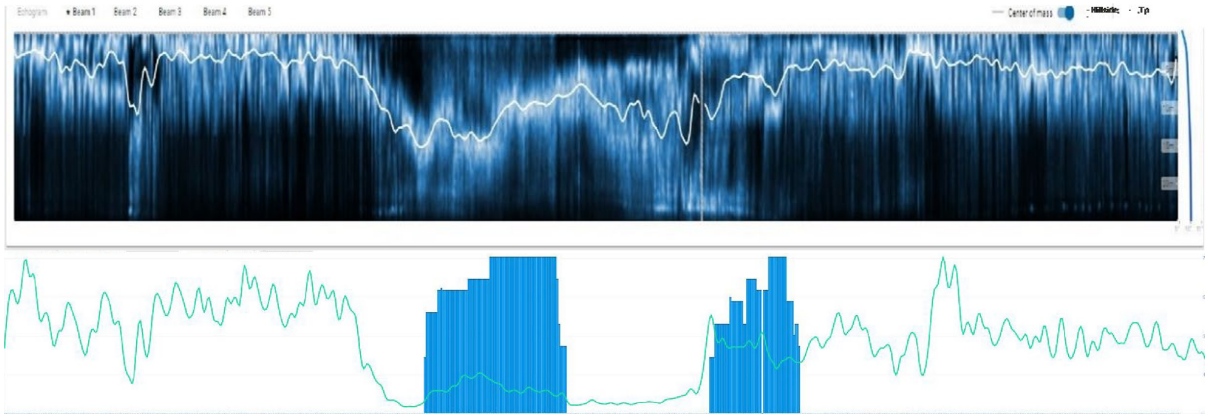


Figure 5: Observations within 24 hours with the bars in the lower part of the diagram representing the feeding periods. The line in the lower part of the chart is represents depth measurements of where the fish stand just below the feed spreader

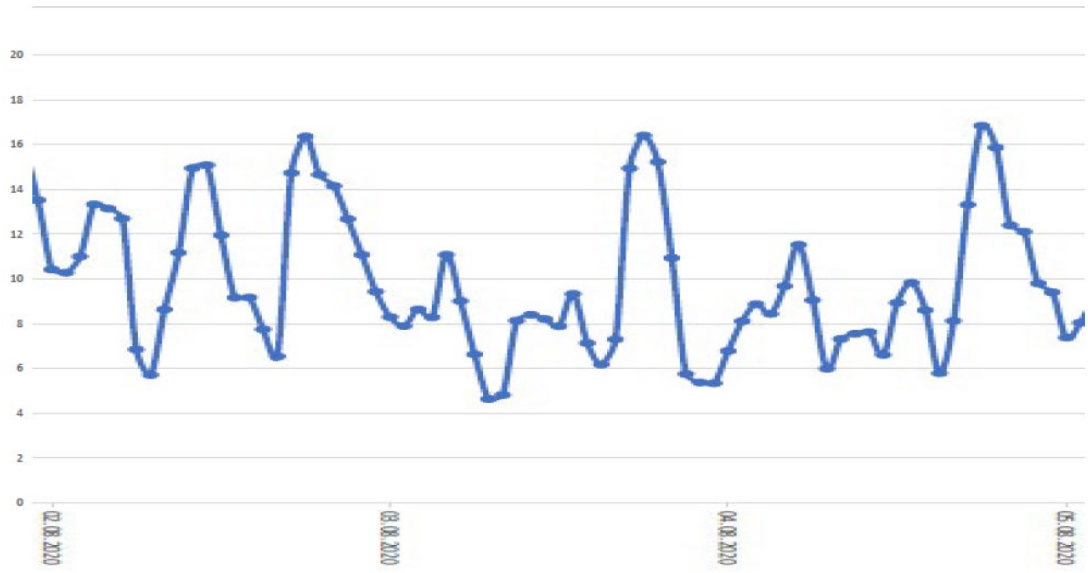


Figure 6: Depth distribution of the salmon in the cage from 02.08.2020 to 05.08.2020

5. Relationships between production data, environmental data, and depth measurements

More generally, growth of salmon is influenced by two main groups of factors, feeding and environmental factors, Aas et al (2019) and Handeland et al (2008). The calculations we will present in this section also support this. In our analysis we have identified the following groups of factors.

Environmental factors

Water temperature: Is measured by temperature inside the cage at the depth of 5 meters (Temp_5m), at a depth of 12 meters (Temp_12m), and outside the cage at a depth of 12 meters (Temp_raw_12m).

Oxygen saturation: Inside the cage at a depth of 5 meters (O2_5m [%]), at a depth of 12 meters (O2_12m[%]) and measured outside the cage at a depth of 12 meters (O2_raw_12m[%]).

Water salinity: Water salinity (ppt).

Current, measured in 2 ways: (1) Based on water tables about flood and spring, Tide1 and Tide2. (2) Water current velocity x (m/s) and Water current velocity y (m/s).

Light conditions: Here we have used observations at the cages. This variable shows how far down into the water (the sea) that light penetrates measured in meters: Sunlight penetration depth (m).

Feeding variables

We have information about feeding in kilograms per day: Feed tot/day.

Result variables

For the site of Storskjeret (including the cage we analysed), Salmar has data from a system called Optoscale that calculates the weight (biomass) of the fish on a 24-hour basis. From these observations, we have calculated how much the salmon grow from one day to the next - % weight gain. We have "smoothed" these observations to hourly results based on knowledge about how the fish grow during a 24-hour period, and this variable we have called: % weight smoothed.

The advantage of carrying out these "smoothing procedures" are obvious. We have observations from about 240 days. On an hourly basis that means about 240 X 24 = 5760 observations. For some variables, 24-hour variation is central – for light, temperature, oxygen saturation and acoustic measurements. This means that we must have hourly data for all variables to do a relevant analysis. If we look at the data quality for the different variables, it is the data on how salmon grow (biomass in kg) that is the weakest link.

A key objective of this project is to show what possible connections we can find between the different types of data. An important innovative aspect for NorseAqua is to be able to show customers what characteristics the acoustic data has and how it can be used in conjunction with other data to optimize the feeding process.

The regression calculations reported in Table 2 have "% weight smoothed" as dependent variable so we can analyze the factors that influence how salmon grow during the production period based on 4735 valid observations. The results we find are similar to others like Aas et al (2019) and Handeland et al (2008), namely that growth is explained by feeding and environmental factors. The variable based on the actual feeding, "feed interp" is significant with a high t-value. Environmental factors like "Water current velocity x (m/s)", "O2_5m [%]", "Sunlight penetration depth (m)", and "Water salinity (ppt)" are all significant with expected signs. We have also included the average depth at which the salmon stand, "Av_Depth", and this variable is also significant with the interpretation that the deeper the fish stand, the more they grow. This must be seen as a preliminary result. We have no similar research results to compare with, so this needs to be analysed in more detail.

Another interesting observation is that the variable "Av_Depth" also shows relationships with other variables when we look at the correlation matrix, see Westeren (2022). This indicates that this variable may well be part of a step-by-step, cause-and-effect chain. To find out more about this, we can use a model framework called SEM (Structural Equation Modelling). Another type of analysis we will proceed with is to examine daily and monthly variations. Salmon have distinct day and night behavioral pattern and we now have a new tool, depth distribution, we can use to better understand these patterns and create advice for more efficient feeding procedures.

Table 2: Regression calculations based on observations for the entire production period

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Regression	0,054	7	0,008	48,329	.000
Residual	0,752	4728	0,000		
Total	0,806	4735			
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	-0,002	0,005		-0,387	0,699
Water current velocity x (m/s)	0,010	0,001	0,110	7,495	0,000
Feed interp	1.602E-06	0,000	0,241	12,805	0,000
O2_5m [%]	0,000	0,000	0,181	9,956	0,000
Sunlight penetration depth (m)	0,000	0,000	0,063	4,118	0,000
Water salinity (dpi)	-0,001	0,000	-0,065	-4,428	0,000
Av_Depth	0,000	0,000	0,058	3,955	0,000
Dependent Variable: % weight smoothed					

6. Use and information exchange of sonar data by the feeding operators.

Salmar A/S has centralized feeding from a control center to several sites in Mid-West Norway, including Storskjeret. We have conducted interviews with two feeding operators responsible for the site at Storskjeret for the majority of the project duration. Due to Corona, the interviews took place by telephone.

For the interviews we had an interview guide with the following main points:

- Communication from the feeding responsible at Salmar to the supplier o
- f the equipment (NorseAqua)
- Communication from the feeding responsible to the company management and the site personnel
- How the sonar data was understood and utilized

The situation with Covid resulted in less visits from the supplier to the actual site than initially had been planned. Communication took place mainly through digital media and supplier and user of the equipment met on average once a week. This communication was mainly perceived as focus-based and directed at problem solving. The user was satisfied with the contact with the supplier because (mostly) all issues were resolved quickly.

From the internal company side, the interviews show that the information about average depth and distribution of the salmon in the cage was to a limited extent conveyed from the feed operator and upwards in the company's organization. The results from the system were discussed daily between feeding responsible and the operators at the site. Both the feeding operator and the site responsible at Storskjeret were positive about the system but wanted more "actionable" knowledge about the sonar measurements, feeding procedures, and environment data. Another important exploitation of the sonar system was to get information when the underwater cameras did not provide good enough images, for example when it was dark.

7. Discussion and conclusions

From innovation management, Tidd and Bessant (2020), we learn that the combination of resources (capital, knowledge, and organizational) is fundamental for an innovation to be successful. This is also true for the NorseAqua sonar equipment used at the Salmar site, Storskjeret. NorseAqua had managed to develop sonar equipment that could be placed under water and detect the surface, and send data streams that were transferred into readable data and usable images. NorseAqua was also able to create a system for data collection based on sonar observations and relevant environmental and feeding variables. The project showed a starting point for creating algorithm-assisted feeding. The technology was successful in two ways. It created data that could be integrated and tested together with other data about firm operations like feeding, environmental conditions and outcome of production. This gave new information about the salmons' behaviour during feeding periods, but also gave rise new questions for examination like more in depth testing of seasonal properties of the variables. Many of the important variables also have day/night variations and we have found some patterns from the hydroacoustic data that can be related to this. Here we need more work to be done, especially how stepwise causal chains can be detected.

The other technology and operational advance was that the feeding operators could study the distribution of the salmon in the cage during feeding periods. This was looked at as an addition to the information from the underwater cameras. The underwater cameras have until now been the main source of information about when to start and stop the feeding periods. Especially in winter time with reduced light the combination of cameras and depth images (like in Figure 5) improved the certainty of when to start and end feeding periods. Here we see a business application of the argument from Joffre et al (2017) that technology driven and systemic arguments for innovations are linked together.

Communication and knowledge transfers based on the hydroacoustic equipment took place during the study period without special problems, between NorseAqua and the salmon producer and within the salmon firm. It was clear that the feed operators were the group that gained the best experience with the system and they exchanged knowledge with the employees at the site, although to a lesser degree with management level. Communication with the supplier was perceived as satisfactory. If sonar data shall be utilized more thoroughly and integrated in feeding routines on a more permanent basis, the management level must be involved more directly. The larger future challenge of incorporating hydroacoustic data in feeding is, as earlier mentioned, to find out more about stepwise causal chains related to both day/night variations and seasonal variations.

References

Aas, T. S., Ytrestøyl, T. and Åsgård, T. (2019) "Utilization of feed resources in the production of Atlantic salmon (Salmo salar) in Norway: An update for 2016", *Aquaculture Reports,* 15, pp 1-10.

Bartley, D. (2022) *World Aquaculture 2020–A brief overview,* FAO, Rome.

Bjordal, Å., Juell, J., Lindem, T. and Fernö, A. (2020) "Hydroacoustic monitoring and feeding control in cage rearing of Atlantic salmon (Salmo salar L.)" pp 203-208, in *Fish Farming Technology*, CRC Press/Taylor & Francis, Abingdon.

Corallo, A., Latino, M. E., Menegoli, M. and Cataldo, M. (2020) "Business process modeling in aquaculture for environmental sustainability and fish traceability: A case study in Italian region", *Knowledge and Process Management,* 27(2), pp 150-156.

FAO (2018) *The future of food and agriculture—Alternative pathways to 2050,* FAO, Rome.

FAO (2020) *The State of World Fisheries and Aquaculture 2020 (Sustainability in Action),* FAO, Rome.

FAO (2021) *Strategic Framework 2022-2031. Documents C 2021/7,* FAO, Rome.

Føre, M., Frank, K., Dempster, T., Alfredsen, J. A. and Høy, E. (2017) "Biomonitoring using tagged sentinel fish and acoustic telemetry in commercial salmon aquaculture: a feasibility study", *Aquacultural Engineering,* 78, pp 163-172.

Galappaththi, E. K., Ichien, S. T., Hyman, A. A., Aubrac, C. J. and Ford, J. D. (2020) "Climate change adaptation in aquaculture", *Reviews in Aquaculture,* 12(4), pp 2160-2176.

Handeland, S. O., Imsland, A. K. and Stefansson, S. O. (2008) "The effect of temperature and fish size on growth, feed intake, food conversion efficiency and stomach evacuation rate of Atlantic salmon post-smolts", *Aquaculture,* 283(1-4), pp 36-42.

Joffre, O. M., Klerkx, L., Dickson, M. and Verdegem, M. (2017) "How is innovation in aquaculture conceptualized and managed? A systematic literature review and reflection framework to inform analysis and action", *Aquaculture,* 470, pp 129-148.

Nærings- og fiskeridepartementet (2015) *Meld. St. 16 (2014-2015) - Forutsigbar og miljømessig bærekraftig vekst i norsk lakse- og ørretoppdrett*, Nærings- og fiskeridepartementet, Oslo.

Orduna Martín, C., Encina, L., Rodríguez Ruiz, A. and Rodríguez Sánchez, V. (2021) Hydroacoustics for density and biomass estimations in aquaculture ponds, *Aquaculture,* 545, pp 1-11.

Tidd, J. and Bessant, J. R. (2020) *Managing innovation: integrating technological, market and organizational change,* John Wiley & Sons, Chicester.

Westeren, K. I. (2022) *Final report to RFF Nordland, Project 317973 (in Norwegian)*, Nord University, Bodø.

Winfield, I. J., Emmrich, M., Guillard, J., Mehner, T. and Rustadbakken, A. (2012) "Guidelines for standardisation of hydroacoustic methods", pp 186-188, In Schmidt-Kloiber et al (eds.) *Current questions in water management: book of abstracts to the WISER final conference, Tallinn, Estonia, 25-26 January 2012.*

Emerging Business Models for Circular Economy: A Systematic Literature Review

Tirufat Woldeyes, Moreno Muffatto and Francesco Ferrati
School of Entrepreneurship, Department of Industrial Engineering, University of Padova, Padova, Italy
tirufatdejene.woldeyes@phd.unipd.it
moreno.muffatto@unipd.it
francesco.ferrati@unipd.it

Abstract: Business models for circular economy keep products alive and operating for as long as possible during their use and consumption. Business model (BM) innovation in the circular economy (CE) helps firms design their BMs based on CE principles and identify new value-creation opportunities. Since research on the design of circular business models (CBM) is at an early stage, there is a lack of unified terminologies, and the meanings and relationships between the various CBM archetypes are unclear. This study aims to review and analyze existing emerging BMs in CE from peer-reviewed journals and recommend future research directions. The systematic review of 76 research articles resulted in identifying 23 CBM archetypes. This study analyzes the CBM archetypes based on descriptions, examples, similarities in the terminologies, and the frequency of use in the literature. The review identifies the three widely adopted CBM classification frameworks, the ReSOLVE framework (Ellen MacArthur Foundation), Accenture's CBM framework, and the CBM strategies by Bocken et al. Most of the studies in this review combine BMs derived from several classification approaches to categorize suitable BM archetypes for the CE, which illustrates the lack of comprehensive classifications. The key findings show that providing access to a product's functionality, recycling materials that would otherwise be sent to landfills, and restoring the functionality of existing products (re-manufacturing/refurbishing) are the most discussed archetypes in CBM literature, and other types do not get adequate attention. Future studies should examine BMs that have not received enough attention and provide a comprehensive classification of CBMs that clarifies their meaning and relationships. With this study, we contribute to advancing the body of knowledge in CBM and help practitioners in developing new CBMs.

Keywords: circular business model, business models, circular economy, business model innovation, classification

1. Introduction

The transition to the circular economy (CE) has generated interest because of increasing resource consumption and waste generation, as well as limited available natural resources. Efficient use and reuse of resources could reduce resource inputs, energy, emissions, and waste leakage; as a result, negative environmental effects would be reduced without compromising growth and prosperity while maintaining a better balance between the economic, environmental, and societal dimensions (Geissdoerfer et al., 2018b; Manninen et al., 2018). A circular economy helps to reduce waste generation and emission by maintaining components, parts, and products value to their maximum useful life and returning them to the product cycle at their end of life(EMF, 2013). Shifting from a linear economy to a CE model has environmental, social, and economic benefits (Bocken et al., 2016b; Lewandowski, 2016). There has been increased interest in CE among scholars, practitioners, and policymakers, as evidenced by an increase in related publications (Esposito et al., 2018; Urbinati et al., 2017).Innovative and disruptive business models (BMs) are needed to transform the linear economy into circular ones by replacing the existing model or taking advantage of new opportunities (Bocken et al., 2016a; Hopkinson et al., 2020; Linder et al., 2017). Different adaptations to transform a firm's BM through CE principles will affect the value creation and delivery(Bocken et al., 2016; Lüdeke-Freund et al., 2018; Planing, 2015).Furthermore, the literature on circular business models (CBM) is emerging (Lüdeke-Freund et al., 2018; Nußholz, 2017; Santa-Maria et al., 2021) in which many aspects need to be explored (Geissdoerfer et al., 2020). Scholars have offered conceptual definitions (Bocken et al., 2016a; Geissdoerfer et al., 2020; Nußholz, 2017), archetypes and taxonomies (Henry et al., 2020; Pieroni et al., 2020; Urbinati et al., 2017), product design strategies (Bocken et al., 2016a; de Kwant et al., 2021; Moreno et al., 2016) and have redefined the BM canvas by incorporating CE and sustainability (Antikainen, 2016; Lewandowski, 2016) and BM patterns (Lüdeke-Freund et al., 2018; Pieroni et al., 2021) towards value creation and capture. The literature of CE with a BM perspective has become popular, igniting a discussion among scholars and practitioners to further study the opportunities for creating, delivering, and capturing the value of a business while following CE principles (Diaz Lopez et al., 2019; Lüdeke-Freund et al., 2018; Nußholz, 2018). However, a unified understanding of the current state of knowledge remains elusive (Salvador et al., 2020) as there is a lack of studies that equates to the different perspectives. Due to the growing trend in scientific production, updating earlier works to include

the most recent contributions is necessary. Therefore, this study provides a systematic literature review of circular business models classification frameworks and archetypes. Section 2 presents the different classification approaches of BMs for the CE, and Section 3 offers an overview of the methodological steps used to draft and conduct the systematic literature review. Section 4 presents the results of our literature review, followed by concluding remarks and recommendations for future research in Section 5.

2. Theoretical background: Circular Business Models (CBMs)classification approaches

Based on the generally accepted definitions of the traditional BM given by Osterwalder (2010) as well as by Richardson (2008), scholars try to define CBMs in the same terms. Osterwalder (2010) describes a business model as "a rationale of how companies create, deliver, and capture value" Osterwalder (2010).While, Lüdeke-Freund et al. (2018), Nußholz (2017), and Oghazi et al. (2018) define CBMs as "the way an organization creates, delivers, and captures value by incorporating the principles of CE". Studies in CBM literature have used the BM canvas (Osterwalder, 2010) and the three core functions of a BM "value proposition, value creation and delivery, and value capture"(Richardson, 2008) to analyze CBMs and study all or parts of the BM building blocks. For example, to incorporate the sustainability and circularity evaluation of a BM and its sustainability impact at an ecosystem level, Antikainen and Valkokari (2016) try to redefine the BM canvas in terms of CE and sustainability while Nußholz (2017) incorporates circular strategies in to the BM canvas. In the literature, CBM studies have used different classification frameworks developed by practitioners (international organizations and consulting firms). In this study, we present the most commonly used classification approaches: the ReSOLVEframework (EMF 2015), CBM framework (Accenture 2014), CBM strategies (Bocken et al. 2016), business models for CE (BSI 2017), business models archetypes for a CE(ForumFortheFuture, 2018) and CBM scan (Van Renswoude et al., 2015).

2.1 ReSOLVE framework (Ellen MacArthur Foundation)

ReSOLVE is a framework developed by the Ellen MacArthur Foundation (EMF, 2015)under the principles of circularity which are translated into six actions. (i) *Regenerate* entails harnessing renewable energy and secondary materials and returning recovered biological resources to the biosphere. In other words, this goal incorporates reclaiming, retaining, and regenerating the health of an ecosystem.(ii) *Share* focuses on utilizing the under used capacity of products by sharing assets, reusing (second-hand) resources, and extending product life through maintenance, design for upgradability, and durability. (iii) *Optimize* efforts regards improving the performance or efficiency of products and eliminating waste in the manufacturing process and supply chain. (iv) *Loop*refers to retaining products or components in closed loops through re-manufacturing, recycling, anaerobic digestion of wastes, and biochemical extraction from organic wastes. (v) *Virtualize* focuses on delivering products virtually rather than physically. (vi) *Exchange* focuses on applying new technologies or choosing new products/services (EMF, 2015). Despite providing a comprehensive overview of the six CE-based actions, some categories merge two or more potentially distinct BMs. For instance, the action to share combines BMs such as sharing, product life extension, and product as a service. Furthermore, business models towards providing the access or performance of a product without having the ownership by the customers are not addressed.

2.2 Circular business model framework (Accenture)

By analyzing 120 business cases worldwide that generate resource productivity improvements, Accenture's framework classifies BMs according to their function within the CE and shows the product outcome of such a BM. Accenture (2014) presents five distinct types of CBMs and 11 sub-models: (a) *circular supply chain* that is based on the use of renewable energy, bio-based, or recyclable materials and the 'built to last' approach; (b) *sharing platforms* that encourage collaborative usage, access, or ownership models; (c) the *product as a service* model provides access to products or performance while maintaining product ownership; d) the *product life extension* model refers to extending the life cycle of a product through repairs, maintenance, upgrades, resale, and re-manufacturing; (e) the *resource recovery* model deals with recovering energy or resources from wastes or by-products (Accenture, 2014). Despite the five BMs presented by Accenture (2014), the classification does not address BMs related to improving product performance or efficiency and waste reduction such as narrowing the resource loop or optimization and BMs for delivering products virtually rather than physically, such as virtualization or dematerialization.

2.3 Circular Business Model strategies (Bocken et al.)

Bocken et al. (2016) present the typologies of BM innovations for the CE to slow, narrow, and close resource loops. The typology of slowing resource loops includes (a) *access and performance* models that focus on providing the ability or service to meet users' needs without requiring them to own the product physically, (b) *extending product value* involves circular practices of re-manufacturing or return programs towards exploiting the residual value of a product,(c) *classic long-life* models focus on providing long-lasting and repairable products, and(d) the *encourage sufficiency* model recommends that firms help consumers decrease their consumption by offering durable, upgradeable, serviceable, warrantable, and reparable products as well as by taking a non-consumerist approach(Bocken et al., 2016). In addition, the BM strategy towards closing resource loops comprises (e) *extending resource value* refers to the exploitation of a resource's residual value and (f) *industrial symbiosis* in which leftovers are utilized from one process as feedstock for another Bocken et al. (2016). This classification approach neglects discussing aspects such as circular inputs and collaborative consumption approaches even though it organizes BMs from a slowing and closing resource loops perspective. Aside from the elements presented, other scholars integrate BMs such as “intensifying” and “dematerializing” (Geissdoerfer et al., 2020) and “regenerating” and “informing”(Konietzko et al., 2020) into this approach to fill the gaps in this CBM classification.

2.4 Business models for circular economy (British Standard Institute)

The British Standard Institute (BSI, 2017) proposes potential BMs compatible with a CE in six groupings. (a) *Product as a service* is a BM that combines both products and services and uses results as a basis for innovation such as leasing and pay for success system. (b) *Sharing economy or collaborative consumption* focuses on enabling greater use of unused or under-used assets. (c) The *on-demand* model focuses on providing the product/service only when the customer requests it. (d) *Dematerialization* stresses replacing physical items with virtual ones. (e) The *product life extension* models focus on extending the life cycle of a product by designing it for durability, modularity, reuse, refurbishment, repair, and re-manufacture. (f) *Recovery of secondary materials* focuses on incentivizing customers to return used products as well as recovering and recycling secondary materials/by-products(BSI, 2017). This classification covers most CBMs, but it does not mention BMs that work towards circular inputs such as the use of the residual from one process as in input for other (i.e., industrial symbiosis), renewable energy, and bio-based and recyclable resources.

2.5 Business models archetypes for a circular economy (Forum for the Future)

Forum for the Future (ForumFortheFuture, 2018) conducted a study on fast-moving consumer goods and presented 10 BM archetypes for a CE in two categories. Five of the BMs are categorized as classic CBMs: (a) *closed loop* recycling focuses on using secondary materials as an input source; (b) *downcycling* takes materials and turns them into products of lower quality; (c) *upcycling* involves recycling used products into new ones with better quality; (d) i*ndustrial symbiosis* involves sharing services, utilities, and by-products between companies; and (e) c*ollection services* allow for the collection of old or used products (ForumFortheFuture, 2018). Five other enabling BMs are not circular by nature, but they can boost the circularity of other models: (f) product-service systems provide a solution rather than the actual product, (g) the l*ock-in* model encourages consumers to use a particular product or service regularly, (h) L*ocal loop* models focus on the closer and more beneficial cluster of industries, (i) the *modular design* divides products into smaller sections which can be utilized and replaced separately, and (j) p*ersonalization* creates opportunities for product personalization through data management (ForumFortheFuture, 2018). While this classification approach places a strong emphasis on recovery and recycling models, it does not consider circular practices that extend product life during the use phase, such as repairing, maintaining, re-manufacturing, upgrading, reusing, and redistributing.

2.6 Circular Business Model Scan (Van Renswoude et al.)

The CBM Scan(Van Renswoude et al., 2015) classifies BMs into six cycles and 19 CBMs based on the value flow. The cycles and related CBMs include the following: (i) short cycle contains the CBMs paying per service, repairing, reduction of waste, sharing platform, and progressive purchase;(ii) long cycle includes the performance based contracts, take back system, resale for next-life, and refurbishment BMs;(iii) pure circle includes the CBMs cradle-to-cradle and circular sourcing models;(iv) cascading categorized with upcycling, recycling and collaborative production BMs;(v) dematerialized services contains the shifting of physical products to virtual and rental models on subscription bases; and(vi) produce on-demand includes produce on

order, 3D printing, and customer voting(Van Renswoude et al., 2015). While this classification includes most CBMs, the models related to extending a product's life cycle such as modular design, upgrading, hybrid, or gap exploiter models, are missing. Furthermore, the models of 3D printing and take back management do not reflect a complete BMs they are production methods and enabling mechanisms. Based on the aforementioned information, the goal of this study is to investigate existing CBMs using a systematic literature review.

3. Methodology

The method we used for our study is a systematic literature review. The following research question examines the CBM classifications and identify gap: How are business models classified in a CE?

To perform this systematic literature review, we first identified relevant and adequate literature on the topic under consideration. We used Scopus and Web of Science for retrieving all relevant articles, andthe main keywords primarily used for the required publications in this area were “business model” and “circular economy."We reviewed the keywords of prominent authors to expand our search and find other variations in keywords. Furthermore, we used Vosviewer to support our keyword analysis, and three more keywords included “closed-loop,” “resource efficiency,” and “business strategy.” Although keywords such as "sustainability" and "sustainable development" are often used and have strong links, this study did not include these keywords because the scope is limited to CE and related activities. Keywords such as "waste management," "product-service systems," "re-manufacturing," and "industrial symbiosis" were also excluded to prevent biases of focusing on specific actions. For the inclusion criteria, articles had to focus on BM theory or CE or discuss the CBM as the major topic of the study. The document types included journal articles and reviews written in English. As shown in figure 1, step by step filtration was made and finally 76 articles were selected.

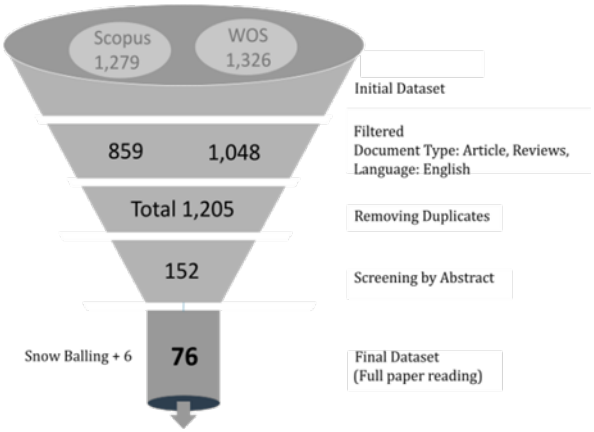


Figure 1: Articles retrieval and selection procedure

4. Circular business model archetypes

The number of articles on circular business models has increased since 2018 as demonestrated on figure 2. Since 84.4% of the reviewed works were published within the last four years, this proposition highlights the topic’s relevance in the literature. Furthermore, 32.95% of the articles are from the *Journal of Cleaner Production* and 22% are from the *Journal of Sustainability*. The study also identified 16 other journals with only one publication. Most of the papers (75.8%) were published by research institutes in Europe, and Sweden contributed the most (12.5%), followed by the UK (10%) and the Netherlands (10.8%). Most authors (43.3%) in this research are from Northern Europe (Sweden, Norway, and Denmark). As for the distribution of articles by research approachesas shown in figure 3, most papers from the sample are qualitative (79%), supported by case studies (50%) and exploratory analyses (51%).According to this systematic literature review, researchers used different CBM classification frameworks or approaches developed by practitioners. The CBM classification frameworks developed by EMF (2015), Accenture (2014), and Bocken et al. (2016) are the most widely used, as presented in Table 1. Since there is no clarity on the standard classification of CBMs (as presented in Section 2), most reviewed articles were found to use circular strategies or practices derived from different approaches to determine suitable BM archetypes for the CE. Moreover, other studies use waste hierarchy and R strategies (Bianchini et al., 2019; Bigliardi et al., 2021; Blomsma et al., 2019; Bocken et al., 2016b; Ranta et al., 2021).

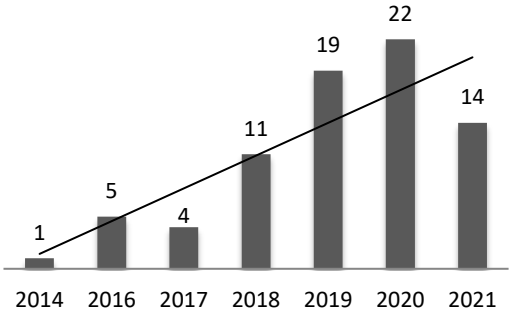


Figure 2: Distribution of articles over time

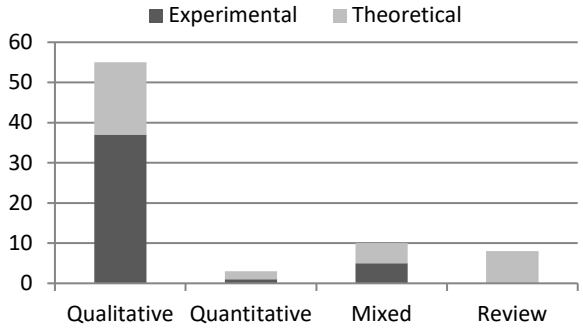


Figure 3: Distribution of articles by research approach

Table 1: BMs for CE classification approaches

Framework	CBMs	Sources	Observations
Approach I ReSOLVE framework Ellen MacArthur Foundation (2015)	Regenerate, Share, Optimise, Loop, Vertualise and Exchange	Ceptureanu et al. (2018); Heyes et al. (2018);Horvath et al. (2019); Lewandowski (2016); Manninen et al. (2018); Marke et al. (2020); Mendoza et al. (2017); Rosa et al. (2019)	Bases on V*alue flow* Merges sharing, product life extension, and PSS under *optimization BM* While PSS not sufficiently addressed
Approach II Accenture's BM framework Accenture (2014)	Circular Supplychain, Sharing platforms, Product as a service, Product life extension, and Resource Recovery	Chen (2020); Moreno et al. (2016); Guzzo et al. (2019); Pollard et al. (2021); Upadhyay et al. (2019); Vermunt et al. (2019); Whalen et al. (2020)	*Focuses on BMs function within the CE* Waste reduction, product efficiency improvement, and dematerializing BMs are not sufficiently addressed.
Approach III CBM strategies Bocken et al. (2016)	Slowing, Narrowing & Closing resource loop	Bocken et al. (2016); Bocken and Ritala (2021); Ertz et al. (2019); Geissdoerfer et al. (2018); Geissdoerfer et al. (2020); Guldmann et al. (2020)Han et al. (2020)Hansen (2020); Konietzko et al. (2020); Salvador et al. (2020)	BMs towards the use of circular inputs (bio-based and recyclable resources, renewable energy) and 'Resource sharing' models not sufficiently discussed.
Combined Approach CE Strategies from multiple approaches	CBMs compiled using different approaches	Brendzel-Skowera (2021); Centobelli et al. (2020); de Kwant et al. (2021); de Mattos et al. (2018); Diaz Lopez et al. (2019); Fehrer et al. (2021); Galvão et al. (2020); Henry et al. (2020); Hofmann (2019); Husain et al. (2021); Lüdeke-Freund et al. (2018);Karman (2020); Nußholz (2017); Pieroni et al. (2020); Planing (2018); (Salvador et al., 2021)	Most of the studies do not provide scientific procedures for their categorization and are not comprehensive.

Our primary objective is to investigate and present a complete and more organized breakdown of circular business model archetypes. To conduct a comparative analysis of classification approaches and to identify suitable BMs for CE in the literature, the study reviewed 76 journal and review articles. Through a detailed comparison analysis of CBM archetypes based on descriptions, examples, similarities in the terminologies, and the frequency of use in the literature, this study identifies 23 consolidated archetypes which are supported by descriptions, examples, and alternative terms as shown in the Table 2.

Table 2: CBM archetypes, alternative terms used, descriptions, case examples and the frequency of use in the reviewed literature

CBM Archetypes	Alternative Terms Used	Description	Example	#. Use
Access Model	Availability/Usage based services; Hire and leasing; Leasing/renting; Pay-per-service/use; Product as a Service; Product service system; Service instead of product; Servitization	Providing access to a product's functionality for a specific use or cycle through leasing, renting, or pooling while retaining the ownership.	Clothing rental and subscription - Vigga, Mud Jeans Heavy Machinery Rental - AMECO Compressed air as a service - Tamturbo	48
Recycling	Closed/Open-loop recycling; Upcycling or Downcycling; Extending resource value; Product recycling/Recycling 2.0; Resource Recovery; Cascades and Repurposing	Exploiting the residual value of materials considered to be waste through Recycling, Upcycling, Downcycling, or Biodegradation.	Playground from recycled athletic shoes - Nike Roofing felts into asphalt material - Tarpaper recycling Repurposing of containers to housing purposes - Mærsk	44
Repair and Maintenance	Product life extension	Extending product lifecycle through improved maintenance and repair services.	Condition-based maintenance service - ABB Free repairing service for jeans - Nudie Jeans, Patagonia	32
Remanufacturing/ Refurbishing	Reconditioning; Remaking; Product Transformation	Restoring product or part functionality to a “like new” or better performance through remanufacturing, refurbishing, or reconditioning.	Remanufacturing automotive parts - Renault; Bosch; Refurbishes and sell IT equipments - Refurb electronics - Gazelle, HP	31
Bio-/Secondary materials	Bio-based resources; Circular Supplies/sourcing; Closed-loop; Environmentally friendly material usage; Use of recycled materials; Renewable, Recyclable materials	Use of bio based or fully recyclable or renewable resource inputs that can be returned to the biological cycle.	Recycled fabrics in furniture production - Flokk, Pure Waste Circular Supplies for Packaging - Ecovative	28
Sharing or pooling systems/ platforms	Co-access; Co-ownership; Collaborative consumption; Pooling systems/models; Sharing economy; Sharing platform	Facilitate the sharing of under-utilized products through shared use, access or ownership.	Car sharing services - Zipcar, car2go, Blablacar Apartment sharing - airbnb Underused resources sharing platforms - Rheaply	27
Incentivized return	No alternative terms found	Incentivizing customers financially or in an alternative way to return used products	Clothing return initiatives - H&M, M&S’ Shwopping Used electronic gadgets - Gazelle	25
Collection/ Take back of used products	Collection services; Reverse logistics/Supply Chain; Take-back system	Facilitate sales, return or collection of used units of functional products or components	Take back cartridges for reuse or recycling: Lexmark Takes back reusable crates and pallets for reprocessing and reuse - Svenska Retursystem	18

CBM Archetypes	Alternative Terms Used	Description	Example	#. Use
Resource and energy efficiency	Cleaner production Eco-efficiency; Fewer resources; Optimize; Waste reduction	Reduce/minimize energy consumption and waste both in the production process and before.	No example found	18
Performance model	Deliver functionality than ownership; Functional sales; Product as a Service; Result-based models	Delivering product's performance or results rather than the product itself.	Pay per Lux - Philips Power by the Hour - Rolls Royce Pay per print - Xerox	17
Industrial Symbiosis	No alternative terms found	Process-oriented solution to use by products of one process as input to another process, taking advantage of geographical closeness.	Eco-Industrial Park - Kalundborg AB sugar and other sugar refiners	16
Dematerialized services	Dematerialization; Digitization;Software instead of hardware; Vertualise	A BM based on shifting physical activities and assets to digital/virtual services.	Online film and music services - Spotify, Netflix, Amazon	13
Upgrading	No alternative terms found	Extending the use cycle of a product by enhancing the performance or functionality through replacing modules or components with better quality ones.	Repurpose old furniture to new trends and workspace needs - Gispen; Phoneblocks Modular phone - Google Ara Project	13
Classic long life model	Build to last; Durable products; Lifetime products; Long-lasting; Product longevity	Delivering long lasting products through design for durability and reparability.	Phantom car - Rolls Royce; Washing machines - Miele; Luxury watches - Rolex or Patek Philippe	13
Renewable Energy	Circular supplies Regenerate	Use of renewable energy sources for products and components manufacturing and functioning.	Renewable electricity - Gabriel Holding AS	10
Encourage sufficiency	Demand reduction services; Slowing down consumption; Enable and incentivize users to consume less	Encourage customers to moderate consumption of products through warranties, upgradability, and maintenance services.	Premium, high service and quality brands - Patagonia and Vitsoe	10
Modular design and Design for x	Design for circularity Modularity	A design that divides products into smaller sections which can be utilized and replaced separately	Modularity into the design of smart phones - Fairphone	10
Product oriented PSS	Extended producer responsibility; Premium products with life extension services ; Provide an unconditional lifetime warranty;	Besides the product, this BM provides additional services (finance, consultancy, maintenance, take-back programs) during the use phase.	Life cycle care program for heavy machinery - Konecranes	8
Redistribute/ Reuse	Resell, Next-life sales; Second hand Direct reuse; Facilitated reuse;	Product resale to the second and third-hand market or reuse them with or without repairs or upgrades and provide them either free of charge or for sale	Reselling of used medical equipments - Agito Medical; Reuse of automotive components - Tata Motors; Godsinlösen	7
Energy recovery	Waste to energy Energy from waste	Recover energy out of waste materials	Unwanted biological material into sustainable biofuel - Celtic Renewable	7
Hybrid model	No alternative terms found	A BM relies on combination of durable product and short-lived consumables.	Printers and copiers - Océ Canon; Coffee machines and branded capsules - Nespresso	6
Gap-exploiter model	No alternative terms found	Exploit lifetime value gaps in company’s products or	Printer cartridges outlasting the ink they contain	5

CBM Archetypes	Alternative Terms Used	Description	Example	#. Use
		services.		
Produce on demand	Made to order	Producing only when its products or services are demanded	Furniture designs to order - Made	5

5. Discussion and conclusion

This systematic literature review explores the research context of business models in the circular economy. We identified the most commonly used CBM classification frameworks and archetypes adopted in the literature. These results offer valuable insights into the current understanding of BMs for circular economies. Since CBM research is still in its infancy, there is a lack of unified understandings and classifications. This review identifies the three most commonly adopted CBM classification frameworks: the ReSOLVE framework (Ellen MacArthur Foundation), Accenture's CBM framework, and the CBM strategies by Bocken et al. Most of the studies in this review combine BMs derived from several approaches to categorize CBMs, which illustrates the lack of comprehensive classifications. In most of the reviewed articles, identified CBM archetypes are not based on explicit criteria and detailed scientific methodologies to identify and systematize the circular strategies. Furthermore, the studies did not fully provide descriptions and related examples for each archetype.

This study conducted a systematic review on 76 scientific articles and identified 23 circular business model archetypes with descriptions and related examples to address the need for a complete and more organized classification of existing CBMs. This study highlights that most studies in the CBM literature concentrate on the three BM archetypes, the access model, recycling and re-manufacturing/refurbishing but, BMs related to product design (such as modular design, hybrid/gap-exploiter model, and the classic long life model), next-life sales, and product-oriented services are not addressed sufficiently. Future studies should focus on BMs that have received limited attention and should provide a comprehensive classification of CBMs that clarifies their meaning and relationships.

6. Acknowledgements

Funding

This work was supported by the CARIPARO Foundation, Padova, Italy.

References

*The full list of references can be obtained from the authors

Accenture. (2014). Circular Advantage Innovative Business Models Technologies Value Growth.

Bocken, de Pauw, I., Bakker, C., & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. Journal of Industrial and Production Engineering, 33(5), 308-320.

BSI. (2017). Framework for Implementing the Principles of the Circular Economy.

Centobelli, P., Cerchione, R., Chiaroni, D., Del Vecchio, P., & Urbinati, A. (2020). Designing business models in circular economy: A systematic literature review and research agenda. Business Strategy and the Environment, 29(4), 1734-1749.

Diaz Lopez, F. J., Bastein, T., & Tukker, A. (2019). Business Model Innovation for Resource-efficiency, Circularity and Cleaner Production: What 143 Cases Tell Us. Ecological Economics, 155, 20-35.

EMF. (2013). Towards the Circular Economy: Economic and Business Rational for an Accelerated Transition.

EMF. (2015). Towards A Circular Economy: Economic and Business Rational for an Accelerated Transition.

ForumFortheFuture. (2018). The Circular Economy Business Model Toolkit. Retrieved from https://www.forumforthefuture.org/the-circular-economy-business-model-toolkit

Geissdoerfer, M., Pieroni, M. P. P., Pigosso, D. C. A., & Soufani, K. (2020). Circular business models: A review. Journal of Cleaner Production, 277.

Guldmann, E., & Huulgaard, R. D. (2020). Barriers to circular business model innovation: A multiple-case study. Journal of Cleaner Production, 243.

Husain, Z., Maqbool, A., Haleem, A., Pathak, R. D., & Samson, D. (2021). Analyzing the business models for circular economy implementation: a fuzzy TOPSIS approach. Operations Management Research.

Konietzko, J., Bocken, N., & Hultink, E. J. (2020). A Tool to Analyze, Ideate and Develop Circular Innovation Ecosystems. Sustainability, 12(1).

Lewandowski, M. (2016). Designing the Business Models for Circular Economy—Towards the Conceptual Framework. Sustainability, 8(1).

Lüdeke-Freund, F., Gold, S., & Bocken, N. M. P. (2018). A Review and Typology of Circular Economy Business Model Patterns. Journal of Industrial Ecology, 23(1), 36-61.

Mendoza, J. M. F., Sharmina, M., Gallego-Schmid, A., Heyes, G., & Azapagic, A. (2017). Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. Journal of Industrial Ecology, 21(3), 526-544.

Moreno, M., De los Rios, C., Rowe, Z., & Charnley, F. (2016). A Conceptual Framework for Circular Design. Sustainability, 8(9).

Nußholz. (2017). Circular Business Models: Defining a Concept and Framing an Emerging Research Field. Sustainability, 9(10).

Oghazi, P., & Mostaghel, R. (2018). Circular Business Model Challenges and Lessons Learned—An Industrial Perspective. Sustainability, 10(3).

Osterwalder, P. a. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley.

Pieroni, M. P. P., McAloone, T. C., & Pigosso, D. C. A. (2020). From theory to practice: systematising and testing business model archetypes for circular economy. Resources, Conservation and Recycling, 162.

Planing, P. (2015). Business Model Innovation in a Circular: Economy Reasons for Non-Acceptance of Circular Business Models. JOURNAL OF BUSINESS MODEL INNOVATION.

Pollard, J., Osmani, M., Cole, C., Grubnic, S., & Colwill, J. (2021). A circular economy business model innovation process for the electrical and electronic equipment sector. Journal of Cleaner Production, 305.

Richardson, J. (2008). The business model: an integrative framework for strategy execution. Strategic Change, 17(5-6), 133-144.

Rosa, P., Sassanelli, C., & Terzi, S. (2019). Towards Circular Business Models: A systematic literature review on classification frameworks and archetypes. Journal of Cleaner Production, 236.

Salvador, R., Barros, M. V., Luz, L. M. d., Piekarski, C. M., & de Francisco, A. C. (2020). Circular business models: Current aspects that influence implementation and unaddressed subjects. Journal of Cleaner Production, 250.

Van Renswoude, Arthur ten Wolde, & Joustra, D. J. (2015). Circular Business Models – Part 1: An introduction to IMSA's circular business model scan.

Vermunt, D. A., Negro, S. O., Verweij, P. A., Kuppens, D. V., & Hekkert, M. P. (2019). Exploring barriers to implementing different circular business models. Journal of Cleaner Production, 222, 891-902.

Whalen, C. J., & Whalen, K. A. (2020). Circular Economy Business Models: A Critical Examination. Journal of Economic Issues, 54(3), 628-643.

The Impact of Organizational Culture on Business Innovativeness: The Case of SME's

Panagiota Xanthopoulou[1] and Alexandros Sahinidis[2]
[1]Department of Economics and Business, University of Neapolis, Pafos, Cyprus,
[2]Department of Business Administration, University of West Attica, Athens, Greece
p.xanthopoulou@nup.ac.cy
asahinidis@uniwa.gr

Abstract: The majority of studies in the '80s and '90s proposed that a strong culture is essential to the success of an organization. However, some researchers have since disputed this claim, arguing that while some strong cultures lead to success, others fail. Examining several examples from the market, over time, the so-called "case for a strong culture" presents significant weaknesses. The present study, based on the Competing Values Model, examines the effects of a culture's strength on the innovativeness of the organization. A sample of 110 Greek Small and Medium Enterprises (SMEs) was examined, of which a total of 504 people responded to a questionnaire. The participating companies range in size, in terms of the number of their staff, from 20 to 250 members, and come from different market segments. The results showed that organizational culture strength is inversely related to a company's innovativeness and that strong cultures have a negative impact on a company's innovativeness. The main objective of this research is to reinforce the existing knowledge in the relationship between culture and innovativeness, especially in the field of small and medium enterprises since the vast majority of studies concern culture comparisons between large companies using mainly small samples. The focus of this research is on the growing importance of culture given the globalization of the market, the increasing pace of mergers, acquisitions, and strategic alliances between companies with different cultures.

Keywords: SME's, organizational culture, strong culture, weak culture, innovativeness

1. Introduction

Organizational culture is one of the main determinants of the organizational success that induce employees to work and participate in knowledge acquisition, experience, and decision-making (Liu & Almor, 2016; Obeidat et al, 2018). The existence of an organizational culture among organization members motivates them and offers the ability to create and exchange information resulting in the improvement and development of their skills and experiences, enabling the cross-fertilization of ideas. Today's organizations need to be armed with a positive organizational culture and a high level of flexibility to achieve continuous improvement and quality, to create an encouraging positive environment which nurtures innovation. The present study is based on the Competing Values Model by Quinn & Rohrbaugh (1983), which is widely used both for measuring the strength of a culture and for diagnosing the type of organizational culture. The purpose of this study is to empirically examine the relationship between innovativeness and the strength of a culture. The focus of the research is on the growing importance of culture given the globalization of the market, the increasing rate of mergers, acquisitions and strategic alliances between companies with different cultures as well as the ever-increasing difficulty of companies to adapt to a changing environment. In the new global market, the relationships between the various parameters are changing, including the organizational culture and the innovativeness. For this reason, the results of the study are expected to have practical value both for business executives (contributing to the better management of their organizational culture, as it evolves over time) and for business consultants and for academic researchers. The absence of direct studies on innovativeness and culture in the organizational literature is conspicuous. The originality of the study lies in two points. The first point is the fact that the study examines the strength of culture and its impact on the innovativeness of an organization, which is rarely found in the relevant literature for SME's. Secondly, the sample used is also original as there are no corresponding studies for Greek small and medium enterprises (with a number of employees less than 250, according to the European Observatory for SME's, 2020). The focus of this paper is on the impact of organizational culture, on the innovativeness of a company. The findings are expected to provide a broader understanding of the concept of culture and its impact on the organization's ability to innovate. Equally important, however, is the contribution of the study to the further development of knowledge about the field of small and medium enterprises, which has not been adequately studied by the academic community despite its importance in the economies of all countries.

2. Literature review

2.1 Organizational culture

Although there are different perspectives over the meaning and definition of organizational culture, most of them refer to a set of guiding principles and values that will influence every behavior, action and working relationship (Carvalho et al, 2017; Arayesh et al, 2017; Massaras et al, 2014). The definition of organizational culture is a subject of long discussions, since it comes from various scientific fields. As a result, the term is used interchangeably with concepts such as the values and the environment of an organization, or, with norms of behavior and common values of a group of people. Serpa (2016) refers to organizational culture as "as the shared way of being, thinking and acting in a collective of coordinated people with reciprocal expectations" (p. 51). All of these are just aspects of culture or rather the different layers of culture and not the culture itself, according to Schein (1985). Schein (1985) believes that culture entails the deeper beliefs and assumptions, shared by the members of an organization that operate at an unconscious level. These beliefs and assumptions are created and maintained by the company's effort to survive in a hostile external environment and to solve the problems of creating and maintaining the organization. Organizational culture is also associated with trust, loyalty and participation through teamwork which helps managers to be nice and encourage employees to comply with the norms and traditions (Parent & Lovelace, 2018; Popoli, 2017). As a result, cultural elements have a strong influence on individual performance, which in turn contributes to the overall performance and helps employees achieve productivity and efficiency organizational goals (Tănase, 2015; Adeoye & Hope, 2020; Taye, Sang, & Muthanna, 2019). Furthermore, organizational culture is considered to be one of the critical success factors for the implementation and success of quality improvement programs (Carvalho et al, 2019; Samuel et al, 2017). Analyzing modern organizations without including their organizational cultures is difficult. It is obvious that culture is a complex concept, and there is no commonly accepted definition of culture in the literature (Tian et al, 2018). Despite the fact that there is no consensus in the literature on organizational culture, it is argued that organizational culture contains both tangible and nontangible characteristics. In the present study organizational culture is defined as the set of basic assumptions or beliefs and values, which determine the behavior, as well as the mode of operation and activities of an organization. Common values and assumptions determine what behaviors are rewarded, which people are promoted, what is considered as high performance, what kind of relationships exist between the members of the organization etc.

2.2 Innovativeness and organizational culture

Although in several studies "Innovativeness" is one of the criteria for effectiveness, it will be considered as a separate independent variable in this study. Innovativeness is the ability of an organization to introduce, implement and assimilate innovations (Sahinidis, 2010). Like culture, there are many definitions of innovation in the literature, leading to a situation in which, there is no clear and authoritative definition of innovation. Innovation has been defined by various researchers, who described innovation as the production, acceptance and implementation of new ideas, processes, products, or services. The common finding in the literature is that innovation plays a vital role in a company's further development (Zhang et al, 2020; Finco, Bucci, & Bentivoglio, 2018). In the present study, innovation is considered anything new in the field of organization.

Different types of culture are expected to respond differently to each of the dimensions of innovation. A highly innovative culture, for example, would be particularly productive in new ideas but potentially less effective in the phase of assimilation of innovation. On the contrary, a culture with an emphasis on rules and regulations will be less productive in new ideas, since rules characterize also a way of thinking, but at the same time, the innovations decided to be implemented are adopted without delay or modifications (Naranjo-Valencia, Jiménez-Jiménez, & Sanz-Valle, 2016). Researchers also distinguish two types of innovations: Administrative and Technological. Administrative innovations are new programs, new processes, policies, and organizational structures adopted by an organization. Technological innovations refer to innovations in the field of products or markets in the processes of production or provision of services and in the technology of the organization. A third type proposed is cultural innovations, which have to do with the adoption of new practices, norms of behavior and values by the organization, at the initiative of executives (Naranjo-Valencia & Calderon-Hernández, 2018). This type of innovation has not been researched at all, perhaps due to the relatively recent appearance of the term culture in the management literature. Finally, researchers on innovation distinguish between radical (disruptive) innovations, i.e., innovations that contain a high degree of new knowledge (Si &

Chen, 2020), and incremental innovations, which usually improve a product or a process, and enhance the existing capabilities of an organization (Acemoglu, Akcigit, & Celik, 2020).

2.3 The concept of strong or weak organizational culture

One dimension of organizational culture is the strength of culture, which according to Cameron & Quinn (1999) is the ability of culture to influence everything that happens within an organization. Organizations vary in terms of the strength of their culture which may be strong, or weak. The strength of culture characterizing an organization is dependent on the extent to which members adapt to that culture (Thokozani & Maseko, 2017). Many authors believe that strong cultures are generally more effective (Parent & Lovelace, 2018; Odor, 2018). The stronger the culture of the organization, the more confidence is built into employees' commitment. Strong cultures serve as a tool of controlling and motivating employees, hence enhancing their performance (Gochhayat, Giri, & Suar, 2017; Thokozani & Maseko, 2017; Naranjo-Valencia & Calderon-Hernández, 2018). Thokozani and Maseko (2017) found that strong organizational cultures are more successful than weak organizational cultures in accomplishing organizational goals.

However, a respectable number of researchers consider that culture is positively related to business performance, but under certain conditions, such as the type of environment. On the other hand, several studies report that companies with strong cultures outperform those with weak cultures and prevent the innovation process within the organization. They come to a conclusion that, flexibility-oriented cultures enhance innovation because flexibility is associated with creativity, freedom, and a risk-taking attitude, whereas cultures that stress stability and control may inhibit innovation (Naranjo-Valencia & Calderon-Hernández, 2018). If a company prefers to avoid external environment changes and trends, it will not be able to discover and exploit opportunities outside its existing businesses, or beyond its current technical or operational capabilities. Jaskyte and Kisieliene (2006) observed that an organizational culture characterized by stability is inversely related to innovation. It is generally accepted, that strong, cohesive cultures allow a freer expression of member feelings, since the members feel close to one another and can air their frustrations, without fearing irreparable damage in their relationships. However, the intense socialization and the strict adherence to the prevailing norms can generate individual views and ideas strikingly similar, since both the information perception and interpretation processes have been influenced in a specific direction, by the overpowering organizational culture. Such controlling cultures stifle novel thinking and creativity and limit innovation stimuli perception, to those existing within the boundaries of the organizational members' perceived environment (Bilal, Ahmad, & Majid, 2018).

On the contrary, in an organization with a weak culture, employees only adhere to rules and regulations not because they derive satisfaction from their jobs, but because of fear of the consequences of their inactions. Weak cultures make no significant effort, or at least not an effective one, to create the sense of team among their employees. People will do what the tasks require, and no effort will be made to engage in social relationships unless attraction forces them to do so. Their interests, values, goals, and perspectives will be highly diverse and the organizational influence over their external lives will be very low. According to Ashipaoloye (2014), a weak organizational culture, refers to values and beliefs not strongly and widely shared within the organization. In an organization with a weak culture, employees only adhere to organizational rules and regulations not because they derive satisfaction from their jobs, but because of fear of the consequences of their inactions (Thokozani & Maseko, 2017). For Warrick (2017) weak culture describes cultures where norms and practices are unknown or confusing, inconsistent, or not reinforced. Similarly, Bateman and Snell (2013) described weak culture as a situation where every individual has different values so there is a lack of clarity about the goals and principles. An organization with a weak culture finds it difficult to clearly communicate the expectations to employees and thus there is a negative impact on factors such as morality, customer relations, innovation, performance, cooperation, service, and loyalty (Suharnomo, 2017). Table 1 summarizes the main characteristics of strong and weak cultures within an organization (Sahinidis, 2010)

Table 1: Strong vs. Weak organizational culture

Characteristics	Strong	Weak
Inside group Memberships	Many	None more than required
Outside group memberships	Few if any	Varies among individuals
Effect on extra-organizational life	Profound	Non-existent
Effect on activities, interests, perspectives	Profound	Non-existent

Characteristics	Strong	Weak
Shared values	Most	Few
Norm intensity	Strong	Weak
Shared cultural assumptions	All shared	Few shared

Therefore, the first hypothesis proposed is:

H1. *Strong cultures have a negative impact on company's innovativeness*

The relationship between strong cultures and innovation rate is summarily presented in the Figure 1 below (Sahinidis, 2010). The innovation rate increases as the culture becomes stronger, up to a point. Beyond that point, a stronger culture will have an adverse effect on innovation adoption. Formally stated, our second hypothesis is:

H2. *There is a curvilinear relationship between the strength of culture and innovation*

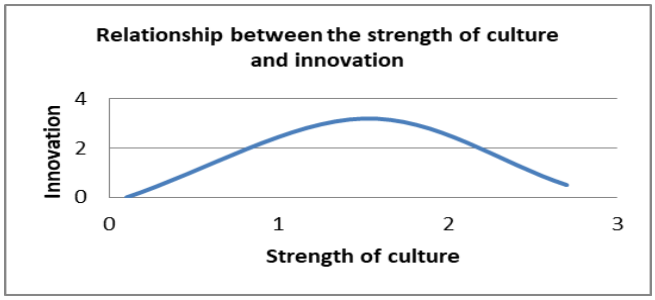


Figure 1: The strength of culture and its relationship with innovation

3. Methodology

To measure organizational culture, we used the Competing Values Framework (CVF). The Competing Values Framework (CVF), proposed by Cameron and Quinn (1999), was used to determine the features of culture. CVF is one of the most significant and widely used models in organizational culture research (Yu, 2009). Cameron and Quinn (1999) distinguish four types of cultures – adhocracy, clan, market, and hierarchy – using two dimensions: flexibility and discretion versus stability and control and external focus versus internal focus and integration (see Figure 2). Four types of organizational cultures are created, by combining these factors with six organizational aspects: dominant characteristics, organizational leadership, employee management, the organizational glue, strategic focus, and criteria for success.

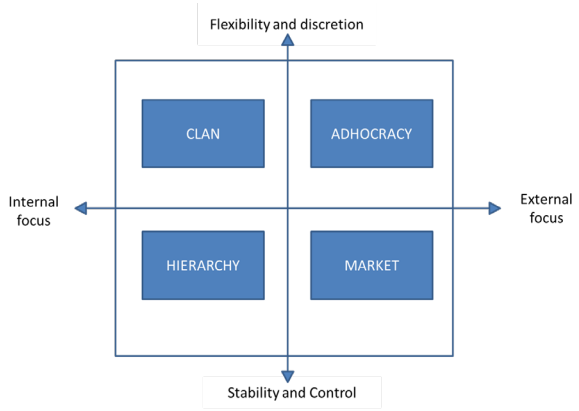


Figure 2: Cameron and Quinn (1999) Model.

- 1. The ***adhocracy culture*** focuses on flexibility and change, so it is externally orientated. It's more common in firms that operate in fast-paced environments or those aiming to be market leaders. Creativity, entrepreneurship, and taking risks are fundamental values in an adhocracy culture.
- 2. The ***clan culture*** also emphasizes adaptability, but it is internally oriented. Teamwork, employee involvement, and corporate commitment to employees are all characteristics of a clan culture.
- 3. A ***market culture*** is externally oriented and preaches control and stability. Goal attainment, consistency, and competitiveness are the main principles of companies with this culture.

- 4. Finally, ***a hierarchy culture*** is also control-oriented, but it emphasizes in the internal organization. Its key values are efficiency and close adherence to norms, rules and regulations.

The second part of the questionnaire concerns "innovativeness". The innovativeness of a company, (i.e., how innovative that company is) is measured in the literature in various ways. One of them is to measure the innovations adopted by a company in a certain period and its comparison with other companies operating in the same sector of the economy. The present study uses an adaptation to Greek of the innovativeness measurement instrument used by Russell & Russell (1992), in which the individual is asked to complete 30 questions on a five-point Likert scale regarding his/her degree of agreement, thus describing the business norms which are related to innovation. The strength of culture is one of its key dimensions and has been the subject of a significant number of studies. In the present study, a culture is considered strong when one of the four types of culture mentioned above dominates the business. The greater the difference from the second in type units the stronger the organizational culture (Cameron & Quinn, 1999). The type of sampling used in this survey, in almost all observations, is snowball sampling since the majority of those who agreed to participate in the survey during the first telephone call, eventually withdrew, thus forming the final sample of 110 companies, with a total of 504 respondents. The hypotheses derived from the literature review are examined using the analysis of variance (ANOVA) and the t-test, and the Kruscall-Wallis and Mann-Whitney tests where the samples are small and the use of non- parametric methods according to their model was deemed appropriate. The following analysis used the statistical software package SPSS, v. 19.1.

4. Results

4.1 Organizational culture

The present study confirms the fact that the scale used is a reliable tool for measuring culture. Specifically, the scale reliability for the clan culture has a Cronbach factor $\alpha = 0.8320$. For the adhocracy culture the coefficient $\alpha = 0.7345$, for the hierarchy culture, $\alpha = 0.7071$ and for the market culture $\alpha = 0.7971$. In the sample used in the present study we observed, 58 companies with clan cultures, 2 companies with adhocracy cultures, 18 companies with hierarchy cultures and 32 companies with market cultures. The variable of strength was divided into three parts after a study of the organizations' relevant scores. Specifically, the total companies in the sample were divided into three groups: those with the strongest cultures, the medium and the low ones, with each group comprising 33.33% of the total sample. Specifically:

- 1: if the strength is less than 6.93 (Low)
- 2: if the strength is between 7.49 and 16 (Medium)
- 3: if the strength is greater than 16.1 (High)

4.2 Innovativeness

Despite the scarcity of similar studies in the literature, the scale of innovation proved to be highly reliable ($\alpha = 0.8861$). In the sample used in this survey, 74% of business executives consider their companies to be innovative, based on the tool for measuring innovation used, while 26% respectively describe their companies as non-innovative. This result comes from the dichotomy of the variable "innovativeness" where the separation value is 64.45, with a minimum value of 37 (the most innovative) and a maximum value of 107 (the least innovative). It is noted that the low score on the variable innovativeness indicates high rates of innovation adoption, while the high score indicates a non-innovative company.

4.3 Statistical hypothesis testing

In the following paragraphs, the hypotheses that emerged from the literature review are statistically tested.

H1. *Strong cultures have a negative impact on company's innovativeness*

Table 2: Strength of culture and innovativeness

1 ANOVA					
Innovativeness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	36,96	2	18,480	9,210	,002

1 ANOVA					
Within Groups	1240,274	68	18,239		
TOTAL	1277,234	70			

Descriptives								
Innovativeness								
					95% Confidence Interval for Mean		Minimum Maximum	
STRENGTH	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound		
LOW	22	19,1908	3,48	,7419	17,6478	20,7337	11,32	25,38
MEDIUM	31	18,2391	4,3071	,7736	16,6592	19,8190	6,34	27,25
HIGH	18	17,2618	5,0259	1,1846	14,7624	19,7611	7,07	26,38
TOTAL	71	18,2862	4,2716	,5069	17,2752	19,2973	6,34	27,25

2 KRUSKAL-WALLIS			
Ranks			
	STRENGTH	N	Mean Rank
Innovativeness		22	40,82
	1,00		
	2,00	31	34,9
	3,00	18	32
	TOTAL	71	
Test Statistics			
	INNOVATIVENESS		
Chi- Square	5,384		
df	2		
Asymp.	,002		
Sig.			
a Kruskal Wallis Test			
b Grouping Variable: SRENGTH			

To test this hypothesis, the method of dispersion analysis (ANOVA) with the factor "strength" in three levels was used. The "innovation" is taken as a dependent variable while the levels of strength are: 1: low strength, 2: medium strength, 3: high strength. Alternatively, to avoid the hypothesis that the sample populations are normal with common dispersion, the Kruskal - Wallis criterion is used to test the hypothesis that the three samples are from populations with equal mean values. Considering the first hypothesis, the non-parametric method of Kruskal - Wallis, is supported by p-value = 0.002 which leads to its acceptance (Table 2). Therefore, based on this sample and the given constraints, there is a statistically significant difference in organizational innovativeness between strong, medium and low strength of culture. The hypothesis of strong culture is confirmed as expected.

H2. *There is a curvilinear relationship between the strength of culture and innovation.*

Table 3: Culture strength and innovativeness

1 ANOVA					
Innovativeness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	23,310	2	11,655	7,625	,015
Within Groups	1831,026	99	18,495		
TOTAL	1854,336	101			

Descriptives								
Innovativeness								
					95% Confidence Interval for Mean		Minimum	Maximum
STRENGTH	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound		
1,00	33	17,9158	3,7832	,6586	17,1196	20,7548	7,35	27,25
2,00	37	18,3845	4,2217	,6940	18,2432	19,9347	9,32	27,25
3,00	32	17,5324	4,8574	,8587	17,3255	20,0347	7,07	27,98
TOTAL	102	18,1123	4,2848	,4243	17,8958	19,579	6,34	27,98

2 KRUSKAL-WALLIS	
Test Statistics	
	INNOVATIVENESS
Chi- Square	4,962
df	2
Asymp.	,018
Sig.	
a Kruskal Wallis Test	
b Grouping Variable: STRENGTH	

Here again, the method of Dispersion Analysis (ANOVA) was used. The hypothesis is accepted at the level of p-value = 0.015 using ANOVA, while using the Kruskal-Wallis test (p-value = 0.018) again the hypothesis 2 is accepted. According to the data of the present research, there is a statistically significant difference between the means of the three levels of culture's strength, in terms of business innovativeness.

5. Conclusions

This study has attempted to demonstrate that the widely shared belief of strong cultures being more innovative than less strong ones is not well founded and deserves further study. Managers should be aware of the strength of their organizational culture. It is particularly important to maintain a moderately strong culture in environments where innovation is vital. Such environments are technology intensive industries, where technological innovation is quintessential. Low technology industries can also benefit from innovation, but to a lesser extent. It is important, however, for every organization's long-term performance, to create and maintain cultures conducive to innovation and creativity, regardless of what environment they operate in, if they are to stay in sync with their environment. The main conclusion is that there is a curvilinear relationship between the strength of culture and organizational innovation. The optimal level of culture strength in the terms of innovativeness is the level of the moderately strong cultures. These cultures are expected to be associated with higher rates of administrative, technological, and cultural innovations and are expected to exhibit higher performance in the long run, than organizations with strong and weak cultures. Regarding the limitations of the current research it should be initially stated that organizational culture is a broad term that encompasses a large number of dimensions, levels and aspects, which makes it an extremely difficult concept to measure and statistically analyze. Next, the research sample is not random as the snowball sampling method is used. The randomness or randomization of the sample would allow conclusions to be drawn regarding the total population. The choice to use a questionnaire leads to the problems faced by all surveys that use this method. These include lack of flexibility in answering questions, recording only the participant's verbal behavior, the lack of control of the respondent's environment, and incompletely answered questionnaires. In addition, the sample used in this research includes companies from different sectors of the economy, so it is difficult to compare them in terms of culture, efficiency or degree of innovativeness. Finally, it would be interesting to look at the results of similar research but in companies based abroad.

References

Acemoglu, D., Akcigit, U. and Celik, M. A. (2020) "Radical and incremental innovation: The roles of firms, managers and innovators", *AEJ Macroecon*.

Adeoye, A. O., and Hope, O. (2020) "Organizational Culture, Employee Retention and Employee Loyalty: Empirical Evidence from Nigeria". *Academic Journal of Economic Studies*, Vol *6*, No. 3, pp 139-145.

Arayesh, M. B., Golmohammadi, E., Nekooeezadeh, M. and Mansouri, A. (2017) "The effects of organizational culture on the development of strategic thinking at the organizational level". *International Journal of Organizational Leadership*, Vol 6, pp 261-275.

Ashipaoloye, F. K. (2014) "A Comparative analysis of the organisational culture and employee's motivation of selected cities in Calabar zone: Basis for employee's motivation, leadership and innovative management". *Asia Pacific Journal of Multidisciplinary Research*, Vol 2, No. 5, pp 54-63.

Bateman, T. S. and S. A. Snell (2013) *Management*, Mc Graw Hill, New York.

Bilal, A., Ahmad, H. M. and Majid, F. (2018) "How formalization impedes employee creativity and organizational innovation: A case of advertising agencies in Pakistan". *NUML International Journal of Business & Management*, Vol 13, No.1, pp 66-78.

Carvalho, A. M., Sampaio, P., Rebentisch, E. and Saraiva, P. (2017) "Operational excellence as a means to achieve an enduring capacity to change–revision and evolution of a conceptual model". *Procedia Manufacturing*, Vol 13, pp 1328-1335.

Carvalho, A. M., Sampaio, P., Rebentisch, E., Carvalho, J. Á. and Saraiva, P. (2019) "Operational excellence, organisational culture and agility: the missing link?". *Total Quality Management & Business Excellence*, Vol 30, No. 13-14, pp 1495-1514.

Chang, C. C. and Huang, L. (2019) How could business culture motivate enterprise innovation. In *Engineering Innovation and Design* (pp. 442-446). CRC Press.

Finco, A., Bucci, G. and Bentivoglio, D. (2018) "Lessons of innovation in the agrifood sector: Drivers of innovativeness performances". *Lessons of Innovation in the Agrifood Sector: Drivers of Innovativeness Performances*, pp 181-192.

Gochhayat, J., Giri, V. N. and Suar, D. (2017) "Influence of organizational culture on organizational effectiveness: The mediating role of organizational communication". *Global Business Review*, Vol 18, No. 3, pp 691-702.

Jaskyte, K., and Kisieliene, A. (2006) "Organizational innovation: A comparison of nonprofit human-service organizations in Lithuania and the United States". *International Social Work*, Vol 49*, No.* 2, pp 165-176.

Kim Jean Lee, S. and Yu, K. (2004) "Corporate culture and organizational performance". *Journal of Managerial Psychology*, Vol 19 No. 4, pp 340-359.

Liu, Y. and Almor, T. (2016) "How culture influences the way entrepreneurs deal with uncertainty in inter-organizational relationships: The case of returnee versus local entrepreneurs in China". *International Business Review*, Vol 25. No. 1, pp 4-14.

Massaras, P., Sahinidis, A., and Polychronopoulos, G., (2014) "Organizational culture and motivation in the public sector. the case of the city of Zografou". *Procedia Economics and Finance,* Vol 14, pp. 415-424.

Naranjo-Valencia, J. C., Jiménez-Jiménez, D. and Sanz-Valle, R. (2016) "Studying the links between organizational culture, innovation, and performance in Spanish companies". *Revista Latinoamericana de Psicología*, Vol *48*, No. 1, pp 30-41.

Obeidat, A. M., Abualoush, S. H., Irtaimeh, H. J., Khaddam, A. A. and Bataineh, K. A. (2018) "The role of organisational culture in enhancing the human capital applied study on the social security corporation". *International Journal of Learning and Intellectual Capital*, Vol *15*, No. 3, pp 258-276.

Odor, H. O. (2018) "Organisational culture and dynamics". *Global Journal of Management and Business Research*, Vol 14, No.2, pp 1-9.

Parent, J.D. and Lovelace, K.J. (2018), "Employee engagement, positive organizational culture and individual adaptability", *On the Horizon*, Vol 26, No. 3, pp. 206-214.

Popoli, P. (2017) "The Impact of Organizational Culture on Outsourcing Choice". *China-USA Business Review*, Vol 16, No. 3, pp 123-131.

Quinn, R. E. and Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organizational analysis. *Management science*, *29*(3), 363-377.

Quinn, R. E. (1988) *Beyond rational management: Mastering the paradoxes and competing demands of high performance*, Jossey-Bass.

Russell, R. D. and Russell, C. J. (1992) "An examination of the effects of organizational norms, organizational structure, and environmental uncertainty on entrepreneurial strategy". *Journal of management*, Vol 18, No. 4, pp639-656.

Sahinidis, A. G. (2010) "The effects of Strong Culture on Organizational Innovation. A Cultural Model Of Innovation. In book: A collection of articles included in the Volume on Management issued by University of Pireaus in honor of Prof. Bartolomeos,Chapter: The effects of Strong Culture on Organizational Innovation. A Cultural Model Of InnovationPublisher: University of Piraeus.

Samuel, A. B., Rahman, M. M., Khairuddin, I., Uddin, M. J. and Rahaman, S. (2017) "A synthesised literature review on organisational culture and corporate performance". *Journal of Advanced Research in Social and Behavioural Sciences*, Vol *7*, No.1, pp 83-95.

Schein, E.H. (1985) *Organisational Culture and Leadership*, Jossey Bass, San Francisco.

Schein, E. H. (1999) *Sense and nonsense about culture and climate*, Sloan School of Management, Massachusetts Institute of Technology.

Serpa, S. N. F. (2016) "Organization as an analytical level for investigation organizational culture". *The Social Sciences*, Vol. *11*, No.13, pp 3257-3263.

Si, S. and Chen, H. (2020) "A literature review of disruptive innovation: What it is, how it works and where it goes". *Journal of Engineering and Technology Management*, Vol 56, 101568.

Suharnomo, S. (2017) "The Role of Strong Organizational Culture to Increase The Organization Competitiveness". In *4th Business Management International Conference (BMIC 2017) Theme: Challenges of Creative and Innovative Management*. BBS Faculty of Management and Tourism, Burapha University.

Tănase, I. A. (2015) "The importance of organizational culture based on culture transfer". *Proceedings of Management and Innovation for Competitive Advantage in 9th International Management Conference, Bucharest University of Economic Studies, Romania.*

Taye, M., Sang, G., and Muthanna, A. (2019) "Organizational culture and its influence on the performance of higher education institutions: The case of a state university in Beijing". *International Journal of Research Studies in Education*, Vol *8*, No. 2, pp 77-90.

Thokozani, S. B. M. and Maseko, B. (2017) "Strong vs. weak organizational culture: Assessing the impact on employee motivation". *Arabian Journal of Business and Management Review*, Vol 7, No. 1, pp 2-5.

Tian, M., Deng, P., Zhang, Y. and Salmador, M. P. (2018) "How does culture influence innovation? A systematic literature review". *Management Decision,* Vol 56, No. 5, pp 1088–1107.

Warrick, D. D. (2017) "What leaders need to know about organizational culture". *Business Horizons*, Vol 60, No. 3, pp 395-404.

Zhang, F., Sun, S., Liu, C. and Chang, V. (2020) "Consumer innovativeness, product innovation and smart toys". *Electronic Commerce Research and Applications*, Vol 41, 100974.

Assessing the Current State of University-based Business Incubators (UBIS) in Canada and the UAE

Naveed Yasin and Sayed Abdul Majid Gilani
Canadian University Dubai, Dubai, UAE
naveed.yasin@cud.ac.ae
sayed.gilani@cud.ac.ae

Abstract: There is a dearth of published research that explores UBIs from a comparative dimension across geographical and institutionalised contexts that assesses the current state and scope of UBI activities. This paper explores the current state of University-based Business Incubators (UBIs) both in the United Arab Emirates and Canada underpinned by a comparative case analysis approach. This study utilises both secondary and primary research data that was obtained through desk-based secondary research and qualitative methods of inquiry (semi-structured interviews) with UBI managers, academics, and support staff that were used to develop each case. This informed the development of 18 cases of UBIs in the United Arab Emirates and Canada (9 each, respectively). The data was collected through VoIP (Voice-Over-Internet-Protocol) and telephone during the COVID-19 pandemic from March 2021 to February 2022. The findings of the study illustrate that the Canadian context offers similar provisions of services for business incubators (BIs) but in comparison, the UAE-based university UBIs are much younger and are transitioning towards the development of various business and enterprise initiatives in Higher Education and are also focused on driving student recruitment using this provision. The value of this study is inherent in its comparative approach between two under-studied and represented empirical geographies (i.e., Canada and the UAE), the findings also indicate the divergence and specialisms adopted by institutions in the UAE based on the various provisions for the governmental vision 2030, and the empirical development of showcasing these initiatives to be novel for the efficacy of UBIs.

Keywords: university, business incubator, United Arab Emirates, Canada, comparative

1. Introduction

There has been an increasing interest among universities to harness the entrepreneurial and innovative talents of their staff and students to develop new products and services, spin-offs, and establish new forms of enterprise as their contribution to their societies and economies, respectively (Imtiaz, 2021; Kurt, 2021). In doing so, Universities are widely known to deliver higher education to continuous (no breaks in education) as well as wider participation (people returning to education) students (Bonilla-Silva and People, 2022. As a result, the creation and adoption of BIs have become a popular strategic initiative across universities to combat doubts over universities' role in ensuring and promoting graduate employability (See, Ahmed et al., 2020). Business incubators are identified by various authors as a platform where budding entrepreneurs share their business ideas, develop them, and are then aided in developing them into a reality (Ahmed et al., 2020; Hassan, 2020).

The first BI was established in 1959 by Joseph Mancuso in New York, United States of America (USA) (Hassan, 2020). Unlike the USA, BIs are a fairly novel concept in the United Arab Emirates where the Arabian Luxury Group (TALG) is known as the very first BI (established in 2015) in the UAE (Rehman et al., 2021). Currently, there are a total of 12 BIs in the UAE (Al Malik, 2022). In addition to industry, in recent years, the inclusion of BIs has become a primary objective in most universities as part of the industrial engagement and employability initiative which aligns with the UAE government's Sustainable Development Goals (SDG) (Yasin et al., 2021). Authors believe that University-Based Incubators (UBIs) may play an important role in increasing the supply of entrepreneurs in the UAE which in turn will have a positive impact on the national economy in terms of job creation (Yasin et al., 2021). The UAE government's policy (Sustainable Development Goals) is proactively driving entrepreneurs to support the Emirati population transitioning out of UAE government roles due to government downsizing (Rashid, 2019). Therefore, BIs or UBIs can play a role in engaging the Emirati population (citizens and residents) as well as other ethnic groups to consider entrepreneurship as a career path (Seretny et al., 2019).

The purpose of this paper is to explore the current state of UBIs in the United Arab Emirates (UAE) with a specific purpose of developing a coherent understanding of the nature and scope of such endeavours that are striving to contribute to the UAE vision 2030 with a comparative approach to Canada, that has comparatively a longer history of incubating enterprise in Higher Education Institutions (HEIs). Currently, there are 24 BIs in Canada (Get Golden Visa, 2022). This next section of this paper will focus on the historical and contemporary contexts for the UAE and Canada, followed by an analysis of the literature, methodology, findings, and discussion and will

conclude by stating the originality and limitations of this research as well as identifying future areas for research development.

2. The United Arab Emirates and Canada

The United Arab Emirates and Canada are what can be described as 'polar opposite' geographical contexts that are embedded under differing economic, social, historical, and political contexts (Statistics Canada, 2022; UAE Government, 2022). The UAE is a country located in the Middle East and comprised of seven emirates, which are Dubai, Abu Dhabi, Fujairah, Ajman, Sharjah, Ras Al Khaimah, and Umm Al Quwain (UAE Government, 2022). However, Canada is located in North America with the main regions of Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, Prince Edward Island, Quebec, and Saskatchewan (Statistics Canada, 2022). The UAE is situated in the Arabian Peninsula, and shares land borders with the Kingdom of Saudi Arabia and the Sultanate of Oman, whereas Canada shares a border with the United States of America (USA) (Crystal, 2022; Hall, 2022). The city of Abu Dhabi is the capital of the UAE (UAE Government, 2022); however, Ottawa is the capital of Canada (Hall, 2022). The UAE is a relatively young country established in 1971 and is an Islamic country, comparatively, Canada is an older country founded in 1867 where Christianity is the main practised religion (Crystal, 2022; Hall, 2022). The Emirati ethnic group are natives of the UAE where Emirati is derived from the Arabic word Emirates which has the meaning of "Arabs originating from the UAE" (Crystal, 2022), whereas, in Canada, the First Nations are the native ethnic group (Hall, 2022; Statistics Canada, 2022).

3. Literature review

The BIs concept was initially implemented in the United States (U.S.) during the 1960s and then followed by the United Kingdom (UK) and other Western European countries establishing varying BIs in varying forms such as science parks, innovation centres, and technopole parks. According to Sanyal and Hisam (2018), the purpose of BIs was to inform as well as address policy needs for economic and socio-economic development, which includes activities like assessing a business' risk profile, employment, researching institutions and business community, wealth creation, technology transfer, promotion of innovation, improving networks and links between universities and government, and industry cluster development. Sanyal and Hisam (2018) explain that BIs in most cases are government-supported, private sponsors, and universities. The main objective for BIs supported by the government is to create employment, expand the tax base, and economic diversification (Yasin and Khansari, 2021). Additionally, incubators may vary based on the body/institution that they are associated with, eg academic institutions/organisations that provide alumni, faculty members, and related groups with research and business opportunities (Yasin et al., 2021; Yasin and Khansari, 2021). In most cases, BIs are identified as 'hybrids' as they combine resources from private as well as government sector bodies (Sanyal and Hisam, 2018). Isenberg (2010) identifies entrepreneurship contexts across different countries (eg Haiti, Iceland, Italy, Liberia, New Zealand, Poland, the Czech Republic, and the West Bank Gaza), where he concludes that the entrepreneurship ecosystem is a combination of capital-market, culture, leadership, and open-minded consumers. The BIs act as enablers for developing innovative products as well as services, which in turn may contribute to the economic growth in a region. Hence, promoting BIs continues to gain global popularity for its efficaciousness in the growth and development of a conducive environment for the creation of new small to medium-size enterprises (SMEs). Jones et al. (2020) identify an effective enterprising environment (entrepreneurial ecosystem) as an environment that supports the effective commercialisation of innovative/creative ideas, promotes the development of skills, and provides resources. The positive impact of BIs has been identified in areas like job creation, innovation and development of a strong entrepreneurial ecosystem, and also an improved growth in financial dividends (Dvoultey, 2018). According to Mouallem (2019), the main aim of BIs is to facilitate/support an entrepreneur in transforming/evolving an innovative idea into the reality of a successful start-up enterprise by connecting factors like conveying knowledge and facilitating access to capital, talent, and technology. To further develop/support/strengthen economic growth as well as sustainability through BIs, international institutions like the National Business Incubation Association (NBIA) play an important and pivotal role in supporting incubators (Al-Mubaraki and Busler, 2017). For example, the NBIA operates as a non-profit institution to promote new business development/growth and educate/inform communities mainly comprised of businesses and investors. The NBIA consists of BI developers as well as managers, corporate joint venture partners, economic development professionals, and venture capital investors. According to the NBIA, the most popular types of incubators provide tangible services like physical infrastructure, (eg internet connection, office space, logistics, and transportation), financial and legal services, managerial and technical support, and access to financial and social capital. Al-Mubaraki and Busler (2017) while

considering the NBIA definition, explain these incubators as technology incubators and add that incubators can be classified/differentiated based on their organisation/business structure, the type of facilities/products/services they provide, and the type of tenants they accommodate/serve.
Yamockul et al. (2019) in their Thailand-based research highlight that UBIs are identified by universities as being crucial to their operations as they allow them to remain competitive with rival universities, forge connections with industry and allow students to develop entrepreneurial characteristics which may not be developed in the classroom. Guerrero et al. (2020) in their Mexico-based study, also identify that currently, students want more than just a university degree to ensure their employability in an industry that is where the approach of UBIs bridges the gap between classroom and employment for students. The key finding in Hassan's (2020) research was identifying how a favourable environment created within a university may enable students to develop/grow from the mindset of an employee to the mindset of an employer which may aid students in developing relevant knowledge and skills to eventually job creation in a region. The findings from a USA-based study carried out by Pellegrini and Johnson-Sheehan (2020), align with the findings in Hassan's (2020) study regarding the importance of a university environment in creating entrepreneurs from the student population. El_sawalhy et al. (2021) explain that UBIs can aid students and university staff in improving their networking and marketing skills and reach. El_sawalhy et al. (2021) add that UBIs are being adopted by universities to ensure that they remain competitive against rival universities and they attract students and employees. A review of literature related to the role of BIs in an industry as well as university setting has identified key findings like the importance of UBIs in transforming students into managers and entrepreneurs, UBIs presenting opportunities for universities to survive, grow and forge industry partnerships, and UBIs bridging the gap between the classroom and employability for students. Despite such in-depth insight provided by the reviewed studies, there has been limited/no research identified for UBIs in a Middle East context, especially, in a UAE context. Therefore, there is a paucity of UBI-related research in a UAE context and the focus of this paper will address this area.

4. Methodology

To achieve the objective of this study which was to identify the challenges encountered by BIs based in Dubai and Canada, a comparative case study approach was adopted. The case study method is defined by Creswell (2013, p.97) as "explor[ing] a real-life, contemporary bounded system or multiple bounded systems over time, through detailed, in-depth data collection involving multiple sources of information….and report[ing] a case description and case themes". The aim of this study is not to generalise findings but to explore barriers/challenges experienced by the unit of analysis (eg the BI as an institutional entity) (Baskarada, 2014). A background manual information search was conducted by inputting terms like 'BIs in Dubai', 'enterprise incubators in UAE', and 'technology-based incubators in Dubai' in online search engines to identify the number of incubators. One of the limitations associated with secondary research was the lack of reliable information that was publicly available, this was further challenged by the freshness of the concept of an entrepreneurial ecosystem within the UAE, therefore, limited research was available on BIs. Dubai is currently adopting a smart governance system, where there is a dedicated wing in the Prime Minister's office which is solely responsible for supporting as well as promoting entrepreneurial-related activities, therefore, demonstrating the importance of the development of an entrepreneurial ecosystem at a national level. Following desk-based research involving the identification of potential research participants among registered BIs based in Dubai, led to the identification of six accredited BIs but only three of these were identified/acknowledged by the local government. Hub71, Area 2071, and Fazaa were identified as the three BIs. However, it should be noted that upon detailed searching about the ownership structures related to BIs based in Dubai, several additional incubators were identified that offer different programs to aid in contributing positively towards growing/developing the entrepreneur-related environment and contributing to the private sector, eg BIs like AstroLabs. Non-disclosure agreements were signed to protect participants' identities; therefore, pseudonyms were associated with each participant and case study included in this paper. It is acknowledged by various authors (Aerts et al., 2007; Bollingtoft and Ulhoi, 2005), that there were methodological challenges for such BI-related studies which may stem from the diversity among institutional and ownership structures related to BIs as each business and initiative appears to differ/vary in their purpose as well as managerial, institutional and ownership structures – whether they are publicly/privately owned – and types of features related to management and service portfolio.

These organisational-related challenges and cultural factors highlight that issues related to the business are not normally discussed with 'outsiders' due to a lack of trust in confidentiality related to research. A snowball sampling approach was adopted after the cases were selected, the sampling approach involved the initial step of the authors using personal contact networks that effectively maintained and facilitated access to research for

the participants and their institutions. The semi-structured interviews were held remotely via Microsoft Team and Zoom with UBI managers in the UAE and Canada (9 participants from each country) during the period of 1st May 2021-31st August 2021. The retrieved data were analysed through a thematic analysis procedure of qualitative template analysis which informed the researcher in developing an interview guide. King and Horrocks (2012) explain Template Analysis involves thematically analysing qualitative data, (eg interview transcripts) by developing a coded template, which summarises themes that were identified by the researcher and organising these under a hierarchy. The NVivo analysis tool was adopted to index and analyse the consistent and inconsistent themes to investigate the data. The selection of barrier themes emerging from interviews and the selection of frequencies were based on the guidelines provided by King and Horrocks (2012) for thematic analysis. The relationships between themes were examined for in-depth template analysis. The key learning gained from the comparison of the difficulties encountered by the BIs against other studies was not entirely based on similarities or disagreements. The BIs based in Dubai are a fairly new addition to the entrepreneurial-related ecosystem, hence, there are limited studies investigating their performance and the complications related to their experience during their practices. Mostly BIs based in Dubai are funded by the government or they are privately owned and are types of classical/technology-based incubators. The general admission process for a potential tenant in an incubator involves the achievement of criteria and an application to a BI.

Demonstrating that there is a feasible and viable business idea with a strong business plan is one of the most common criteria that tenants are required to meet (National Agency for Development to Small and Medium Enterprises in Slovakia, 2009). In most cases, start-up businesses have to move into their facilities and successfully achieve the exit criteria of the program after a specified period.

5. Findings and discussion

The findings from the semi-structured interviews for Cases A to I from the UAE and Cases 1 to 9 from Canada are presented in the table below in terms of City, Type of University (Government/Public), Origin of university, Activities, and Key Findings.

Table 3: Findings from Case A-I in the UAE and Case 1-9 in Canada

Case	City	Type of University	Origin of University	Key Findings
Case A	Dubai	Government	UAE	- Activities - Initiatives - Curriculum - Extra-Curricular
Case B	Dubai	Government	UAE	- Acceleration - Integrated Academic program - Family Business - Digital Communication - Social Media - Product development - Business models
Case C	Dubai	Private	UAE	- Research and Consultancy Platform - Physical space - Networking - Workshops - Keynote Speakers - Industry Visits - Internship - Global Conferences - Competitions - Sustainable innovations
Case D	Dubai	Private	USA	- 3 weeks - A summer incubator program - External invitations and participants

Case	City	Type of University	Origin of University	Key Findings
Case E	Abu Dhabi	Government	UAE	- Technology-based innovations - Mobile applications - Machine Learning - Tech Talks - Schools initiatives
Case F	Dubai	Private	USA	- 3D Printing - Design - Animation course - Maxon 4D Training Course - Open to external students
Case G	Abu Dhabi	Government	UAE	- Research-based ventures - Specialised IP commercialization program - Virtual Incubator
Case H	Dubai	Private	UAE	- Events/Competition - Virtual Reality focus - Robotics competition - High school engagement
Case I	Dubai	Private	UK	- School-level competition
Case 1	Toronto	Private	Canada	- Activities - Initiatives - Curriculum - Extra-Curricular Activities - Accelerator program - Social media
Case 2	Toronto	Government	Canada	- Accelerator program - Integrated Academic program - Digital Communication - Social Media - Industrial engagement - Strategies/Processes
Case 3	Montreal	Government	Canada	- Research-led learning - Alumni support - Industrial engagement - Networking - Workshops - Business models - Innovation - Funding
Case 4	Edmonton	Private	Canada	- Accelerator program - Global partnerships - Joint venture - Industrial engagement - Innovation - Research-led learning
Case 5	Toronto	Government	Canada	- Knowledge sharing - Industrial engagement - Networking - Strategies/Processes

Case	City	Type of University	Origin of University	Key Findings
Case 6	Waterloo	Government	Canada	- Funding - Industrial engagement - Curriculum
Case 7	Kingston	Private	Canada	- Funding - Accelerator program - Industrial engagement - Innovation - Research and Development
Case 8	Montreal	Private	Canada	- Mentoring - Accelerator program - Innovation - Networking - Industrial engagement
Case 9	Victoria	Government	Canada	- Funding - Networking - Industrial engagement - Research-led learning - Strategies/Processes

Source: Authors

As shown in Table 3, UBIs in all cases encouraged *innovation* amongst students and academic staff (eg Cases E to H encouraged technology-based innovations as part of the UBIs) along with collaborations between universities and *industry*, eg industry visits, keynote speakers from industry, networking and internships in Cases C and D. The UBIs played a role in the development of *curriculum* as well as *extra-curricular* activities in some instances, eg Cases A and B. The UBIs also encouraged students to develop their *communication skills* in person and through innovations (social media-based marketing) while developing a product to enter a market, eg Case B. The inclusion of UBIs also allowed the development and growth of *strategic thinking* as entrepreneurs/managers amongst students which may aid their employability, eg Case B. In some cases, the UBIs are identified to aid the development of *research skills* amongst students through students being put in a position as leaders where they had the responsibility to research areas like competition and consumer behaviour in a target market they were aiming to enter, eg Cases C and G. The UBIs were also identified in some cases as an opportunity to *attract new students* through engagement with high schools via incentive-based competitions related to the UBI programs, eg Cases H and I. The links between the cases and key findings are illustrated in Figure 1.

As shown in Figure 1, the most common themes emerging from Cases A-I regarding the role of UBIs were highlighted as the drivers of Innovation and Attracting new customers. However, there was limited Industry engagement and Extra-curricular activity identified in Cases A-I, therefore, there is scope for the researched institutions to improve these areas to improve employability for students. It should be noted that government-based institutions appeared to be more active in the UBI programs through an identified higher level of activity, eg a greater inclusion of the UBIs in courses, more industry engagement events, and securing more internship programs. The authors believe that this may be attributed to a greater level of flexibility encouraged by government funding in comparison to possibly limited funding available to private institutions. Another observation from the data in Table 3 is that the implementation of UBIs in an institution was not affected by whether the university's origin was UAE based or international. This finding demonstrates that culture does not influence the implementation of UBIs in the UAE. The final finding identified from the analysis of the data in Table 3 was whether the region of the university within the UAE affected the implementation of UBIs. It is widely acknowledged that there is a variation in terms of liquidity, culture, and infrastructure between Abu Dhabi and Dubai [eg Abu Dhabi is more politically driven whereas Dubai is more glamorous and authentic which attracts tourists (Martens and Reiser, 2017)] where it is assumed that Abu Dhabi may have greater backing from the UAE government due to its status as the capital (Martens and Reiser, 2017). However, the identified variation between the cities did not affect or influence the implementation of UBIs in institutions. Therefore, in the case

of this study, regional variability did not play a role in UBIs but this may be different if institutions from other emirates outside of Dubai and Abu Dhabi are included in future research.

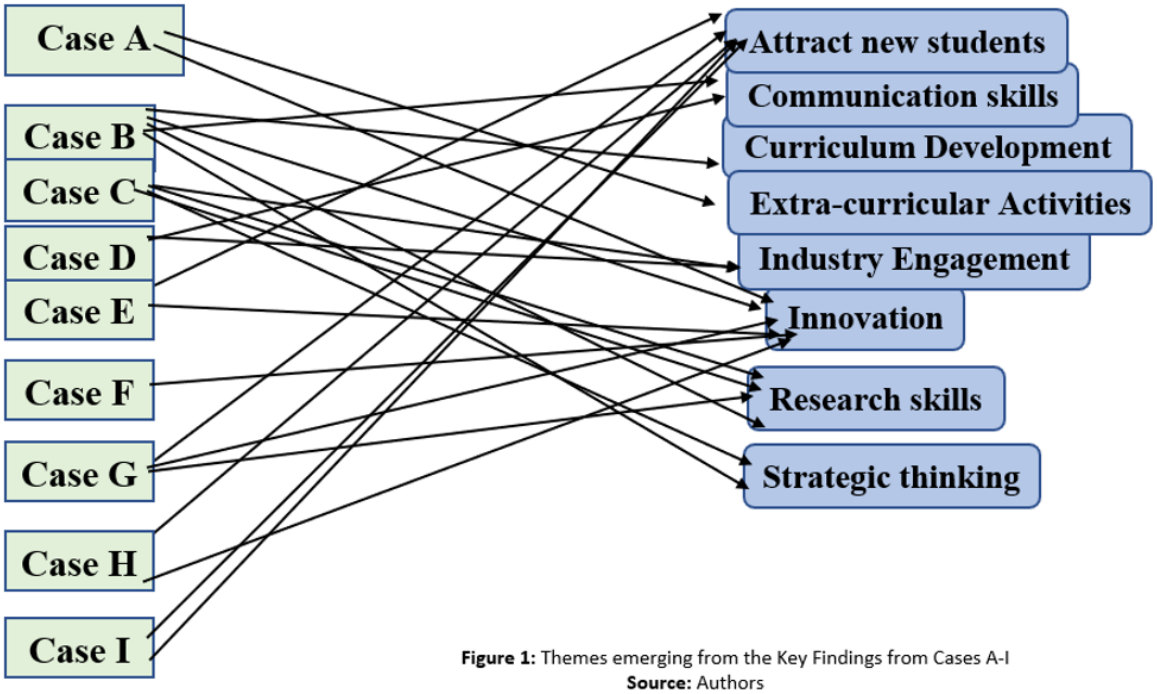


Figure 1: Themes emerging from the Key Findings from Cases A-I
Source: Authors

Source: Authors

Figure 1: Themes emerging from the Key Findings from Cases A-I

Similar to UBIs in the UAE, UBIs in Canada encouraged *innovation* amongst students and academic staff (identified for Cases 2 to 9) along with collaborations between industry and universities, eg *industry engagement* and *industry collaborations* in Cases 1-9. Like UBIs in the UAE, the UBIs played a role in the development of *curriculum* via research-led teaching, eg Cases 1, 4, and 9. Similar to the UBIs in the UAE, UBIs in Canada also encouraged students to develop their *communication skills* in person and through innovations (networking and social media-based marketing) while developing a product to enter a market, eg Cases 1, 2, 8, and 9. The promotion of developing *research skills* was identified by UAE-based UBIs as a crucial factor for students' development in the UAE (eg research areas like competition and consumer behaviour in a target market that aspiring entrepreneurs are aiming to enter) which has also been highlighted by Canadian based UBIs, eg Cases 3, 4, 5, 7 and 9. However, the UAE-based cases identified UBIs as an opportunity to *attract new students* through engagement with high schools via incentive-based competitions related to the UBI programs, however, this has not been highlighted as a common factor for Canadian-based UBIs. The links between the Canada-based cases and key findings are illustrated in Figure 2 below.

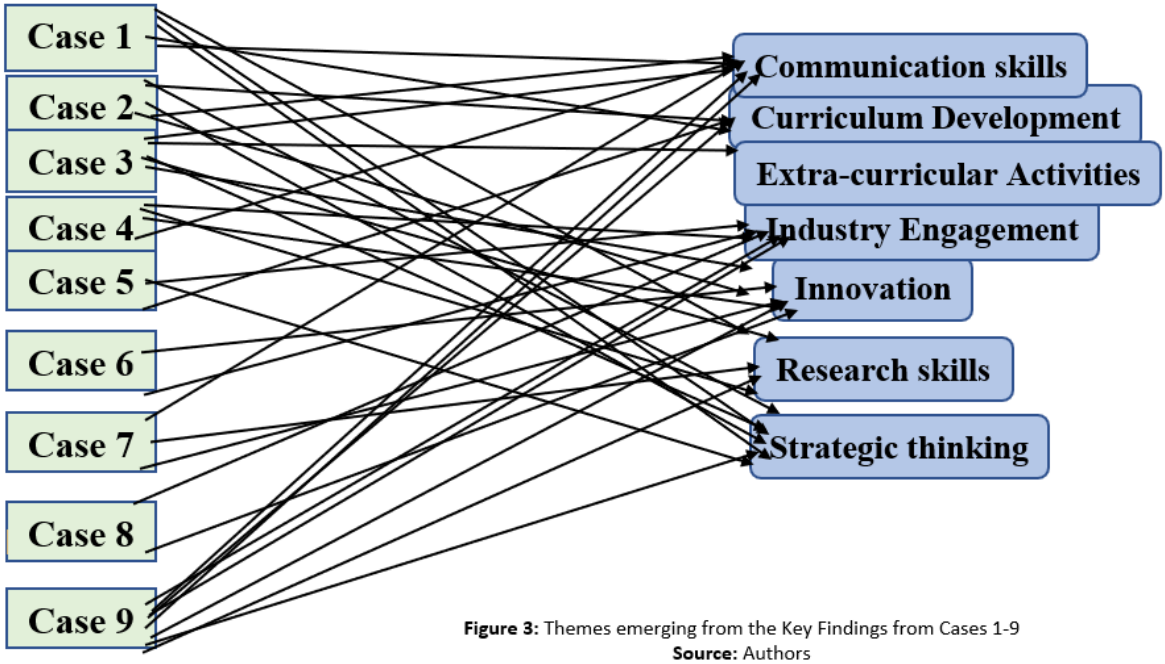


Figure 3: Themes emerging from the Key Findings from Cases 1-9
Source: Authors

Source: Authors

Figure 2: Themes emerging from the Key Findings from Cases 1-9

In Figure 2, the most common themes emerging from Cases 1-9 regarding the role of UBIs in Canada were highlighted as the drivers of Communication skills, Innovation, Research skills, and Industrial engagement.

However, unlike UBIs in UAE, there was limited Extra-curricular activity and drive for Attracting new customers identified in Cases 1-9, therefore, there is scope for the researched institutions to improve these areas to improve the learning environment for students and further ensure the stability/survival of the concerned university. Unlike the cases in the UAE, there was no clear differentiation highlighted between public or private universities in terms of their activity regarding UBIs. The authors believe that this may be attributed to the higher education market being far more established in Canada in comparison to the UAE. Another observation from the data in Table 3 is that like the cases in the UAE, the implementation of UBIs in an institution was not affected by whether the university's origin was Canadian-based or international. This finding demonstrates that culture does not influence the implementation of UBIs in Canada which is also the case in the UAE. The final finding identified from the analysis of the data in Table 3 was whether the region of the university within Canada affected the implementation of UBIs. Unlike the UAE there is not a wide variation in terms of liquidity and infrastructure between the main cities in Canada (Statistics Canada, 2022). Therefore, in the case of UBIs in Canada, regional variability did not play a role in UBIs.

6. Conclusions

This exploratory and comparative study aimed to assess the current state of UBIs across two geographical contexts (the United Arab Emirates and Canada) to develop a coherent understanding of the nature and scope of such endeavours. Based on the analysis of the data, it is evident that there is a diverse range of UBIs that are operational both in Canada and the United Arab Emirates with varied ownership structures and purposes (Yasin et al., 2021) that address specific socio-economic, and policy needs for each nation (Sanyal and Hisam, 2018).

The findings also revealed that UBIs in both of these countries provided their academic institutions and their key stakeholders with a physical space that supports the development of novel products and services and therefore, concurs with the works of Yasin et al., (2021) and Yasin and Khansari (2021). However, most of these incubators offered were not typical of BIs in general as they combined resources from both private and governmental bodies (Sanyal and Hisam, 2018). The analysis also demonstrates that innovation among students and staff played a key role across all cases and that collaboration with the industry was integral to the mission, vision, and operations of the BIs across both contexts. This also extended to the development of curricula and extra-curricular activities as well as a mechanism to promote student recruitment.

Numerous contributions derive from this qualitative study. Firstly, our findings provide a contemporary understanding of the current state of UBI activities across both the United Arab Emirates and Canada. Secondly, the comparative approach illustrates how UBIs are embedded across diverse geographical and institutional contexts as well as illustrating how these UBIs play a key role in developing communication skills, curriculum development, extra-curricular activity, industry engagement, innovation, research skills, and strategic thinking. These findings transcend beyond the general purpose of BIs and UBIs to simply be "spaces or activities" relating to new product and service development towards recognising the broader range of activities, purposes, and functions of UBIs across both countries' contexts. Thirdly, the novelty of the comparative approach between two country contexts addresses the dearth and scarcity of comparative research in enterprise education, BIs, and more specifically UBIs across national contexts. Considering the variance of themes, the only key exception was the presence of UBIs in the UAE to be a mechanism to increase student recruitment, whereas this theme was absent in the Canadian sample. The limitation of this study is that we have focussed specifically on BIs that were housed within universities and do not address those that are partnered with Universities as an "outsourced function" therefore, this study remains focused on UBIs exclusively. Furthermore, another limitation of this study is the lack of generalisation of these cases and the availability of equivalent publicly available data across geographical and linguistic contexts. As such information was translated through forward and backward translation (particularly in Arabic) to English and therefore, is subjective. Although we have identified all UBIs based on web searches, other incubators may exist within organisations that have not been listed. Based on the wide-ranging and diverse implications for academics, policymakers, entrepreneurs, and students of higher education, further research should focus on strategic collaborations between the public and private sectors with universities in the development of UBIs, assess the efficacy of incubator cohorts from the perspective of the tenants enrolled on the programs and for this to be compared across geographical contexts, and also assess the challenges for UBIs across both of these contexts. As this research was conducted for the development of a physical UBI in the emirate of Dubai, the country selection was informed by the geographical contexts and therefore, the findings from this study will have practical implications for the development of a BI. Considering that both the UAE and Canada are 'embedded' in varying geographical, historical, institutional, and political contexts, they are equally committed to enhancing the efficacy of the core University-based activities and are aligned with the development of new products and services as well as improving human, social and financial capital of its tenants by offering a diverse range of programs/services.

References

Aerts, K., Matthyssens, P. and Vandenbempt, K. (2007) 'Critical role and screening practices of European business incubators', *Technovation*, Vol. 27, pp.254–267.

Ahmed N, Li, C, Qalati, S, Khan, A and Siddiqui, F. (2020). Role of Business Incubators as a Service Provider in Entrepreneurship Development. *Journal of Entrepreneurship & Organization Management.* 9 (1), pp1-7.

Al Malik, A. (2022). *Why Dubai has become an ideal incubator for start-ups*. [Online]. Gulf Business. Available at: https://gulfbusiness.com/why-dubai-has-become-an-ideal-incubator-for-startups/ [Accessed 17 August 2022].

Al-Mubaraki, H.M. and Busler, M. (2017) 'Challenges and opportunities of innovation and incubators as a tool for knowledge-based economy,' *Journal of Innovation and Entrepreneurship*, DOI: 10.1186/s13731-017-0075-y.

Baskarada, S. (2014) 'Qualitative case study guidelines', *The Qualitative Report*, Vol. 19, No. 40, pp.1–25.

Bollingtoft, A. and Ulhoi, J.P. (2005) 'The networked business incubator – leveraging entrepreneurial agency?', *Journal of Business Venturing*, Vol. 20, pp.265–290

Bonilla-Silva, E and People, C. (2022). *Historically White Colleges and Universities: The Unbearable Whiteness of (Most) Colleges and Universities in America*. Available: https://journals.sagepub.com/doi/abs/10.1177/00027642211066047. Last accessed 28th January 2022.

Crystal, J. (2022). *United Arab Emirates*. Available: https://www.britannica.com/place/United-Arab-Emirates. Last accessed 11th January 2022.

Dvoultey, O. (2018) 'Are publicly funded Czech incubators effective? The comparison of performance of supported and non-supported firms', *Eur. J. Innov. Manag*., Vol. 4, pp. 543-563.

Get Golden Visa. (2022). *Canada Start-up Visa Incubators: What Are They?*. [Online]. Get Golden Visa. Available at: https://getgoldenvisa.com/canada-startup-visa-incubator [Accessed 17 August 2022].

Guerrero, M., Urbano, D. and Gajón, E. (2020), "Entrepreneurial university ecosystems and graduates' career patterns: do entrepreneurship education programs and university business incubators matter?", *Journal of Management Development*, Vol. 39, No. 5, pp. 753-775.

Hall, R. (2022). *Canada*. Available: https://www.britannica.com/place/Canada. Last accessed 11th January 2022.

Hassan, N.A. (2020), "University business incubators as a tool for accelerating entrepreneurship: a theoretical perspective", *Review of Economics and Political Science*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/REPS-10-2019-0142

Imtiaz, H. (2021). *Leading Integration Strategies for Universities with SDGs Realization in Modern World*. Available: https://www.researchgate.net/profile/Hasnain-Sakib/publication/355081745_Leading_Integration_Strategies_for_Universities_with_SDGs_Realization_in_Modern_World/links/615cb4a5fbd5153f47e4a22e/Leading-In. Last accessed 12th February 2021.

Isenberg, D. (2010) 'How to start an entrepreneurial revolution', *Harvard Business Review*, Vol. 88, No. 6, pp.40–50.

Jones, G., Fleming, S. and Laugharne, J. (2020) 'The challenge of enterprise/innovation: a case study of a modern university', *Journal of Further and Higher Education*, Vol. 44, No. 1, pp.126–142.

King, N. and Horrocks, C. (2012). *Interviews in Qualitative Research*, SAGE Publication, London, UK.

Kurt, İ. (2021). An Overview to Private (Foundation) Universities in Turkey from the Terms of Society and Education. *Journal of Research in Social Sciences and Language*, 1(1), pp30–41.

Martens, H and Reiser, D. (2017). Analysing the image of Abu Dhabi and Dubai as tourism destinations – The perception of first-time visitors from Germany. *Tourism and Hospitality Research*. 19 (1), pp54-64.

Mouallem, A. (2019). *Start-ups Incubators in the UAE are Boosting Entrepreneurs* [online] https://atiejelmouallem.com/startup-incubators-in-the-uae/.

National Agency for Development to Small and Medium Enterprises in Slovakia (2009). *Internal Market, Industry, Entrepreneurship and SMEs*. [online] https://ec.europa.eu/growth/tools-databases/regional-innovationmonitor/organisation/slovenska-republika/slovak-business-agency-former-national-agencydevelopment-small-and (accessed 10 October 2020).

Pellegrini, M and Johnson-Sheehan, R. (2020). The Evolution of University Business Incubators: Transnational Hubs for Entrepreneurship. *Journal of Business and Technical Communication*. 35 (2), pp185-218.

Rashid, L. (2019). Entrepreneurship Education and Sustainable Development Goals: A literature Review and a Closer Look at Fragile States and Technology-Enabled Approaches. *Sustainability*. 11 (19), pp5343-5344.

Rehman, A.U., Al Shammari, S. and Al-Mamary, Y.H. (2021), "Role of religiosity and the mediating effect of luxury value perception in luxury purchase intention: a cross-cultural examination", *Journal of Islamic Marketing*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JIMA-03-2021-0091

Sanyal, S. and Hisam, M.W. (2018) 'The impact of teamwork on work performance of employees: a study of faculty members in Dhofar University', *IOSR Journal of Business and Management*, Vol. 20, No. 3, pp.15–22.

Seretny, M, Cazorla Milla, A, Azeem, M, Gaur, D, Jones, D, Ben Abdallah Moalla, R and Mataruna-Dos-Santos, L.J.. (2019). *Challenges Companies Encounter When Delivering Sustainable Solutions: Research Conducted in the United Arab Emirates*. Available: https://www.preprints.org/manuscript/201910.0106/v1. Last accessed 28th January 2022.

Statistics Canada. (2022). *Statistics Canada*. Available: https://www.statcan.gc.ca/en/start. Last accessed 12th February 2022.

UAE Government. (2022). *Fact sheet*. Available: https://u.ae/en/about-the-uae/fact-sheet. Last accessed 8th January 2022.

Yamockul, S, Pichyangkura, R and Chandrachai, A. (2019). University Business Incubators Best Practice: Factors Affecting Thailand UBI Performance. *Academy of Entrepreneurship Journal*. 25 (1), pp1-14.

Yasin, N. and Khansari, Z. (2021), "Evaluating the impact of social enterprise education on students' enterprising characteristics in the United Arab Emirates", *Education + Training*, Vol. 63 No. 6, pp. 872-905.

Yasin, N, Khansari, Z and Tirmizi, K. (2021). Exploring the challenges for entrepreneurship business incubator hubs in the United Arab Emirates. *International Journal of Globalisation and Small Business*. 12 (2), pp190-212.

Digital Innovation: The Challenges of a Game-Changer

Antonios Zairis [1] and George Zairis [2]
[1]Business Administration-Marketing, Neapolis University, Greece
[2]Sustainable Finance, University of Peloponnese, Greece
antoniszairis@gmail.com
georgezairis21@gmail.com

Abstract*:* A few years ago, marketing managers considered the Internet as another advertising channel and used it as a magazine advertisement, equipped with sound and motion. They placed banner ads and pop-ups to display advertisements on websites, but once again consumers identified them as distractions and found ways to ignore or avoid them. Nowadays, digital technology offers numerous ways for brands to engage with their customers and present new exciting challenges. It would not be an exaggeration to say that the marketing world is changing every day. But as the digital world is evolving, so is the balance shifting between consumers and marketing experts who try to adjust to this new era of consumer engagement. The purpose of the present paper is to address the question of how digital innovation is changing the marketing field. In a post-pandemic environment, terms like social media, artificial intelligence (AI), Internet of Things (IoT), Big Data, Cloud Computing, Blockchain, and cryptocurrencies, Augmented Reality marketing, and Virtual reality marketing are not just buzzwords but crucial aspects of digital marketing. Nonetheless, their integration into a business strategy is followed by the challenges accompanying them. The ever-changing nature and complexity of digital technology and other issues like privacy regulations and funding can be intimidating, especially for SMEs. In the field of entrepreneurship, their use can be viewed as a creative and innovative response to the evolving environment and an ability to recognize and exploit economic opportunities as many companies include the use of digital technology as the original idea. The theoretical framework of the aforementioned digital technologies and their use as marketing tools are analysed. This is followed by an insight into the digital transformation of Greek SMEs, the adoption of such technologies from start-up companies, and the opportunities they provide for the development of entrepreneurship.

Keywords*:* digital transformation, innovation, digital marketing, entrepreneurship, SMEs

1. Introduction

Innovation in marketing is considered an essential element of competitive advantage since it can change product design, pricing, packaging, and promotion (D'Attoma and Ieva, 2020). In a post-pandemic environment, terms like social media, artificial intelligence (AI), Internet of Things (IoT), Big Data, Cloud Computing, Blockchain, Cryptocurrencies, Augmented Reality, and Virtual Reality are not just buzzwords but crucial aspects of digital marketing. Nonetheless, their integration into a business strategy is followed by the challenges accompanying them. The ever-changing nature and complexity of digital technology and other important issues like privacy regulations and funding can be intimidating, especially for SMEs. In the field of entrepreneurship, it can be viewed as a creative and innovative response to the evolving environment and an ability to recognize and exploit economic opportunities considering many companies include the use of digital technology as the original idea. The purpose of the present paper is to provide an overview of the integration of digital innovation and the way new technologies are utilized as advanced marketing tools. It represents a theoretical approach regarding the key features of all these technologies, their importance in the marketing context, and their adoption by Greek enterprises.

2. The intersection of technology and marketing

Based on Hoffman et al., (2022, p.2) new technologies in marketing can be defined as "scientific knowledge and/or its application in the early adoption cycle for firms and/or consumers with the potential to influence the activity, institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large". In the following sub-sections, the concept of social media and certain elements of the Industry 4.0 that have reshaped the marketing landscape (Tuten, 2019), such as the Internet of Things, Big Data, Augmented and Virtual Reality, Artificial Intelligence, and Blockchain are presented.

2.1 Social Media

A few years ago, marketing managers considered the Internet as another advertising channel, and used it as a magazine advertisement, equipped with sound and motion. They placed banner ads and pop-ups to display advertisements on websites, but once again consumers identified them as distractions and found ways to ignore

or avoid them. Those methods were proved either inefficient or not as effective as expected (Weber, 2009) but marketing managers felt the pressure to embrace social media in order to keep up with new trends, harness their potential power, and follow the changes they brought to consumer behaviour (Bond, 2010; Dutta, 2010). Therefore, a new approach was needed. Nowadays, digital technology offers numerous ways for businesses to engage with their customers and presents new exciting challenges for marketing experts. It would not be an exaggeration to say that as the digital world evolves, so is the world of marketing. Social media has become an essential communication channel for companies, organizations, and institutions, but at the same time, the balance between consumers and companies who try to adjust to this new era of consumer engagement is shifting, thus fueling an ongoing discussion regarding the use of social media among both marketing practitioners and scholars. One could argue that social media has become mainstream and therefore is no longer a new technology or media, but for the purpose of this paper, we adopt the case that new is the application of scientific knowledge that has not been replaced by a different one (Hoffman et. al., 2022). And social media keep changing due to two main reasons: the first is technological innovation (as the platforms keep adding new features and services), and the second derives from the ever-shifting consumer trends (as they find new uses of the same media or create the need for new ones) (Appel et al.,2020). So, it is not old. Facebook reported having 2.93 billion monthly active users for the first quarter of 2022, remaining the most popular social media on a global scale (Statista, 2022).

But the question remains, is social media still vital as a marketing tool? Divol et al. (2012) stated that the element that makes this form of communication extremely important, is that it can influence consumers in each stage of their decision journey. Nevertheless, since each consumer is different, it makes it even more difficult to comprehend and influence his decisions (Barwitz and Maas, 2018). Therefore, it should be noted that if marketers do not rely on the basics (e.g., viral marketing, e-WoM, brand strategy, or message consistency) and are consumed by technological innovation, consumers would end up disloyal and confused (Doctoroff, 2014). So, let's go back to the basics. There are two concepts directly related to the use of social media as a marketing tool: e-Word of Mouth and viral marketing (Kaplan and Haenlein, 2011). According to Katz and Lazarsfeld (1955), WoM could influence consumer behaviour and be more effective than traditional advertising methods in impacting brand switching decisions (Hepp, 2019) while e-WoM had a higher diffusion speed for new pieces of information (Kaplan and Haenlein, 2011). Research showed that social media has altered the "bottom-down" model of traditional advertising to a "bottom-up" one. In the new model, the consumer is not just the receiver of a memorable and creative message but an active participant. If the user-generated content (UGC) is spread widely and fast, it will probably attract the attention of the traditional media, and will ultimately be spread to other audiences as well, as these two models could coexist even simultaneously (Hollis, 2013). Besides it is the consumers' participation that differentiates social media marketing from social media advertising, which ultimately leads to "earned media" and not "paid media" (Campbell et al., 2014). It seems that consumers relate more to a brand, after reading other customers' reviews on social media (Ioanas and Stoica, 2014). In addition to audience engagement, they also increase brand visibility and trust (Capitello et al., 2014; Ching-Wei, 2014), and are considered more sophisticated communication tools (Barbulet, 2013). Still, there were cases (at least at the early stages) that abstained from the use of social media and argued that their role in marketing was either debatable or considered inadequate (Drossos et al., 2011). For example, in the field of bank marketing, experts were reluctant at first mainly for security reasons or due to the lack of coordination with other marketing strategies (Mitic and Kapoulas, 2012). Nevertheless, it should be pointed out that their use also has serious risks for a company. User feedback could, for example, backfire as audiences can be offended by a message (Schlagwein and Hu, 2016). Nonetheless, monitoring the impact of brand positioning has been proven difficult (Sokolova and Kefi, 2020).

Aljukhadar and Senecal (2011) divided online consumers into three main categories: the basic communicators, the lurking shoppers, and the social thrivers who engage in more interactive media. Social media have transformed the third group from passive readers of a company's website to content creators. They can participate either in the demotion of a brand by posting negative comments on an online medium or in its promotion by praising it and even sometimes defending it against bad reviews (Colliander and Wien, 2013). The exact motives that drive consumers to post their opinion have not been fully ascertained yet. The trend could be attributed (in the case of a positive review) to altruistic behaviour, or to an attempt of gaining social acceptance/status and admiration regarding an exceptional purchase, and ultimately being characterised as an "expert". The opposite situation (that of a bad evaluation) could be the result of hostile behaviour or simply a search for revenge (Chen et al., 2011).

Another buzzword that is on the rise in the field of digital marketing is the "social media influencers". The term refers to social media users that have well-established credibility in their industry or profession and are connected to a large audience who trust their opinion (Arora et al., 2019). According to Forbes (2017), an influencer is a person who has the power to influence people's opinion on something or lead to a change in their behavior. Those individuals can create online content regarding their opinion on a product or service, make a review, post a personal story or even describe their feelings on their media, and that action can have a huge impact on a brand and perhaps influence many potential customers (Hsu et al., 2013). Furthermore, influencers should have the following characteristics: reach (to be able to spread the message to a large number of people), contextual credibility (the level of trust and power given to them by the public according to their knowledge and experience on a particular subject) and salesmanship (the communication style, the charismatic personality, and the talent to convince the public to follow their point of view). The stronger the above features, the more powerful their influence on the public. Those key individuals can be present in almost all sectors such as food, high-tech technology, fashion, health, fitness, and more (Klassen et al. 2018). What differentiates them from the traditional brand ambassadors is that they are not celebrities (e.g., famous actors, singers, or athletes) and their posts are not the traditional professional advertisements (Abidin, 2016). They usually present the products they have used and provide their opinion or experience on YouTube, Facebook, Twitter, and Instagram (Freberg, 2011). Brands collaborate with influencers to promote their products so that they can capitalize on their social networks and benefit from the "trustworthy and intimate relationship" they have built with their audiences (Khamis et al., 2016). Nonetheless, discovering the right influencer for brand promotion is not an easy strategy (Gan et al., 2019). It should also be noted that in terms of content marketing, it appears that nowadays a company's website is equally important to its social media and that applies to B2B and B2C channels (Statista, 2022b).

2.2 Digital elements of the Industry 4.0

2.2.1 Digital Reality (Augmented Reality and Virtual Reality)

According to Deloitte Consulting, Digital Reality is considered an umbrella term used to describe a wide set of technologies such as Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (which combines digital content into the real world), 360-degree video (users can look in every direction and therefore gain a better view of something), and other immersive experiences, that enable the stimulation of an artificial virtual environment through computer-generated contents (Deloitte Consulting,2018; IGI Global,2020; Baecker et al., 2021). Virtual Reality is a simulated experience that immerses users in an artificially constructed environment (physical or digital) that consists of virtual objects (i.e., computer-generated and displayed objects that appear similar to real ones) (Baranyi et al., 2021). For this purpose, they use wearable devices to prevent the real world (Bonetti et al., 2018). On the other hand, Augmented Reality refers to a combination of "real and computer-generated digital information into the user's view of the physical world, in such a way that they appear as one environment" (Olsson et al., 2013, p.288). As these technology elements grow, they affect marketing evolution and how entrepreneurs make their business decisions (Scholz and Smith,2016). More specifically, marketing research pointed out that VR connects to three stages of the consumer buying process. In the pre-purchase stage, VR has been more applied in manufacturing, designing, and testing new products, e.g., in the automobile industry by providing virtual test drives. It can also promote existing products or brands through communication campaigns, social media, or acting as advertising by simulating a product and its packaging. The use of VR provides consumers with a more vivid representation of the product and a more positive customer experience. Certain hotel chains, for example, offer their future quests the opportunity to visit their hotel room from home and the same applies to tourist agents about worldwide destinations. In the purchase stage, a virtual environment is created so that customers can visualize the products on sale. In the last phase consumers, interactions after the sale are included (Loureiro et al., 2019). On the other hand, AR applications in retail settings are used to a large extend used for the evaluation of products in the pre-purchase phase. According to Tan et al. (2022), the four applications of AR in retail are: entertaining and educating customers, helping them evaluate product fit, and adding to the post-purchase production experience. Using AR through mobile apps has been found to increase sales (especially for unpopular or not very appealing products and luxury brands) and reduced product-related uncertainty

2.2.2 Artificial intelligence

Another technological advancement that has affected the retail industry is Artificial Intelligence (AI). According to Kaplan and Haenlein (2019, p.3), AI is defined as "a system's ability to correctly interpret external data, to

learn from such data and to use those learnings to achieve specific goals and tasks through flexible adaptation." It has been used to automatically generate personalised offerings for consumers based on their search patterns and navigation histories (Hoffman et al., 2021). Bharadwaj et al. (2022), suggested that AI can enchase personal selling in a live stream retailing platform using computer vision to monitor the seller's facial activity (and therefore his emotions) and ultimately the way they affect his sales. It can also provide real-time coaching that can improve sales effectiveness and output. Raisch and Krakowski (2021) pointed out that AI also contributes to a company's new product development decisions. The invasion of AI could not leave social media intact either. It seems that, for the last decade, computer-generated algorithms (i.e., social bots) that can produce content and interact with social media users, have been widely settled on social media platforms. It has been estimated that 15% of active Twitter users are social bots (Appel et al., 2020).

2.2.3 Internet of Things

The term Internet of Things was introduced by Kevin Ashton at a presentation to Procter & Gamble in 1999 (Ashton, 2009). Although there is no official definition, for this paper we adopt the International Telecommunication Union – T Recommendation Y.2060 (2012, p.3) definition: "Internet of things (IoT): A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies." Its fundamental characteristics include its interconnectivity, its capability of providing things-related services, the heterogeneity of devices, the fact that the state and number of devices can change dynamically, and its enormous scale. According to Kumar et al., (2020) IoT it could be described as a data-oriented technology that senses, records and exchanges data about products in the physical world. From a marketing perspective there are two features of IoT products that are of great interest: product analytics and remote access. Product analytics is based on the autonomous collection of data regarding consumers' insights on product usage. Remote access, offers the possibility of remotely using IoT products or changing parameters. Both characteristics provide a wide range of new opportunities regarding research, strategic planning, decision-making, and other marketing purposes (Jara et al., 2014).

2.2.4 Big Data and Cloud Computing

Similarly, to IoT, many researchers have proposed their views on Big Data. It is an involving broad term that refers to traditional, structured, and transactional data as well as more unstructured, contemporary, behavioral data generated not only by traditional information exchange and software but also from sensors and every device that can produce digital information. In 2001, industry analyst D. Laney proposed the mainstream definition of the three Vs of Big Data: Volume(quantity), Variety (different forms), and Velocity (frequency of incoming data). Next to these dimensions researchers and practitioners have proposed additional Vs (e.g., Veracity, Variability, Visualization, Value, and more) (Patgiri and Ahmed, 2016; Dhamodharavadhani et al., 2018). With the support of another innovative technology i.e., Cloud Computing (on-demand computing systems and resources such as cloud storage) these massive quantities of raw data (customer, financial or operational) provide behavioral information about consumers and with the help of consumer analytics (which provides tools that find hidden patterns in data and therefore consumer habits), marketing managers translate them into market advantage. This offers competitive advantages, value creation, business opportunities, and cost reduction (Erevelles et al.,2015). It should be pointed that a Big Data system is important for marketing when it is used for the extraction of useful and effective knowledge that will influence business decisions (Amando et al., 2018). But as the influence of the Big Data phenomenon grows, so are the concerns about privacy issues, data leaks, and consumer privacy laws that if managed poorly will end up being a huge obstacle in a company's marketing strategy (Moorthy and Ghosh, 2015).

2.2.5 Blockchain and Cryptocurrencies

A Blockchain is a "consequential list (chain) of blocks (records), linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. It could be regarded as a public ledger, in which all committed transactions are stored in a chain of blocks. This chain continuously grows when new blocks are appended to it. Blockchain technology has characteristics such as decentralisation, persistency, anonymity, verifiability, and auditability" (Moro Visconti, 2019, p.). Blockchain and the controversial crypto-currencies (e.g., Bitcoin) are vulnerable to security attacks and that is the reason they raise security concerns and are faced with skepticism (Shin and Rise, 2022). Although the role of blockchain in marketing has not been explored in detail it could be integrated indirectly through the supply chain and digital payments and directly

through tokenization and smart contracts. It could ultimately lower advertising costs bringing more direct transactions between marketers and consumers and increasing transparency and trust (Antoniadis et al., 2019).

3. The use of digital technology by Greek SMEs

Most research on the digital transformation of Greek companies focuses on SMEs and not unjustly, as they are the backbone of the Greek economy. Although evidence about the integration of digital media by Greek companies regarding their marketing practices is scarce, few surveys present an indicative picture. In a previous study on the adoption of social media for marketing purposes, the most popular social media platforms were social networking sites, microblogging platforms, and video sharing tools. Fewer companies used photo-sharing applications and only a very small number had picked out RSS feed as their choice of a digital tool. At the time of the research (2012), the majority of participants had used social media for approximately two years. The main reasons (in descending order) for their use were to promote products and services, attract new customers, provide information about the brand, communicate with existing clients, improve corporate image, obtain and analyse information about consumers, and to provide customer service. The vast majority thought that social media was a useful marketing tool, and only a very small percentage described them as moderately useful. On the issue of funding, companies appeared divided regarding the existence of a specific social media budget (Zairis and Lagia, 2015). Triantafillidou and Yannas (2014) studied the use of social media specifically in public relations organizations. Their research showed that Greek practitioners had incorporated digital platforms in their communication campaigns, as they perceived the opportunities offered concerning research, public relations, and the formation of public opinion (views and beliefs) regarding a firm. The most common uses of these tools were the management of Facebook accounts (YouTube accounts were not so popular), the creation of corporate sites, and the implementation of email and viral campaigns. Results also showed that the presence of a social media professional in the company played a significant role in the implementation of digital campaigns, but so did the opinion that the public relations manager had on their advantages. According to the results of another study regarding how digital was business marketing in Greece, companies were divided into three categories: the “pioneers” who are described as the leading companies in the use of digital media (accounted only for 16%), the “beginners” who have just started to make their first digital steps (represented the 18%) and the “traditional” (accounted for 66%) who have an established presence in digital media. On the issue of advertising budget, most companies spent 18% of their total marketing budget on online campaigns, except for the travel industry which raised the percentage to more than 85%. An impressive 69% of the participants stated that they intended to increase their digital budget in the future. Facebook, was again the basic digital marketing tool that companies preferred while the potential of Twitter was growing. Regarding SEO, Greek companies although valued its importance were not so familiarised with its use, in comparison to SEM which was considered very valuable and more popular (Eltrun and Valuecom, 2015).

It should also be pointed out that most research on the integration of digital technologies by SMEs does not focus on marketing but their use in business generally. The same applies to the research of the Small Enterprises Institute (GSEVEE, 2020) about the understanding of key concepts of the new digital environment by practitioners working in the SME sector. Data revealed that: 75,3% were familiar with digital platforms, 60,5% with AI, 55,8% with Cryptocurrencies, about 36,5% with IoT and Cloud Computing, 27% with Big Data, and 15,9% with Blockchain technology. On the important subject of digital technologies’ integration into a business strategy, almost 60% use digital marketing and social media but only 15% use Cloud Computing. Recently, ELTRUN (2022) also surveyed the use of digital systems and infrastructure by SMEs and compared their results with those of 2020. Even though results can in no way be described as impressive, an increasing trend was nevertheless recorded. The use of websites increased (from 70% in 2020 to 78% in 2022) and the same applied to digital campaigns implemented by professionals (from 17% in 2020 to 33% in 2022). In addition, 2 out of 3 businesses use servers. On the other hand, the use of technologies such as IoT (4%) and the utilization of Data Analytics (25%) was limited. It appears that their limited resources force Greek SMEs to choose only the absolute necessary technologies for their management purposes as well as for the expansion of their customer base even though a digital marketing technique could be detrimental to the survival of a startup or a small company (Dianeosis.org, 2022).

4. Conclusion

There is no doubt that social media and digital technologies are no more a side project in the communication mix, and that marketing managers have increased the advertising budgets of social media tools, which are now used in conjunction with the traditional media. It should be pointed out that although all companies share many

of the same objectives (e.g., brand awareness or customer engagement) they should customize their social media strategy to meet their specific goals. After all, social media is just the tip of the marketing iceberg. Marketers should be more creative, search for the media channels and technologies that are unique for their audiences, and should use both digital and non-digital tools to meet their goals. Regarding their use in Greece, it appears that executives acknowledge the role of digital technology and social media in marketing, understand their value and try to incorporate them into their marketing strategy. Data showed that in the last decade digital technology in Greece has shown increasing trends although there are still many obstacles to be covered. The most important trend is the change in attitude from luxury technologies to necessary tools even by small businesses. It is now obvious that companies applying emerging technologies such as cloud, big data, mobile, and social technologies acquire higher revenues in the long run and bigger market valuations than their competitors. It should also be noted, that using as many of these technologies as possible is not the appropriate strategy. There should be a clear vision of a company's development and therefore the necessary tools should be chosen.

Although the study advances knowledge in the area of digital innovation and marketing and provides useful literature for real-world applications in entrepreneurship (e.g., marketing campaigns) it has limitations such as the lack of more data on Greek SMEs. Therefore, further research needs to be carried out regarding their use in Greek companies specifically in the marketing domain. Other important issues that should be addressed in the future are their relationship with the basic rules of marketing, how well strategically organized the social media campaigns and measuring their true value. After all, it would be disappointing if it all turned out to be just buzzwords.

References

Abidin, C. (2016) "Visibility labour: Engaging with Influencers' fashion brands and #OOTD advertorial campaigns on Instagram," *Media International Australia*, 161(1), pp. 86–100.

Aljukhadar, M., and Senecal, S. (2011), 'Segmenting the online consumer market', *Marketing Intelligence & Planning*, Vol. 29 No. 4, pp.421 – 435

Amado, A., Cortez, P., Rita, P. and Moro, S. (2018) "Research trends on Big Data in Marketing: A text mining and topic modeling based literature analysis," *European research on management and business economics*, 24(1), pp. 1–7.

Antoniadis, I., Kontsas S., Spinthiropoulos, K. (2019) "Blockchain Applications in Marketing", 7th International Conference on Contemporary Marketing.

Appel, G., Grewal, L., Hadi, R. and Stephen, A.T. (2020) "The future of social media in marketing," *Journal of the Academy of Marketing Science*, 48(1), pp. 79–95.

Arora, A., Bansal, S., Kandpal, C., Aswani, R. and Dwivedi, Y. (2019) "Measuring social media influencer index- insights from facebook, Twitter and Instagram," *Journal of retailing and consumer services*, 49, pp. 86–101.

Ashton, K. (2009), "That Internet of Things Thing: In the real-world things matter more than ideas". *RFID Journal.* Available from: http://www.rfidjournal.com/articles /view?4986. [Accessed 1 May 2022].

Baecker, O., Finger, K. and Mesic, E. 2021. *Digital Reality explained... in under 100 words. Available at https://www2.deloitte.com/ch/en/pages/innovation/articles/digital-reality-explained.html* [Accessed 1 May 2022].

Baranyi, P., Csapo, A., Budai, T. and Wersenyi, G. (2021) 'Introducing the Concept of Internet of Digital Reality – Part I'. *Acta Polytechnica Hungarica*, 18(7), pp.225-240. Available at: http://acta.uni-obuda.hu/Baranyi_Csapo_Budai_Wersenyi_114.pdf [Accessed 1 May 2022].

Barbulet, G. (2013) "Social Media-A pragmatic approach: contexts & implicatures," *Procedia - Social and Behavioral Sciences*, 83, pp. 422–426.

Barwitz, N. and Maas, P. (2018) 'Understanding the omnichannel customer journey: Determinants of interaction choice', *Journal of Interactive Marketing*, 43, pp. 116–133.

Bond, C. (2010) *Engagement with social media and outcomes for brands: A conceptual framework*, *Anzmac2010.org*. Available at: https://www.anzmac2010.org/proceedings/pdf/anzmac10Final00478.pdf [Accessed: May 28, 2022].

Bonetti, F., Warnaby, G. and Quinn, L. (2018) "Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda", in *Augmented Reality and Virtual Reality*. Springer International Publishing, pp. 119–132.

Campbell, C., Ferraro, C. and Sands, S. (2014) "Segmenting consumer reactions to social network marketing," *European journal of marketing*, 48(3/4), pp. 432–452.

Capitello, R., Agnoli, L. Begalli, D. and Codurri, S., (2014) 'Social media strategies and corporate brand visibility in the wine industry', *EuroMed Journal of Business*, Vol. 9 No 2, pp. 129-148.

Chen, Y., Fayb, S. and Wangc, Q. (2011) 'The role of marketing in social media: How online consumer reviews evolve', *Journal of Interactive Marketing,* Vol. 25 No.2, pp.85-94.

Ching-Wei, H. (2014) 'Consumer behavior on Facebook', *EuroMed Journal of Business*, Vol. 9 No 3, pp. 252-267.

Colliander, J. and Wien, A.H. (2013) 'Trash talk rebuffed: consumers' defense of companies criticized in online communities', *European Journal of Marketing*, Vol. 47 No.10, pp.1733 – 1757.

D'Attoma, I. and Ieva, M. (2020) "Determinants of technological innovation success and failure: Does marketing innovation matter?," *Industrial marketing management*, 91, pp. 64–81.

Deloitte Consulting. (2018) *Digital reality: A technical primer.* Available at: https://www2.deloitte.com/content/dam/insights/us/articles/4426_Digital-reality-primer/DI_Digital%20Reality_Primer.pdf [Accessed 1 May 2022].

Dhamodharavadhani, S & Rajasekaran, G. and Rathipriya, R. (2018) "Unlock Different V's of Big Data for Analytics". Conference: First International Conference on Computer Vision, Networks and Informatics (ICCVNI 2018).

Dianeosis.org (2022). Mapping the Greek start-up ecosystem. Available at: https://www.dianeosis.org/wp-content/uploads/2022/01/startups.pdf [Accessed 1 May 2022].

Divol, R., Edelman, D. and Sarrazin, H. (2012) *Demystifying social media*, *Mckinsey.com*. McKinsey & Company. Available at: https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/demystifying-social-media [Accessed: May 27, 2022].

Doctoroff, T. (2014) *Twitter is Not a Strategy: Rediscovering the Art of Brand Marketing*. Pallgrave McMillan, United States.

Drossos, D.A., Fouskas, K.G., Kokkinaki, F. and Papakyriakopoulos, D. (2011) "Advertising on the internet: perceptions of advertising agencies and marketing managers," *International journal of internet marketing and advertising*, 6(3), p. 244.

Dutta, S. (2010) "What's your personal social media strategy?", *Harvard business review*, 88(11), pp. 127–30, 151.

Gan, T., Wang, S., Liu, M., Song, X., Yao, Y. and Nie, L. (2019) "Seeking Micro-influencers for Brand Promotion," in *Proceedings of the 27th ACM International Conference on Multimedia*. New York, NY, USA: ACM.

ELTRUN (E-Business Research Center /Athens University of Economics and Business) and VALUE.COM. 2015, *State of digital leadership*. https://www.slideshare.net/sntelos/state-of-digital-leadership-2014 [Accessed 1 May 2022].

ELTRUN and Cosmote. 2022, *The digital readiness of small and medium-sized enterprises in Greece.* https://www.growyourbusiness.gr/news/i-psiphiaki-etoimotita-twn-mikromesaiwn-epixeirisewn-stin-ellada-2022 [Accessed 6 August 2022].

Erevelles, S., Fukawa, N. and Swayne, L. (2016) "Big Data consumer analytics and the transformation of marketing," *Journal of business research*, 69(2), pp. 897–904.

Forbes (2017). https://www.forbes.com/sites/forbescommunicationscouncil/2017/11/14/what-is-influencer-marketing-and-how-can-marketers-use-it-effectively/#5994d62423d1(Accessed 9 May 2022).

Freberg, K., Graham, K., McGaughey, K., and Freberg, L.A. (2011) 'Who are the social media influencers? A study of public perceptions of personality, *Public Relations Review,* Vol. 37 No 1, pp. 90-92.

Godes, D., Mayzlin, D., Chen, Y., Das, S., Dellarocas, C., Pfeiffer, B., Libai, B., Sen S., Shi, M., and Verlegh, P. (2005) 'The firm's management of social interactions', *Marketing Letters*, Vol.16 No.3-4, pp. 415-428

Hanna R., Rohm A. and Crittenden, V.L. (2011) 'We're all connected: The power of the social media ecosystem', *Business Horizons*, Vol. 54 No.3, pp.265-273.

Hansen D., Shneiderman B. and Smith, M.A. (2011) *Analyzing social media networks with Node XL: Insights from a connected world*, Elsevier, Boston.

Hepp, A. (2019) "Katz/Lazarsfeld (1955): Personal Influence," in *Schlüsselwerke der Netzwerkforschung*. Wiesbaden: Springer Fachmedien Wiesbaden, pp. 293–296.

Hill, R. A. and Dunbar, R.IM. (2003) 'Social network size in humans', *Human Nature*, Vol. 14 No. 1, pp.53-72

Hoffman, D.L., Moreau, C.P., Stremersch, S. and Wedel, M. (2022) "The rise of new technologies in marketing: A framework and outlook", *Journal of Marketing*, 86(1), pp. 1–6. doi:10.1177/00222429211061636

Hollis, N. (2013), 'Top down and bottom up marketing' http://www.millwardbrown.com/global-navigation/blogs/post/mb-blog/2013/11/25/Top-down-and-bottom-up-marketing.aspx (Accessed 9 May 2019).

Hsu, C., Lin, J.C. and Chiang, H. (2013) 'The effects of blogger recommendations on customers' online shopping intentions'. *Internet Research,* Vol. 23 No 1, pp. 69–88

IGI Global. (2020) *Employing Digital Reality Technologies in Art Exhibitions and Museums: A Global Survey of Best Practices and Implications*. Available at: https://www.igi-global.com/chapter/employing-digital-reality-technologies-in-art-exhibitions-and-museums/241599 [Accessed 1 May 2022].

Ioanas, E., and Stoica, I. (2014) 'Social media and its impact on consumers behavior', *International Journal of Economic Practices and Theories*, Vol. 4 No.2, pp. 229-303

ITU. (2012) "Overview of the Internet of Things.", Available at: http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=Y.2060 [Accessed 1 May 2022].

Jara, A.J., Parra, M.C. and Skarmeta, A.F. (2014) "Participative marketing: extending social media marketing through the identification and interaction capabilities from the Internet of things," *Personal and ubiquitous computing*, 18(4), pp. 997–1011.

Kaplan, A.M. and Haenlein, M. (2011) "Two hearts in three-quarter time: How to waltz the social media/viral marketing dance," *Business horizons*, 54(3), pp. 253–263.

Kaplan, A. and Haenlein, M. (2019) "Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence," *Business horizons*, 62(1), pp. 15–25.

Klassen, K.M., Borleis, E.S., Brennan, L., Reid, M., McCaffrey, T.A., and Lim, M.S. (2018), "What people 'like': analysis of social media strategies used by food industry brands, lifestyle brands, and health promotion organizations on Facebook and Instagram. *Journal of Medical Internet Research*. Vol. 20 No 6, pp. e10227

Khamis, S. Ang, L. and Welling, R. (2016): Selfbranding, micro-celebrity and the rise of social media influencers, *Celebrity Studies*.

Loureiro, S.M.C., Guerreiro, J., Eloy, S., Langaro, D. and Panchapakesan, P. (2019) "Understanding the use of Virtual Reality in Marketing: A text mining-based review," *Journal of business research*, 100, pp. 514–530.

Mitic, M. and Kapoulas, A. (2012), Understanding the role of social media in bank marketing. *Marketing Intelligence & Planning*. Vol. 30 No. 7, pp. 668-686.

Moorthy, J. and Ghosh, P. (2015) "Big Data and Consumer Privacy". *The Journal for Decision Makers*. 40. 92 - 95.

Morgan, N., Jones, G., Hodges, A., (2010), 'Social media: The complete guide to social media from the social media guys', available at http://rucreativebloggingfa13.files.wordpress.com/2013/09/completeguidetosocialmedia.pdf [Accessed 9 May 2022].

Moro Visconti, R. (2019) "Blockchain valuation: Internet of value, digital networks and smart transactions," *SSRN Electronic Journal* [Preprint]. doi:10.2139/ssrn.3533860.

Olsson, T., Lagerstam, E., Karkkainen, T. and Vaananen-Vainio-Mattila, K. (2013) "Expected user experience of mobile augmented reality services: A user study in the context of shopping centres", *Personal and ubiquitous computing*, 17(2), pp. 287–304. doi:10.1007/s00779-011-0494-x.

Patgiri, R. and Ahmed, A. (2016) "Big data: The V's of the game changer paradigm," in *2016 IEEE 18th International Conference on High Performance Computing and Communications*

Raisch, S. and Krakowski, S. (2021) "Artificial intelligence and management: The automation–augmentation paradox," *Academy of management review*, 46(1), pp. 192–210.

Schlagwein, D. and Hu, M. (2016), 'How and why organisations use social media: five use types and their relation to absorptive capacity', *Journal of Information Technology*, pp.1–16

Scholz, J. and Smith, A.N. (2016) "Augmented reality: Designing immersive experiences that maximize consumer engagement," *Business horizons*, 59(2), pp. 149–161.

Sokolova, K. and Kefi, H. (2020) "Instagram and YouTube bloggers promote it, why should I buy? How credibility and parasocial interaction influence purchase intentions," *Journal of retailing and consumer services*, 53(101742), p. 101742.

Small Enterprises' Institute-GSEVEE (2020). *Digital Transformation and Small Business*. Available at: https://imegsevee.gr/ekthesi-imegsevee-2020-psifiakos-metasximatismos-mikres-epixeiriseis/ [Accessed 13 May 2022].

Statista. (2022) Number of monthly active Facebook users worldwide as of 1st quarter 2022. Available at: https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

Statista. (2022b) 'Social media marketing usage rate in the United States from 2013 to 2022 https://www.statista.com/statistics/203513/usage-trands-of-social-media-platforms-in-marketing/ (Accessed 13 May 2022).

Triantafillidou, A. and Yannas, P. (2014) 'How public relations agencies in Greece respond to digital trends', *Public Relations Review*. Vol. 40, pp.815-817.

Weber, L. (2009) *Marketing to the social web: How digital customer communities build your business,* John Wiley & Sons, Inc., New Jersey.

Zairis, A. and Lagia, P. (2015) 'Social Media: The new trend in marketing communication', *Journal of Euromarketing*, Vol. 24 No 1,pp. 62-80.

PhD Research Papers

Innovation and Entrepreneurship of Professors in Public Universities: Case Study in Brazil

Paula Geralda Barbosa Coelho and Márcia Siqueira Rapini
Federal University of Minas Gerais, Belo Horizonte, Brazil
coelhopaula@ufmg.br
msrapini@cedeplar.ufmg.br

Abstract: In the literature on academic entrepreneurship, the creation of academic spin-offs is one of the Knowledge and Technology Transfer (KTT) channels most studied. The use of different KTT channels and the creation of spin-offs can be a source of opportunity for the overflow of knowledge and innovation with wealth creation. Although with a broad spectrum, research on academic entrepreneurship still has gaps to be explored in the literature. In Brazil, there is a lack of studies that explain more specifically how the professor at the public university transfers knowledge and technology and undertakes entrepreneurial activities. The main motivations of the doctoral research presented in this article are the lack of studies concerning the trajectory of successful entrepreneurial professors and the exploration of the use of different KTT channels in academic entrepreneurship for wealth creation. The general goal of the research is to identify the strategies used during the innovation trajectory of entrepreneurial professors in Information Technology (IT), who converted knowledge and scientific assets into wealth. To meet this goal, an adapted retrospective roadmapping approach was used to collect data, to map and to analyze the life trajectory of innovation of six professors from three Brazilian Public Universities in the IT area. The results made it possible to understand how professors innovated, became entrepreneurs and transferred knowledge and technology. They mobilized 136 strategies using different channels (e.g., Entrepreneurs Training, Collaborative Research and Development Projects, Technology Residency, Academic Spin-offs Creation, Academic Consulting). The professors' strategies resulted in a value distribution, with considerable wealth (tangible and intangible). The results showed that although there is no pattern in the professors' trajectories of innovation and entrepreneurship, there are several strategies common to the cases. One of them was to train qualified personnel at the university, based on intensive research in knowledge seeking to solve real market problems.

Keywords: innovation and entrepreneurship, entrepreneurial professors, information technology, knowledge and technology transfer, Brazilian public university, roadmapping

1. Introduction

The university has an important role in entrepreneurship and entrepreneurial activities (Hayter et al., 2018). Innovation and wealth creation can occur from academic entrepreneurship (Shane, 2005). The academic entrepreneurial practice is related to Knowledge and Technology Transfer (KTT) (Rothaermel, Agung and Jiang, 2007). In this sense, a KTT from the university to society can be accomplished in several ways and it occurs in addition to professional development teachings, academic spin-offs creation and patent licensing (Audretsch, Lehmann and Wright, 2014; Orozco-Barrantes, 2020).

In Brazil, studies on innovative activities and academic entrepreneurship are few when compared to the United States and the United Kingdom (Hayter et al., 2018). There are no publications that look at the actors and academic researchers involved in KTT at an individual level (Bercovitz and Feldman, 2008). Despite the studies found in the literature, it is not always wise to indiscriminately “copy” from developed countries if they are not properly adapted to the Brazilian institutional context and characteristics (Orozco-Barrantes, 2020). Taking this into account, Brazil should consider aspects that are more relevant and appropriate to the Brazilian university context (Siegel and Wright, 2015). It should also consider the determinant aspects that help the professor to innovate, to undertake as well as to perform entrepreneurial activities both at the university and at the individual levels (e.g., training, entrepreneur behavior), at the institutional level (e.g., resources, policies, university culture) and his/her access to resources (e.g., financial, physical, human, technological, social) and management (Breschi et al., 2019; Rothaermel, Agung and Jiang, 2007). It would also be important to consider understanding the university's entrepreneurial and innovation ecosystems (e.g., actors, legal structure to foster innovation, economic sectors, stakeholders) and the role that the university and the entrepreneurial professor have within said ecosystems (Lemos, 2012). Moreover, it is important to underscore the fact that several of these aspects may affect the academic researcher´s entrepreneurial decision. As far as strategies adopted for the academic entrepreneurship, there is a lack of research applying a structure of strategic choices to factors that influence university strategies and that also examine the narrative adopted by different universities to rationalize and communicate their adopted strategies (Siegel and Wright, 2015).

This study investigates the strategies used by six successful entrepreneurial professors from three Brazilian public universities in the Information Technology (IT) area: Federal University of Minas Gerais (UFMG), Federal University of Pernambuco (UFPE) and Federal Rural University of Pernambuco (UFRPE). These universities are ranked as some of the country's best especially in the areas of teaching (undergraduate and post-graduate), scientific research and entrepreneurial and innovation initiatives. In this study, a structured mapping of innovation life experiences was done for each of the professors who, using several KTT channels have transformed knowledge and scientific assets into wealth. The term "wealth" in this study is related to the value that was created, captured and distributed (Bowman and Ambrosini, 2000). Wealth can be a tangible type of asset (e.g., money) or intangible (e.g., strengthening the university brand; creation of technology that can save lives).

2. Theoretical background

Academic entrepreneurship has been seen as an important channel for knowledge and transfer of technology from science to industry and has been receiving greater political attention. Products resulting from research are the most recognized form of academic entrepreneurship (Breschi et al., 2019). There are determinant aspects both at the individual and at the institutional levels that can affect a professor´s decision whether to undertake and to perform entrepreneurial activities at the university. The social capital factor of the scientist, which refers to his/her potential to derive benefits (both tangible and intangible) from interactions and activities in cooperation with individuals and groups can be a determinant factor in the scientific entrepreneurship (Aldridge et al., 2017). Moreover, a professor´s entrepreneurial activities and behavior are directly related to determinant aspects at the institutional level. The universities can make strategic choices (Bowman and Ambrosini, 2000; Casadesus-Masanell and Ricart, 2010) as far as the use of the channel to transfer the knowledge and technology that they wish to emphasize (Siegel and Wright, 2015).

Academic entrepreneurship is a topic that is broader than academic spin-offs and patent licensing which are only a subset of technology transfer (Rothaermel, Agung and Jiang, 2007; Shane, 2005). The university channels for KTT are intrinsically related to the University-Enterprise (U-E) interaction, which is the driving force for innovation, economic development, technology advance and competitivity in the country (Audretsch, Lehmann and Wright, 2014). The U-E interaction can be a vehicle for the transfer of knowledge and technology for both the university and the enterprise (Dutrénit and Arza, 2010).

Academic Spin-offs Creation is one of the KTT channels used to explore commercially the university's technology innovations and knowledge generated and accumulated from academic research (Shane, 2005). In the development of *Collaborative Research and Development (R&D) Projects* of the university with companies, there is a bidirectional flow of knowledge transfer, from the university to the company and from the company to the university. The bidirectional channel may be the most appropriate to transfer tacit knowledge and can be best to solve technology bottleneck problems by personal interaction with long-term benefits. The development of Collaborative R&D Projects can reduce investment costs and innovation risks for the companies and may foster more research for the universities (Dutrénit and Arza, 2010; Garcia, Rapini and Cário, 2018). The *Academic Consulting* usually prompts an activity for the university´s specific human resource and while in the partnership for the Research, Development, and Innovation (RD&I) or R&D projects different resources are allocated to reach the result established in the work plan for this type of project. Results from the latest Industry Research on Technology Innovation by the Brazilian Institute of Geography and Statistics (IBGE, 2020) show that technology services in Brazil are relevant for innovation in the domestic industry both as a source of information and as encouragement to enter into partnerships and cooperation to generate innovation. There are *Technology Residency* programs at some universities that draw inspiration from Medical Residency Programs. In IT courses are named simply as Residency or Software Residency (Sampaio et al., 2005). The goal of these professional programs is to qualify and train human resources. These Education and Research Institution programs are mostly science applied to every day real life problems, i.e., so the university can understand the skills required by companies to solve their problems and to execute transfers of know-how (tacit knowledge) by the professional qualification and training of human resources*. Entrepreneurs training* can be seen as a KTT channel. Professors and students trained as entrepreneurs by the university and using the university's scientific and technical knowledge from several knowledge areas can be more readily encouraged to easily create new enterprises including knowledge intensive enterprises. Or, still, even without creating an enterprise, they can generate new, marketable products, services and technologies facilitated both by the technical, technology and scientific skills acquired at the university and by learning how "to be an entrepreneur," transferring even more knowledge and

technology and, as well, by generating even more value (Breschi et al., 2019; Rothaermel, Agung and Jiang, 2007).

The work related to this study is the one by Hirose and Phaal (2016) – the authors used roadmapping with a retrospective approach, as a research method to capture entrepreneur's past experiences and personal perspectives on the emergence of technology ventures (e.g., independent ventures, spin-offs, or internal corporate ventures). In this work, multiple case studies with 13 companies have been conducted in Europe and Asia-Pacific regions, including the United Kingdom, The Netherlands, Japan, and Australia, to demonstrate the utility and applicability of the approach in a variety of ventures and technological sectors across different country settings.

3. Methodology

This is a qualitative and exploratory research with multiple case studies of the life trajectory of innovation of IT entrepreneurial professors (professor's trajectory) using different KTT channels. This study used the roadmapping method. The use of roadmapping is a powerful and practical way to support organizations in their strategy, for long-term planning, innovation and forecasting activities (Kerr and Phaal, 2021). An adaptation of the retrospective roadmapping method was applied (Hirose and Phaal, 2016) for data collection, mapping and qualitative analyses of the trajectory of the successful IT professors at the UFMG, UFPE and UFRPE universities. In the roadmapping section, an interview takes place and, in parallel, the preparation of the roadmap. The roadmap is a map containing collected data and that can be drawn either physically in a cardboard (using post-its) or digitally using the appropriate software. Roadmapping can be used for prospective planning (visualization of the future). It can also be used in a retrospective approach where the timeline is inverted to provide a useful framework for application of historical projects development, as a tool for research and diagnostic and to learn from the past.

The goal of this study was to investigate the strategies used by entrepreneurial IT professors, from Brazilian federal universities, in KTT, while creating and distributing value using different channels. Personas were created for the entrepreneurial professors selected for this study for purposes of anonymity: Prof. Charles and Prof. Joseph (from UFMG); Prof. Kim, Prof. Walter, and Prof. Willy (from UFPE); and Prof. Oswaldo (from UFRPE).

An adapted roadmap was used for data collecting and analyses in order to meet the goal proposed in this study; it includes choosing dimensions for the roadmap (prepared at the roadmapping session). An adaptation was also made for the application of the roadmap, i.e., organization and execution of interviews with each professor where, in parallel, a roadmap was prepared with a timeline of the stages of their innovation trajectory.

The first thing done in the roadmapping section was to present to the professor the roadmap dimensions and an explanation of its meaning. After that, the professor was asked to freely talk about his experience with entrepreneurship and innovation throughout his life, observing aspects that could fit into the roadmap dimensions. The interviewer used a table prepared by him with questions about each dimension of the roadmap (e.g., Has a business model been developed?; Was any project management methodology used?; Did the technology created have a pioneering or disruptive innovation?). These questions were not presented to the professor. These questions were used by the interviewer to better understand what the professor said. But, if the professor did not mention anything in his narrative about these questions, then the interviewer asked him those questions sometime during the interview. The interview lasted two hours. Only one of the interviews (Prof. Oswaldo's interview) was done remotely. During the interview, for each professor, data was collected and distributed in eight dimensions which were then adapted for the roadmap: *Strategy, Technology, Value Created, Value Distributed, Partnership, Main Stakeholder, Resource, and Environment*.

3.1 Data analysis

After each interview, the data was refined by listening to the interview, each of which was recorded, and by consulting the Internet for additional information for the data collected from each professor. During the refinement phase, the data was recorded in a spreadsheet with eight tabs, each one representing one of the eight roadmap dimensions. In addition, to help understand the logical sequence of findings (data), considering the timeline of the professor's trajectory stages, the roadmap of some professors was redrawn in a digital format while the spreadsheet was being filled out. This spreadsheet made it easier to analyze individual and global cases.

The individual analysis of the cases examined the most significant aspects of each case, key questions about the strategies used, important points of the findings in each one of the dimensions of the roadmap, the lessons learned cited by the professor (barriers and facilitators for academic entrepreneurship), and channels used for KTT. The global analysis of the cases sought to revisit each case and interpret its main findings, formulating propositions, grouping/categorizing and compiling the narratives between the cases, contextualizing, understanding and recording the perceived and observed reality, along the trajectory of the entrepreneurial professors, and confronting the relevant evidence with the theoretical review carried out in the study.

4. Results and discussion

Several results were found in this study. Results that contribute to the literature and that are relevant to the Brazilian context will be presented and discussed. Overall, 136 strategies used by the professors were identified. These strategies were classified according to their nature (Table 1).

Table 1: Strategies used by entrepreneurial professors

Nature	Total	Example of Strategy Used
Management	**71**	Invite other university professors to participate in the spin-off´s society; Come up with solutions and products of impact, knowledge-intensive, with a lot of research, keeping up on the latest results from the world´s literature. Hiring of a Project Manager for the team; Prepare and execute a Business Plan; Prepare relevant Scientific Production, accepted at the distinguished conferences; Initially choose a community and begin to solve its problems, using own research; Attend spin-offs team meetings.
Personnel Qualification	**28**	Prepare a research agenda (during orientation for master´s and PhD students) focusing on research geared towards real market problems (applied research).
Resources	**32**	Hire a highly qualified team: technical, business, commercial and strategic; Create strategic alliances with other professors from the university's departments in order to offer course subjects such as entrepreneurship and innovation at the same time. In this way, these courses, non-officially, thus avoiding university bureaucracy and then becoming, in practice, one sole course with professors from several departments. The students enrolled in these courses attend classes together at one sole location (for instance, the university´s main auditorium); Participate (as coordinator, consultant or researcher) in collaborative R&D projects with domestic and foreign companies; Have a strong relationship, and constantly interact, with stakeholders.
Market	**5**	To be “bilingual”, know how to speak academic language and corporate language, updated on the latest literature research, and knowing how to listen/understand both society and the market; Create a multiplatform, multiuser software in several languages.

Of all the strategies, 78 (57%) appeared only once in a case and 58 (43%) appeared in more than one case (use of similar strategies). Among the 58, 27 (46%) strategies were “Management”. This evidence reinforces the importance of a professor´s access to management knowledge for their entrepreneurial activities (Breschi et al., 2019; Shane, 2005) either by hiring a professional manager for project development or by acquiring a partner for his/her spin-off that understands financial management (Hayter et al., 2018). Moreover, the professor may hire a complementary team with experience and knowledge of management, business, products and markets, among other subjects or he/she can either enroll in management courses or use the partner´s expertise (e.g., investor) (Shane, 2005). As far as “Management” strategies it is important to point out that in the strategies classified as “Intellectual Property Management” none of the UFPE professor´s narratives included information on the university´s Technology Transfer Office (TTO). This evidence also suggests that the few IP experiences observed in the cases may be related to an individual´s cultural issues and the university´s IP culture (O'Shea et al., 2005) on issues related to the university´s TTO (for instance, when it contains abusive terms in the license; a request for higher amounts for royalty participation and hiring; has bureaucratic practices for licensing and hiring; or, still, will only do IP protection with exclusivity) (Feld, 2020).

The use of several “Resources” was identified as “Physical” (e.g., the university´s research lab), “Social,” “Technological,” “Human,” and “Financial”. Considering the strategies classified as “Resources,” the “Financial” type was the most used by the professors regardless of the type of KTT channel. This evidence is in line with the recurrent need for money for entrepreneurial activities and innovation and, especially, to maintain and invest

in spin-offs growth since, frequently, it requires a greater effort for its technical and market development, among other needs (O'Shea et al., 2005; Shane, 2005). It was also observed that all professors distributed the financial value "Money" ("tangible") to the university, their students and themselves, by participating in more than one enterprise, using more than one KTT channel, resulting in technologies, products, services and/or spin-offs. A total of 68 distributed values were found in the cases. The cases showed a large amount (60) of the distributed value of the "intangible" type (only eight are the "tangible" type). Table 2 shows a sample of 12 of these distributed values in the cases that were identified according to their nature.

Table 2: A few values distributed from the strategies used by the entrepreneurial professors

Type	Nature	Example of Distributed Values
Tangible	**Money**	Participation of the professor on the academic spin-off´s profits and dividends.
	Research	Grants for research scholarships for professor and/or research and internship for students.
Intangible	**Award**	Awards earned in competitions/contests recognizing the relevance of knowledge, research, technology or university undertaking giving visibility to the university and the researchers involved.
	Competitive Advantage	Commercialization/distribution of software/hardware in several countries.
	Entrepreneurship	Startups founded by university students with professor support.
	U-E Interaction	Expansion of networking and proximity to market companies.
	Infrastructure	Improvement of the infrastructure of the professor's laboratory.
	Job Creation	Hiring market professionals.
	Marketing	Recognition in Brazil and the world of the university´s competencies and excellence in research and projects related to the professor´s field of knowledge.
	Personnel Qualification	Hundreds of students currently work on Games area because they had studied in a pioneering discipline in Brazil (and Latin America) that was created by the professor.
	State of the Art	Relevant scientific research publications with high worldwide impact.
	Training	Training of specialized professionals for the market.

Figure 1 shows the KTT channels used by the professors. The identified KTT channels are described in the gray arrows. The professors used them in each stage of their trajectory. The main channel is highlighted in bold, i.e., the most used by the professor at that stage. It can be seen in Figure 1 that Professor Kim (UFPE) in his fourth stage (Stage 4) stated that he used the channel "Technology Residency" (his most used channel) as well as other channels: "Academic Spin-offs Creation" and "Collaborative R&D Project". This professor took part in a Software Residency program (channel same as "Technology Residency") enabled by a proposed Brazilian IT Law, with a multinational company (channel same as "Collaborative R&D Project") and he created, at the same time, a spin-off with her master´s student (channel same as "Academic Spin-Off Creation").

It is worthy to note that the professors from this study still continue to research, to innovate and to engage in entrepreneurial activities. Five of them continue to be founding partners of spin-offs (still open and operational). This is evidence of the strong positive effects of financial resources for innovative activities and continuity both for the company (spin-off) and for the individual researcher. It is also worthy to note that the strategies classified as "Resources" of the "Social" type were used during all the professor's trajectory stages as they counted on the support of strategic partners. In all of the professors' trajectory stages, it was also observed strong interactions and collaborative activities with several stakeholders: Professors and students (from their own departments and from other departments); the university´s TTO; companies and market suppliers; several government institutions; other research institutions; technology park; and suppliers. This evidence suggests that access to social resources, by establishing good relationships and social networks is aligned to the success of the entrepreneurial professor. It also suggests that social resources can foster a process of discovery and the exploration of market opportunities, increasing access to resources (e.g., human, physical and financial resources), the maintenance of partnerships already established and to the acquisition of new partnerships (O'Shea et al., 2005). Thus, this evidence also strengthens the fact that access to social resources (the researcher´s social capital) expands the professor´s tendency to use more KTT channels, either by developing more collaborative R&D projects, supplying more academic consulting, participating in more technology residency programs or creating more spin-offs (Aldridge et al., 2017). The evidence in the cases related to "Social

Resources" also highlights the importance and need of entrepreneurial professors (or a team member or spin-off) to have skills to access and to explore relationship networks, research networks and business networks both within and outside the university (Hayter et al., 2018; Shane, 2005).

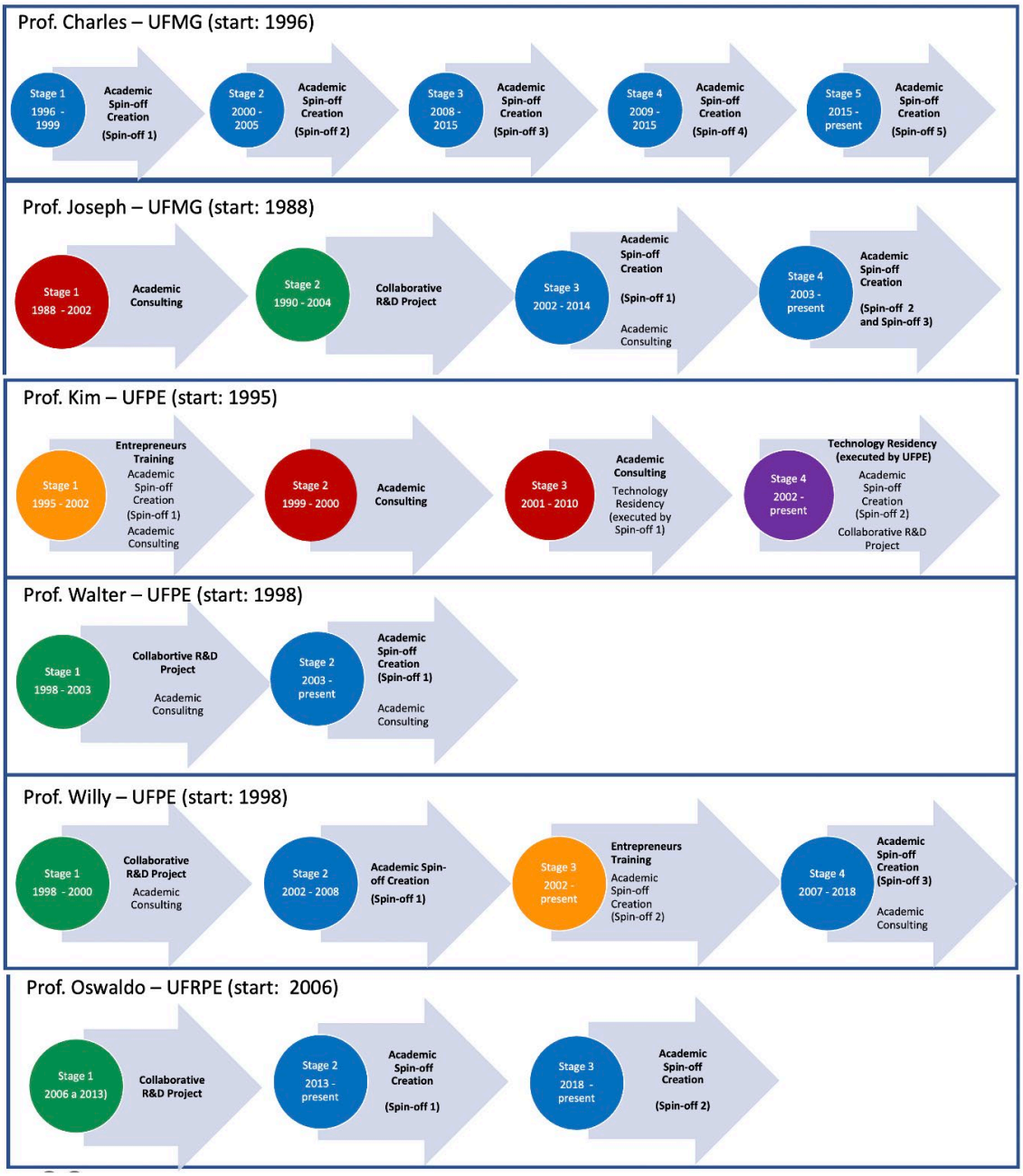


Figure 1: KTT channels used by the entrepreneurial professors along their trajectories

The strategies classified as "Human" type of "Resources" used by the professors showed a preference by the professors to hire "qualified" or "highly qualified" personnel. In this context, since the university is responsible for developing people, including through the professors, strategies used by the professors related to "Personnel Qualification" was actually expected especially due to the type of KTT channel used (e.g., Technology Residency, Collaborative R&D Project). However, an evidence relatively unexpected was that some professors' spin-offs came about from research projects developed by students (especially those in the master and doctorate programs) who then became partners of the professor in his spin-offs. The professor's own students or other university students appeared in several stages of the professor's trajectory in the cases. Even though it seems obvious, this evidence strengthens the relevance of the university´s teaching and research mission and the development of qualified personnel (Guaranys, 2010). However, it is worthy to note that most strategies in the cases related to "Personnel Qualification" show the "care" and contribution of the entrepreneurial professors

in the training quality of their students (O'Shea et al., 2005). They used "Training of Qualified Labor" strategies, be it by teaching differentiated disciplines (including seeking to solve market problems) where the student learns not only theory but also the practice (Martinelli, Meyer and von Tunzelmann, 2008); or, by guiding the master and doctorate students "efficiently"; be it by creating disciplines that result in jobs and competitivity for the students; or even by hiring the students to participate in collaborative R&D projects with companies. Moreover, the expressive amount of strategies related to "Personnel Qualification" that appears in the cases also reinforces the fact that in order for the academic entrepreneurship and entrepreneurial activity to occur it is necessary that the university and the professors are truly responsible and have the same "care" shown by the professors in this study in the development of "qualified" human resources (Hayter et al., 2018; Rothaermel, Agung and Jiang, 2007).

Analyses of the strategies used classified as "Market" show that there is a concern among the professors about good communication skills in the business context (Shane, 2005) and that it is a must to have a team member who is "bilingual," i.e., someone who can speak both the academic language as well as the market language, who knows how to listen and understand their problems (social needs) (Aldridge et al., 2017). Also, in some strategies classified as "Personnel Qualification" it is possible to perceive the professor´s concern with the "Market," for instance, when the professor stated that while teaching and during orientation for the master and doctorate students, he required that his students solve real market problems and that they also need to understand and to solve society´s problems. This evidence reinforces the importance of developing technologies that create value for the market and for society in academic entrepreneurship (Bowman and Ambrosini, 2000; Casadesus-Masanell and Ricart, 2010; Hayter et al., 2018).

However, it is important to point out that many instances of innovation in the cases began with a student creating a software developed in a machine (computer) and using a free software as a platform for development. This can be seen in Professor Kim´s (UFPE) trajectory when he created his second spin-off with his master student. This evidence suggests that in order to build a groundbreaking technology and/or disruptive technology in the IT area it may only be necessary to implement an algorithm that solves a problem using a computer. On the other hand, it is important to note that the creation of a groundbreaking technology does not, in itself, generate a business venture. Lastly, as far as a KTT, it was noticed that the more a technology that was transferred creates value (e.g., technology with disruptive innovation or pioneering), more value was distributed, showing a strong value creation of the technology. Likewise, it was also noticed that the more a knowledge that was transferred creates value, more value was distributed (Bowman and Ambrosini, 2000).

In sum, from the evidence shown in the results, it was noticed that some determinant aspects in the academic entrepreneurship for an effective KTT (with wealth creation) deserve attention for the possible evolution of more innovative and entrepreneurial activities by the professors, taking into account the context of Brazilian public universities and the IT field. Table 3 shows the main determinant aspects found in the cases related to both institutional level, i.e., university level (Level U) and the individual level, i.e., the professor as an academic entrepreneur (Level I).

Table 3: Main determinant aspects for academic entrepreneurship in Brazil

	Level	
Main determinant aspects for the evolution and occurrence of academic entrepreneurship at Brazilian public universities	**U**	**I**
Supply of resources (e.g., physical, financial, human, technological, social) to foster more intensive research on knowledge and excellence, accomplish more KTT and encourage more academic entrepreneurship.	X	
Reformulation of the university´s internal policies considering the determinant aspects for academic entrepreneurship, the local ecosystem and the Brazilian context in order for the university to be truly entrepreneurial and favors the occurrence of more academic entrepreneurship.	X	
Training of qualified manpower and training of entrepreneurs from the undergraduate to postgraduation, teaching theory and practice, solving real societal and market problems.	X	X
Management teaching and practice (e.g., projects, business, strategic management): Methodology, tools and techniques and the market´s best practices.	X	X

	Level	
Main determinant aspects for the evolution and occurrence of academic entrepreneurship at Brazilian public universities	**U**	**I**
Perform intensive research on knowledge that generates innovation and technologies with higher degree of maturity and technological base and well-founded to solve really societal/market problems.	X	X
Development/improvement of some soft skills (interpersonal skills) inherent to the entrepreneur.	X	X
Access to knowledge and management practices and/or acquisition/access to people (professionals) with this knowledge to carry out KTT.	X	X
Investment in the use and combination of other knowledge and technology transfer channels (besides patent licensing) which are more adequate to the IT field to create wealth.	X	X
Use of several KTT channels in order to complement the training of qualified manpower (e.g., Academic Spin-off Creation, Collaborative R&D Projects, Academic Consulting, Entrepreneurs Training, Technology Residency).	X	X
Understand and follow upon the evolution and opportunities related to the main elements and characteristics of the entrepreneurial and innovation ecosystems (e.g., market, economic sectors, current legal framework, initiatives to foster innovation, main stakeholders, success stories, culture, geographic proximity) and the role the university and the academic entrepreneur have in the ecosystem.	X	X
Access to financial resources outside the university (e.g., government, investors).	X	X
Access and expansion of social network, research network and business network both within the university and out (social resources).	X	X
Expansion of interaction with the market, getting to know its demands, challenges and opportunities.	X	X

5. Conclusions

Although in Brazil patent licensing has been the most encouraged channel for technology transfer in most universities (Azevedo, 2005), none of the professors applied for a patent licensing. The professors in these cases used several types of KTT channels. They were able to create and to distribute a considerable amount of value. Thus, one of the important results of this study is to demystify the patent as the sole channel for KTT with value creation and distribution.

As it can be seen, from the strategies used and the variety and amount of needed resources (especially financial) the KTT (regardless of channel) is not simple and does not happen in a linear and natural fashion. Another result that called attention, common to all the cases, was that every KTT came about from students or the qualified training and effective orientation by students. Behind the strategies used, along the life trajectory of innovation of IT entrepreneurial professors, is the training of people, that ends up by fostering and encouraging entrepreneurship and the generation of new ventures. This result shows that it is important to work on the training of qualified students (Guaranys, 2010), from their undergraduate level, broadly, taking into account the training (basic teaching) in knowledge areas (competencies) up to teaching of innovation and entrepreneurship in well-structured disciplines. People training at the university is the thread that leads to academic entrepreneurship, including forming entrepreneurial professors (Siegel and Wright, 2015).

In the case studies, no university programs were identified to encourage a professor´s academic entrepreneurship. The research suggests that the main motivation for the professors to be entrepreneurs, at the start of their trajectory of innovation, was not solely related to "making money" but the achievement of transferring results of successful, pioneering and/or innovative research as well as bringing benefits to society (Dias, 2018; Kirchberger and Pohl, 2016). The distributed tangible value of the cases appears to be a consequence of the KTT with the choice of several strategies using several types of channels.

Despite several contributions, this work also has some limitations. The research included only cases of successful entrepreneurial professors, operating in the IT field, and their "success stories". It is suggested a bigger sampling in future research that includes both success stories and failures in academic entrepreneurship. It is also suggested the inclusion of other Brazilian public universities. This expanded research may allow, for instance, to compare case results in a way that it is possible to understand the best and worst strategies used by the professors taking into account a KTT with wealth creation at the same university or among universities. Besides

allowing for the comparison of results, also consider the determinants for academic entrepreneurship as far as similarities and differences among components of the entrepreneurial and innovation ecosystems of each university (e.g., university policies and culture, local innovation system).

References

Aldridge, T. T. et al. (2017) "Scientist Entrepreneurship Across Scientific Fields", In Audretsch, D. and Link, A. (Orgs.) *Universities and the Entrepreneurial Ecosystem*, [online], Edward Elgar Publishing, pp 67–84, https://www.elgaronline.com/view/edcoll/9781786432780/9781786432780.xml.

Audretsch, D. B., Lehmann, E.E. and Wright, M. (2014) "Technology Transfer in a Global Economy", *The Journal of Technology Transfer*, Vol 39, No. 3, June, pp 301–312.

Azevedo, G. C. I. (2005) *Transferência de Tecnologia Através de Spin-Offs: os Desafios Enfrentados pela UFSCAR,* Post-Graduate in Production Engineering, Master's Thesis, Federal University of São Carlos, São Carlos.

Bercovitz, J. and Feldman, M. (2008) "Academic Entrepreneurs: Organizational Change at the Individual Level", *Organization Science*, Vol 19, No. 1, January, pp 69–89.

Bowman, C. and Ambrosini, V. (2000) "Value Creation Versus Value Capture: Towards a Coherent Definition of Value in Strategy", *British Journal of Management*, Vol 11, No. 1, March, pp 1–15.

Breschi, S. et al. (2019) "Public Research and Innovative Entrepreneurship: Preliminary Cross-Country Evidence from Micro Data", *OECD Science, Technology and Industry Policy Papers*, OECD Publishing, Paris, No. 64, March.

Casadesus-Masanell, R. and Ricart, J. E. (2010) "From Strategy to Business Models and onto Tactics", [online], *Long Range Planning*, Vol 43 Vol 2-3, April, pp 195–215, http://www.businessmodelcommunity.com/fs/Root/8oex1-Casadesus_et_Ricart.pdf.

Dias, I. (2018) *Da Docência à Criação de Spin-offs Acadêmicos: Aspectos Que Impactam na Decisão de Levar a Pesquisa Para o Mercado*, Post-Graduate in Technological Innovation and Intellectual Property, Master's Thesis, Universidade Federal de Minas Gerais, Belo Horizonte.

Dutrénit, G. and Arza, V. (2010) "Channels and Benefits of Interactions Between Public Research Organizations and Industry: Comparing Four Latin American Countries", *Science and Public Policy*, Vol 37, No. 7, August, pp 541–553.

Feld, B. and Hathaway, I. (2020) *The Startup Community Way : Evolving an Entrepreneurial Ecosystem*, John Wiley & Sons, Inc, New Jersey.

Garcia, R., Rapini, M., and Cário, S. (Orgs.) (2018) *Estudos de Caso da Interação Universidade-Empresa no Brasil*, UFMG Cedeplar, Belo Horizonte.

Guaranys, L. R.. (2010) "Universidade Empreendedora: Conceito em Evolução, Universidade em Transformação", In Lopes, R. M. A. (Ed.) *Educação Empreendedora: Conceitos, Modelos e Práticas*, Elsevier, Rio de Janeiro, pp 93-142.

Hayter, C. S. et al. (2018) "Conceptualizing Academic Entrepreneurship Ecosystems: a Review, Analysis and Extension of the Literature", *The Journal of Technology Transfer*, Vol 43, No. 4, February, pp 1039–1082.

Hirose, Y.; Phaal, R. (2016) "A Retrospective Visual Mapping Approach for Understanding the Emergence of Technology Ventures", *R&D Management Conference*, Cambridge, Vol 3, No. 6, June, pp 1-16.

IBGE. (2020) Pesquisa de Inovação PINTEC 2017, [online], IBGE, https://www.ibge.gov.br/estatisticas/multidominio/ciencia-tecnologia-e-inovacao/9141-pesquisade-inovacao.html?edicao=27431&t=publicacoes.

Kerr, C. and Phaal, R. (2022) "Roadmapping and Roadmaps: Definition and Underpinning Concepts", *IEEE Transactions on Engineering Management*, Vol 69, No. 1, August, pp 6–16.

Kirchberger, M.A. and Pohl, L. (2016) "Technology Commercialization: A Literature Review of Success Factors and Antecedents Across Different Contexts", *The Journal of Technology Transfer*, Vol 41, No. 5, June, pp 1077–1112.

Lemos, P. (2012) *Universidades e Ecossistemas de Empreendedorismo: a Gestão Orientada por Ecossistemas e o Empreendedorismo da Unicamp*, Editora Unicamp, São Paulo.

Martinelli, A., Meyer, M. and von Tunzelmann, N. (2007) "Becoming an Entrepreneurial University? A Case Study of Knowledge Exchange Relationships and Faculty Attitudes in a Medium-Sized, Research-Oriented University", *The Journal of Technology Transfer*, Vol 33, No. 3, June, pp 259–283.

O'Shea, R. et al. (2005) "Entrepreneurial Orientation, Technology Transfer and Spin-off Performance of US Universities". *Research Policy*, Amsterdam, Vol 34, No. 7, September, pp 994-1009.

Orozco-Barrantes, J. (2020) "Una Visión Crítica del Concepto de Transferencia Tecnológica y de Conocimiento", In Suárez, D., Erbes, A., and Barletta, F. (Orgs.) *Teoría de la Innovación: Evolución, Tendencias y Desafios: Herramientas Conceptuales para la Enseñanza y el Aprendizaje,* Edicones Complutense, Universidad Nacional de General Sarmiento, Madrid, pp 381-401, https://repositorio.una.ac.cr/handle/11056/18038.

Rothaermel, F.T., Agung, S.D. and Jiang, L. (2007) "University entrepreneurship: a taxonomy of the literature", *Industrial and Corporate Change*, Vol 16, No.4, August, pp 691–791.

Sampaio, A., et al. (2005) "Software Test Program: a Software Residency Experience. *Proceedings of the 27th International Conference on Software Engineering, 2005*, ICSE 2005, IEEE, 15-21 May, Saint Louis, pp 611-612.

Shane, S. A. (2005) *Academic Entrepreneurship: University Spinoffs and Wealth Creation*. Edward Elgar Publishing.

Siegel, D. S., and Wright, M. (2015) "Academic Entrepreneurship: Time for a Rethink?", *British Journal of Management*, Vol 26, No. 4, May, pp 582-595.

University Science Parks as an Innovative Tool for University-Business Cooperation

Klaudia Glittová and Miroslav Šipikal
University of Economics in Bratislava, Slovak Republic
klaudia.glittova@euba.sk
miroslav.sipikal@euba.sk

Abstract: Collaboration between universities, business and government is important in creating innovation, but often they face barriers which block the successful cooperation among institutional spheres. To improve and strengthen collaboration and overcome existing barriers were created hybrid organizations (like university science parks, research centres or incubators) to address innovation blockages. With the growing popularity of this tool among regional policy makers, there is a need to specify their roles and functions in regional innovation systems. The main goal of our paper is to examine the contribution of university science parks and research centres in Slovakia, which were built thanks to financial support from European Structural and Investment Funds (ESIF). University science parks (USPs) and research centres (RCs) are tools for connecting the university, industry and government sector in a Triple helix framework. They create a suitable space for generating innovation with existing resources at universities, research institutes, research departments of companies and governments, and improve them through mutual interactions. We applied the method of quantitative research – an online questionnaire survey complemented with interviews, which we used to collect basic data on all science parks in Slovakia. The key question in the article is whether research infrastructures represent effective investment with long-term sustainability. We evaluated the current functioning of the parks in terms of fulfilling the functions that contribute to innovation creation, because quality and modern infrastructure is a prerequisite for the implementation of research, the results of which have a high development and innovation potential. We found that the research infrastructure doesn't perform the required functions, which were declared during their creation. The main barriers to development include insufficient funding for research, technological infrastructure and long-term financing of professional staff. Unclear conditions for the continued operation of parks and uncertain position of government support shows that these investment projects financed by the European Funds are not independently viable after the end of the sustainability period.

Keywords: innovation, university science parks, cooperation, enterprises

1. Introduction

The competitiveness of countries and regions in sustainable growth is based on innovation and technology which depends to a large extent on the ability to create an attractive infrastructure environment that supports interactions between universities and industry (Battelle, 2007). The activities of universities have increased significantly, the main changes can be observed in joint activities with companies such as research projects, contract research and activities to support innovative entrepreneurship. Universities thus help to establish companies through their university incubators or science and technology parks (Blažek and Uhlíř, 2011). The level of technical infrastructure has qualified by human resources, a basic condition for the quality of research activities.

According to several international statistics (such as European Innovation Scoreboard or Community Innovation Survey by EU), Slovakia has been long-term on the last stages of the EU countries in terms of comparative evaluations of research and innovation results. The Triple helix model points to the increasing and necessary overlap of activities between universities, government and the private sector. There are many barriers that block successful overlapping activities and mutual cooperation between actors. Within the Triple helix model, it is possible to create independent hybrid organizations at the intersection of overlapping activities, which can be one of the solutions to innovation blockades (Champenois and Etzkowitz, 2018).

Observing European research and development trends, we see that focusing on creating European Research Area and intensifying the research base is an increasing priority. Success in European research means a high concentration of human and financial resources, strong background need to connect specialized workplaces with a focus on interdisciplinary research (Brzica et al., 2014). University science parks (USPs) and research centres (RCs) are one of the hybrid organization tools for connecting the academic and private sectors (Champenois and Etzkowitz, 2018). Over the past two decades, USPs been a continued source of interest for academics and policy makers due to their potential to aid innovation (Messina et al. 2022; Nieth and Benneworth, 2020). They create a suitable space for creating innovation using existing resources

at universities, research institutes, research departments of companies and governments, and improve them through their interactions. On the other hand, in addition to identify the strengths, benefits and motivating factors, it is necessary to focus on the barriers and weaknesses of joint innovation activities that prevent mutual cooperation between the actors of the Triple helix model.

The present paper examines the position of USPs and RCs in Slovakia. The key question that this article will address is whether research infrastructures represent effective investment for active collaboration between actors with long-term sustainability. We have tried to evaluate the current functioning in terms of fulfilling the functions that contribute to strengthen university-business cooperation, because quality and modern infrastructure is a prerequisite for the implementation of research, the results of which have a high development and innovation potential.

2. Theoretical framework

University Science Parks and Research Centers represent a special type of science park in which universities offer facilities for researchers on the development processes of projects with market potential. If a regional development entity, government agency, developer, or global technology company establishes a park in partnership with a university, it is defined as USP. The primary goal of this interconnection of university research parks for tenants is some form of access to university resources (knowledge, talent, infrastructure equipment), which is expected for further regional economic development. There are more added values for universities – facilitating the commercialization of university research, attracting and funding excellent researchers, increasing publishing activities and creating patents (Link and Scott, 2003). According to the Association of University Science Parks (AURP, 2021), the main idea is to generate, attract and maintain research institutions and talents in line with sponsoring research institutions, which include universities, public and private research laboratories. Information flows from academia to the business sector are rapidly taking place in geographically close regions and they are an essential tool for creating innovation (Alegre et al., 2019). At the same time, they bridge the gap between the supply of universities and the private sector on the demand side, requiring the knowledge and expertise of universities (Leyden et al., 2008). They are also seen as a solution to complex political and economic regional problems in society, such as industry (Autio and Klofsten, 1998), in addressing the lack of commercialization of publicly funded research (Nowotny et al., 2001) or the lack of new innovation in the market. Universities expect commercialization their research and secure funding for more.

Almeida et al. (2020) show that science and technology parks are presented as a panacea for countries to catch up and accelerate the costly processes of structural changes. Globally, successful examples such as Silicon Valley, Cambridge or Grenoble have led to a boom across whole Europe by promoting universities or regional development agencies. They have become an element of the operationalization of regional innovation policy (Vasquez-Urriago et al. 2016, Guadix et al. 2016). However, in areas with insufficient R&D capabilities, these investments have proved to be very controversial. A strong focus on science in regions where companies are weakly linked to universities and the small technology market has led to inefficient results. Developed regions have built regional innovation systems on international context, R&D activities also rely heavily on endogenous initiatives (Meyer-Krahmer and Reger, 1999). Less developed regions face problems of lack of visibility and attractiveness due to lower income and technological levels. Although publicly managed R&D with investment in higher education institutions, what has enabled them to develop human capital and excellence in several scientific domains. USPs and RCs can contribute to increasing the external visibility and potential of the region and to attracting research, development and technology centres of transnational companies.

Although the literature is lightly more focused on developed and rapidly developing regions, the unfavorable results of various science parks have highlighted the need to balance the perspective of scientific pressure with considerations of demand. If the return on R&D needs to be maximized, especially in public R&D, Watkins-Mathys and Foster (2006) argue that policy makers and managers need to pay more attention to business. Therefore, it is necessary to emphasize the possibilities focused on the ability to attract external companies. Many European regions are making significant progress in subsidizing technology inputs, but they still lack a real innovation system because the interactions between academic research outputs and the technological activities of existing firms are weak. Science parks can be seen as a major contributor to the consolidation of regional innovation systems and act as a major impulse for structural change (Hobbs et al., 2017). To make

science parks successful, they should integrate design functions into the support of university products, attracting and grouping external R&D initiatives from transnational companies, but also from public and non-profit institutions (Almeida et al., 2020).

With the growing popularity of this tool among policy makers, it was necessary to specify their roles and functions in regional innovation systems (RIS). The regional approach is emphasized mainly in relation to the importance of geographical proximity and maximizing synergies between actors. At the same time, it emphasizes the need to strengthen cooperation and create innovation networks. USPs and RCs actively contribute to RIS concepts. If the park is effective, it will be at the heart of the RIS building process and play a key role in providing certain functions that the innovation system must supply (Table 1). They also contribute to the application of strategic R&D activities and the creation of knowledge and expertise. In addition, to attracting other external companies, there may also be an active grouping of companies and other institutions in the region and thus participate in their development. Edquist (2005) considered 10 functions that cover several areas – R&D, competence institution building, new products, identification of system needs, creation of organizations, innovation networking, incubation activities, financial resources and cooperation relationships. Almeida et al. (2020) also refers to Edquist's identification of functions in his research which considers them appropriate in terms of scope of UVP competencies.

Table 1: Functions and indicators of URPs and RCs with contribution in RIS

FUNCTION	CONTRIBUTION TO RIS	INDICATOR
Knowledge creation – University R&D	Creation of technological opportunities	Own research
Knowledge creation – Business R&D	Facilitating the access to technological inputs	Common research with enterprises, contract research
Technology transfer	Technology transfer and interactive learning, STPs can promote a market for knowledge and reduce transaction costs	Transfer technology offices, patent office
Networking	Joint location of companies in the region	Cooperation with enterprises/sectors
Creation of new firms	Technological opportunities and its transformation into economic opportunities.	Incubators and projects supporting business, business consulting
Clustering	As an attractor for foreign firms that seek technological inputs for their R&D activities.	FDI
Business support services	Provision of business support services within an STP fosters business sophistication for newly created firms. Business consultants are more aware of technological aspects.	cooperation with venture capital funds
Specialization	High degree of specialization for one activity.	Specialized professional workplaces
Common infrastructure	STPs generate some agglomeration economies by the existence of common infrastructures and amenities. High quality, low building construction ratio.	Renting of business premises and devices to extern institutions
Community involvement	Local or regional governments and external nonprofit agencies make the STP a node of the RIS.	Collaboration with regional partners (such as regional governments, non-profit org ..)

Source: Edquist 2005, Almeida et al., 2020

3. Methodology

Other authors evaluate the measurement of impacts and results of USP performance by different methods and it is not precisely determined which tool should be used / which is correct for evaluating implemented activities (Squicciarini 2008; McCarthy et al. 2018). The problem of a small quantity of theoretical knowledge about USPs point to different strategies for their conceptual solutions (McCarthy et al., 2018), as they may differ in the focus of their activities, research methods or role in the regional innovation systems.

The literature points to the heterogeneity of methodological approaches to research implementation. In most cases, the authors apply qualitative research methods. They approach either case study (Park 2002, Albahari et al. 2013, Etzkowitz a Zhou 2018, Albahari et al. 2019, Cadorin et al. 2019), semi-structured interviews or questionnaire surveys (EC 2014, Lis a Romanowska 2018, Balog 2019, Olvera et al. 2020). Indicators assessed

in the studies include, for example - linkages with universities, infrastructure area, staff numbers, specialization, total R&D expenditure, provided services, number of companies established in parks, networking, establishment of a technology transfer office, number of patents and publications, innovation results, revenue or internationalization (Guadix et al. 2016, McCarthy et al., 2019, Almeida et al. 2020). The European Commission also used several basic criteria/indicators in the evaluation, such as park area, number of host companies or number of employees (EC, 2014). Based on the selected indicators, we evaluated their significance in Slovakia through a questionnaire survey.

Given the main objective of the parks, which is to support innovation, it is necessary to correctly determine the appropriate evaluation parameters. We conceived our submitted research similarly to the research that was carried out. We applied the method of quantitative research – an online questionnaire survey, which we used to collect basic data on all USPs and RCs in Slovakia. As part of the survey, we contacted all 14 USPs/RCs to whom we sent online questionnaires. We received fully completed questionnaires from 7 subjects, so our research had a 50 % return. We realized the questionnaire survey took place from April to June 2021 and consisted of closed and open questions. The questionnaires were structured into several areas: basic information, evaluation of state support and support mechanisms, barriers to further development, activities and services implemented in USPs/RCs, cooperation with external partners and research results. As we focused more on the evaluation of USPs/RCs functions in the region in our paper, the results describe 14 activities and services that are currently underway in comparison with those that the individual entities plan to implement in the future. We also divided them into 4 areas: research (own, contracted, joint with companies), rent of premises and equipment, professional advisory services and consultations, cooperation (with companies, other actors at the regional and international level, with venture capital funds). In the next steps of our research, we will plan to address selected subjects through interviews.

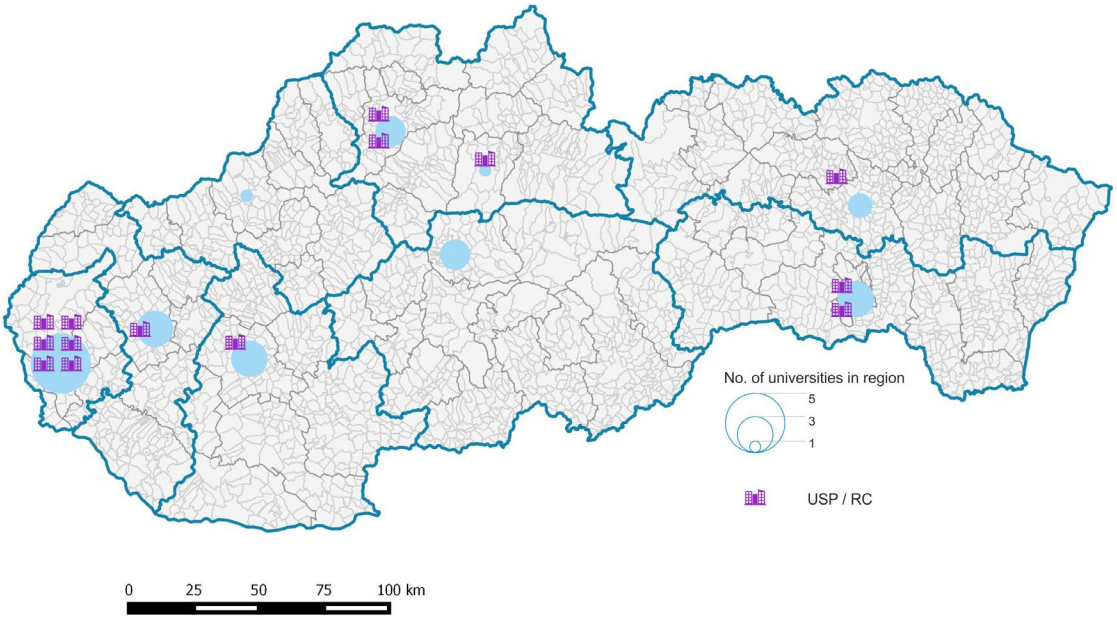
4. Results and discussions

In the V4 countries, many public and private R&D institutions had problem with the limited capacity of research facilities, insufficient material equipment, brain drain or lack of specialized staff and cooperation with private sector. Similarly, it was case of Slovakia too, because universities had not had experience with active cooperation, entrepreneurial activities, and R&D development. The lack of practical experience and financial resources for setting up R&D infrastructure had not created opportunities for the implementation, integration and support for university-business cooperation.

The implementation of USPs and RCs projects began in the mentioned programming period 2007-2013 within the operational programme Research and Development. The Ministry of Education, Science, Research and Sports as a budgetary authority announced calls for demand-oriented projects entitled "Building university science parks and research centres". The projects were mostly implemented as consortium projects of several organizations, which made it possible to support the networking of public R&D organizations and improve specialization processes (Jakab, 2020). A total of 14 strategic research and development infrastructure projects were supported. The purpose of the challenge was to create USPs and RCs, composed of academic institutions and possibly also with economic entities, which will be equipped with modern research infrastructure, and whose results of research and/or development will be: qualitatively at the international level, applicable in practice and linked to the needs of key industries in Slovakia (MŠVVaŠ SR, 2012). The main aim was to strengthen the innovation environment by promoting cooperation between academia and the private sector and the subsequent commercialization of research results. In total, projects were supported with more than 400 million €. Neverthless, the project implementation dates were extended to the 2014-2020 programming period and divided into two phases. The original budget of individual projects was adjusted in the amendments to the contracts, which reduced the total amount of allocated funds to 429.63 million € (NKÚ, 2019).

The established USPs and RCs are located mainly in the Bratislava region (6), Žilina region (3) and Košice region (2), one project in Trnava region, Nitra region and Prešov region and none in Trenčín region and Banská Bystrica region. The highest concentration of USPs and RCs is in the capital city Bratislava, due to its strategic location, which intensively opening up to the business and innovation environment. Due to the fact that almost half of these entities are located in the Bratislava region, the level of services and their functionality for regional innovation systems is much higher. A relatively well-developed network of universities, research institutes connected to the newly built research infrastructure that offers several advantages for potential

cooperation with other partners in the region. The Bratislava Region is also home to the most of Slovak public universities (5) and the Slovak Academy of Sciences (Figure 1).



Source: Own elaboration based on information about each USP/RC and university

Figure 1: Regional distribution of universities/USPs/RCs

One of the functions that USPs and VCs contribute to the development of regions is knowledge creation. It is based on two levels - the first is the creation of knowledge at university level, which is represented by the university's own research. The second level assume the role of knowledge creation in cooperation with business entities through joint and contractual research with external companies. The results of our research show that all USPs and RCs have carried out their own research since their inception. About half are already conducting joint research with companies and contract research now, and they plan to do in the future. Sharing of premises and equipment to external institutions in the region is currently carried out by only one entity. About 71 % of respondents plan to carry out this activity in the future (Table 2).

The concept of regional innovation systems emphasizes the importance of networks as factors influencing innovation performance. The innovation networks mean the accumulation and exchange of knowledge or the development of new ideas between organizations (Žítek and Klimová, 2016; Powell and Grodal, 2005). Innovation network activities include the creation, combination, exchange, transformation, absorption, and use of resources through a wide range of formal and informal relationships. More than half of the entities (57 %) indicated that they use forms of networking with other partners. Only 29 % entities currently carrying out cooperation with non-business entities (local governments, n.o. and others), 71 % plan this activity in the future, 71 % subjects already cooperate with foreign partners.

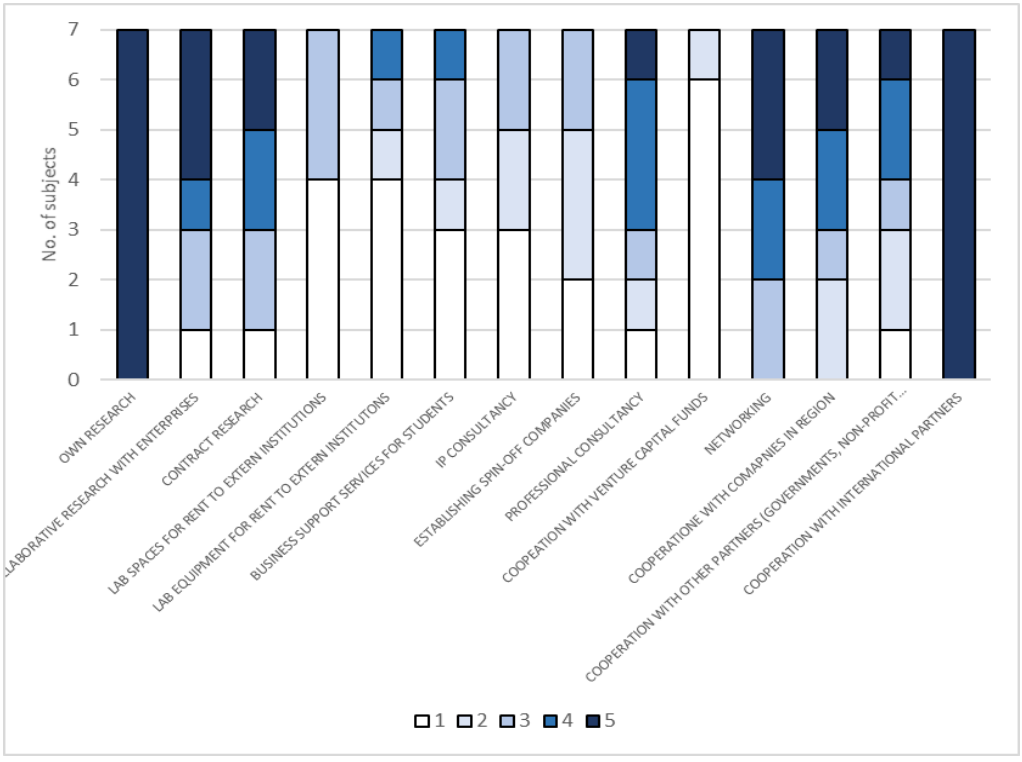
Table 2: Realization of activities in University Science Parks and Research Centers (% of all responses)

	ONGOING	PLANNING
OWN RESEARCH	100	100
COLLABORATIVE RESEARCH WITH ENTERPRISES	57	57
CONTRACT RESEARCH	43	71
LAB SPACES FOR RENT TO EXTERN INSTITUTIONS	14	71
LAB EQUIPMENT FOR RENT TO EXTERN INSTITUTONS	0	71
BUSINESS SUPPORT SERVICES FOR STUDENTS	14	43
IP CONSULTANCY	29	29
ESTABLISHING SPIN-OFF COMPANIES	0	86

	ONGOING	PLANNING
PROFESSIONAL CONSULTANCY	71	71
COOPEATION WITH VENTURE CAPITAL FUNDS	0	43
NETWORKING	57	57
COOPERATION WITH COMPANIES IN REGION	57	57
COOPERATION WITH OTHER PARTNERS (GOVERNMENTS, NON-PROFIT ORG, ...)	29	71
COOPERATION WITH INTERNATIONAL PARTNERS	71	71

Source: Based on own elaboration

Due to the increasing business activity of universities, only one entity provides business counseling for its students with starting business ideas. The existence of business support funds is still low. Not a single entity cooperates with venture capital funds, 43 % plan to do so in the future. The establishment of spin-off companies is also only among the planned activities of almost all entities. Only one entity (14 %) provides business counseling for students, two entities (29 %) provide intellectual property counseling. However, interesting findings of the questionnaire survey illustrate Figure 2. In terms of the importance of activities, there are activities in the field of business consulting, establish of spin-off companies, rental of premises and equipment, or cooperation with venture capital funds are described by entities as less to least important (except own research) and cooperation with foreign partners. These activities are necessary to directly support start-ups and the establishment of spin-off companies for university students. Intellectual property advice is also beneficial for researchers who will gain the necessary knowledge to deal with their patents or inventions. As illustrates Figure 2, the significance of activities is different. The most important are own research and cooperation with international partners. On the other side, the least important are activities and services like cooperation with venture capital funds or renting laboratory spaces and equipment.



Source: Own elaborations

Figure 2: Evaluation of the significance of activities in University Science Parks and Research Centers (1-least important, 5-most important)

Through the agreement on the provision of non-repayable financial contribution, Slovak public universities and the Slovak Academy of Science were committed to the sustainability of the USPs. They meet this condition with difficulty, especially their capacities. However, in the area of EU Funds is the lack of R&D funding does not allow the development of parks to such an extent as to increase the chances of gaining support in the

European science area after the sustainability period of projects (NKÚ, 2019). The original calls intended to focus on supporting the innovation environment, particularly linking academia and business with quality research results with an international reach, with modern and high-quality infrastructure. But the reality hampers many obstacles, problem areas, and unfulfilled goals. According to the original intention of the call, the USPs and RCs projects were focus on supporting the international innovation environment, especially on connecting the academic and business environment with quality research results with an impact also thanks to a modern and high-quality infrastructure. However, the reality shows several obstacles, problem areas, and unfulfilled goals. However, almost 71% of entities perceive state support as bad. The biggest barriers are insufficient funding for research, infrastructure, and staff. Other barriers are legislative obstacles, outdated or missing infrastructure for specialized research, excessive administrative burden, weak cooperation with other research institutions, or lack of cooperation on international projects and grants. Unclear conditions for USPs and RCs after the end of the sustainability period are the results of persistent and unresolved problems with operability of investment projects.

5. Conclusion

EU considers that research, development and innovation are favourable strategic factors for growth to boost the European economy. Research Infrastructures represent the primary tools to fill the scientific and technological gaps with regards to other international. Government support could play a key role in achieving scientific progress, technological advancement and knowledge transfer. The process of building and operating a successful science park is extremely costly not only in terms of financial and human capital, but also with regard to time and management. These types of research infrastructures have an important integration role, as they allow the concentration of different research capacities, even with international involvement in one place. Thanks to EU funding, top research infrastructures have been built in Slovakia and bring knowledge society actors. In the whole world, USPs and RCs are a successful tool for connecting the academic and private sectors, where interactions between universities, the private sector and government take place.

In conclusion, in this paper we pointed out the position of USPs and RCs based on the definition of their functions in regional innovation systems. We tried to evaluate the importance and position of USPs and RCs in Slovakia as a new phenomenon, which was co-financed by the European Structural and Investment Funds. First of all, we wanted to point out the inefficiency of using and actual functioning, as they fulfill the minimum of their functions. In terms of regional comparison and localization, almost (43 %) of them are located in the Bratislava region. This is understandable, as they are a tool for bringing institutions and companies together in the field of science and research, while also reflecting the innovation performance of the regions. Despite the many benefits that they bring, they do not perform most of the functions in the regions and currently focus more on own R&D activities within the universities that set them up. Above all, however, these functions have no added value, because universities carry out their own research as standard, even without the occupancy of parks. USPs and RCs should provide a wide range of services to support the emergence of new ideas that can later be put into practice.

Finally, there is an assumption that the strategies of parks are heterogeneous and operation in the region differs (McCarthy et al., 2018). Lack or absence of plans, limited financial resources and lack of infrastructure are very important negative factors that affect the outputs and further direction of USPs and RCs development. However, strong cooperation, clustering and networking between companies, government, municipalities and other institutions are important factors influencing success. It seems that solutions with long-term sustainability of parks and centres will have to be clarified in relation to increase and reinforce Slovak investment to research infrastructures and keep them viable. We would like to expand our research accompanied by direct interviews with stakeholders so that we can better identify problem areas and management.

Acknowledgements

This contribution was supported by the Scientific Grant Agency VEGA under the contract No.1/0605/19 „New role of universities in regional innovation systems".

References

Albahari, A., Catalano, G. and Landoni, P. (2013) "Evaluation of national science park systems: a theoretical framework and its application to the Italian and Spanish systems", *Technology Analysis & Strategic Management*, 25:599–614.

Albahari, A., Klofsten, M. and Rubio-Romero, J.C. (2019) "Science and Technology Parks: A study of value creation for park tenants", *The Journal of Technology Transfer*, 44:1256–1272. Doi: 10.1007/s10961-018-9661-9.

Alegre, I.; Berbegal-Mirabent, J. and Guerrero, A. (2019) "Mission statements: what university research parks tell us about timing", *Journal of Business Strategy*. Vol. 40, No. 5, pp. 46 -53, ISSN 0275-6668.

Almeida, A.; Afonso, O. and Rui Silva, M. (2020) "Panacea or illusion: an empirical analysis of European science parks in the case of follover regions", *Journal of Innovation Economics and Management*, No 31, 2020/1, pp. 155 – 194.

AURP (2021). Association of University Research Parks. <https://www.aurp.net/what-is-a-research-park> accessed 13.8.2021

Autio, E.; Klofsten, M. (1998) "A comparative study of two European business incubators" *Journal of Small Business Management* 36 (1), 30–43.

Balog, M. (2019) "*Vedecké parky a výskumné centrá na Slovensku Výzvy (aj) pre programové obdobie 2021 – 2027*", Prognostický ústav SAV, Bratislava, 214 strán, ISBN 978-80-89524-35-8.

Battelle (2007) "Characteristics and Trends in North American Parks" Research 21st Century Directions. Ohio: Battelle, *Technology Partnership Practice*, 42 s.

Blažek, J. and Uhlíř, D. (2011) *Teorie regionálního rozvoje (nástin, kritika, klasifikace).* Praha: Karolinum.

Brzica, D. et al. (2014) *Motivácia aktérov pri smerovaní k znalostnej spoločnosti*. Bratislava: VEDA, 2014. 282 s. ISBN 978-80-224-1415-9.

Cadorin, E., Johansson, S.G. and Klofsten, M. (2017) "Future developments for science parks: Attracting and developing talent", *Industry and Higher Education*, 31:156–167.

Castells, M. and Hall, P. (1994) *Technopoles of the World: The Making of the 21th Century Industrial Complexes*, London, Routhedge.

Edquist (2005) "Systems of Innovation: Perspectives and Challenges", In Fagerberg, J., Mowery, D. C., Nelson, R. R. (eds), *The Oxford Handbook of Innovation*, London, Oxford University Press, 181-208.

Etzkowitz, H., Zhou, C. (2018) "Innovation Incommensurability and the Science Park", *R&D Management*, 48 (1), pp. 73–87.

European Commission (2014) "Setting up, managing and evaluating EU science and technology parks". An advice guidance report on good practise. *Regional and Urban Policy*, October 2013, ISBN 978-92-79-37274-2.

Guadix, J., Carrillo-Castrillo, J., Onieva, L. and Navascue´s, J. (2016) "Success variables in science and technology parks" *Journal of Business Research*, 69 (11), 4870–4875.

Hansson, F., Husted, K. and Vestergaard, J. (2005) "Second generation science parks: from structural holes jockeys to social capital catalysts of the knowledge society", *Technovation*, 25 (9), 1039–1049.

Hobbs, K.G.; Link, A.N. and Scott, J.T. (2017) "Science and technology parks: an annotated and analytical literature review". *Journal of Technology Transfer* Vol. 42, 957–976.

Champenois, C., Etzkowitz H. (2018) "From Boundary Line to Boundary Space: The Creation of Hybrid Organizations as a Triple Helix Micro-Foundation", *Technovation Journal* 76: 28–39.

Jakab, F. (2020) "Univerzitné vedecké parky ako kľúčový prvok ekosystému technologického transferu a inovácií", In: *Transfer technológií bulletin*. Centrum vedecko-technických informácií, 1/2020, ISSN 1339-2654.

Leyden, D.P., Link, A.N. and Siegel, D.S. (2008) "A theoretical and empirical analysis of the decision to locate on a university research park", *IEEE Transactions on Engineering Management*, Vol. 55, No. 1, pp. 23-28.

Link, A.N. and Scott, J.T. (2003) "U.S. science parks: the diffusion of an innovation and its effects on the academic missions of universities", *International Journal of Industrial Organization*, 21 (9), 1323-1356.

Lis, A., Romanowska, E. (2016) "Shaping the brand awareness of science and technology parks in Eastern Poland", *Barometr Regionalny*, 14(2), 147-156.

McCarthy, I. P.; Silvestre, B. S.; von Nordenflycht, A. and Breznitz, S. M. (2018) "A typology of university research park strategies: What parks do and why it matters", *Journal of Engineering and Technology Management*, 47, 110-122.

Messina, L., Miller, K., Galbraith, B. and Hewitt-Dundas, N. (2022) "Recipe for Success? Unravelling the micro-foundations of dynamic capability building to overcome critical junctures", *Technological Forecasting and Social Change*, 174, 121257.

Meyer-Krahmer, F. and Reger, G. (1999) "New Perspectives on the Innovation Strategies of Multinational Enterprises: Lessons for Technology Policy in Europe", *Research Policy*, 28 (7), 751-776.

MŠVVaŠ SR (2012) "*Priebežná výzva na predkladanie žiadostí o NFP – Vybudovanie univerzitných vedeckých parkov a výskumných centier pre OP Výskum a vývoj*" <https://www.minedu.sk/data/att/4720.pdf> accessed 10.8.2021

Nieth, L. and Benneworth, P. (2020) "Challenges of knowledge combination in strategic regional innovation processes-the Creative Science Park in Aveiro", *European Planning Studies*, 28(10), 1922–1940.

NKÚ (2019) "*Záverečná správa. Vedecké parky a výskumné centrá*", Najvyšší kontrolný úrad Slovenskej republiky, Bratislava.

Nowotny et al. (2001) "Re-thinking science: knowledge and the public in an age of uncertainty", *Polity Press*, Cambridge.

Olvera, C., Piqué, J. M., Cortés, U. and Nemirovsky, M. (2021) "Evaluating University-Business Collaboration at Science Parks: a Business Perspective", *Triple Helix*, 8(3), 445-485.

Park, S.C. (2002) "Science parks in Sweden as regional development strategies: a case study on Ideon Science Park", *AI & society* 16:288–298. doi: 10.1007/s001460200023.

Powell, W.W. and Grodal, S. (2005) "Networks of innovators", In: Fagerberg, J. Mowery, D.C., Nelson, R.R. (eds.) *The Oxford Handbook of Innovation*. Oxford University Press. s. 56-85. ISBN 978-0-19-928680-5.

Squicciarini, M. (2008) "Science Parks tenants versus out-of-Park firms: who innovates more? A duration model", *Journal of Technology Transfer* 33 (1), 45–71.

Vasquez-Urriago, A. R., Barge-Gil, A., and Modrego, A. (2016) "Science and Technology Parks and Cooperation for Innovation: Empirical Evidence from Spain", *Research Policy*, 45(1), 137-147.

Watkins-Mathys, L., Foster, J. M. (2006) "Entrepreneurship: The Missing Ingredient in China's STIPs?", *Entrepreneurship & Regional Development*, 18 (3), 249-274.

Žítek, V. and Klímová, V. (2016) "*Aplikace konceptu regionálních inovačních systémů a implikace pro inovační politiku*", Masarykova univerzita v Brne, Ekonomicko-správní fakulta, 178 s., ISBN 978-80-210-8415-5.

Innovative Practices for Pollution Prevention and control Implemented by Companies in Romania

Andreea Maria Gabriela Militaru, Andreea-Mihaela Rotărescu, Bogdan Fleacă and Elena Fleacă
University POLITEHNICA of Bucharest, Romania
andreea.militaru95@upb.ro
andreea.rotarescu@stud.faima.upb.ro
bogdan.fleaca@upb.ro
elena.fleaca@upb.ro

Abstract: This paper explores the practices of companies present on the Romanian market which are preventing and controlling the pollution in their areas of expertise. Many of the companies are trying to find solutions to implement the United Nations Sustainable Development Goals, some of them pleading for the importance of keeping the environment safe, the ecosystems protected, and the degree of pollution at a lower level. Given the massive use of fossil fuels and other non-renewable resources and the international commitment to the Sustainable Development Goals, care to natural resources and pollution reduction becomes essential in ensuring access of future generations to a safe and healthy life. In today's time, technology plays an essential role in the management of a company, naturally it cannot be absent from the solutions thought to reduce air and water pollution. Hence, the importance of the existing solutions which could be considered innovative measures. The purpose of this paper is to determine the pollution situation and the factors that contributed to it. At the same time, it will present the evolution of the practices applied by companies to combat water and air pollution, so far. The methodology is based on an analysis of the Public S ustainability Reports from the past years, of the activity of the companies on the Romanian market. Through sustainability reports, large companies present the evolution and results of the applied solutions. Anti-pollution practices can be classified according to their field of activity and type of activity. The study contributes to the review of the literature by focusing on the practices implemented by companies in relation to work and the natural environment at the borders of Romania. Companies embrace the fight against pollution, including this as part of their sustainability strategy, as a goal which can be achieved only with teamwork, with the stakeholder's involvement: employees, customers, suppliers, and all those stakeholders who stand for the same values, taking action and using concrete facts to follow the strategy to make an impact for the better.

Keywords: sustainability, solutions against pollution, pollution practices, SDGs

1. Introduction

In recent years, pollution has reached the peak, impacted all forms of life, and continued to do so. The massive use of fossil fuels and non-renewable resources are just a few examples that keep high the pollution level.

The values, the management and the technology of a company play essential roles in reducing the environment pollution. Seeing this, large companies have begun to follow the guidance of the European Union policies and take safety measures, develop practices and resort to various strategies to combat and prevent pollution and its spread.

Among the solutions are the practice of the sustainable development objectives, the measures taken by big companies with high degree of competitiveness and even the development of sustainable strategies; The present study follows the analysis of sustainability reports from 2019-2021 of large companies, and presents the concrete measures taken by project implementation. The paper presents an analysis of the literature review, then the main findings and results, followed by the conclusions.

Within this research were identified several large companies existing on the Romanian market, from food retail, technology and IoT services, and petrochemical industry, as a sample, having an implication and correcting their practices related to pollution on the Romanian territory.

2. Literature review

The problem of pollution has been analyzed by many specialists, and despite the progress made in the last decades by the European Union, pollution is still a great threat to any form of life. Even though the European Green Deal is being implemented by EU country members, the environmental improvement is not significant. Another actor involved in fighting pollution worldwide is the World Health Organization (WHO) is pleading to

protect the planet and ensure a prosperous environment for all inhabitants. From this idea in 2015 the Sustainable Development Goals (SDGs) were established.

There are several SDGs which are linked with the concept of pollution. Combating the pollutants, these harmful materials, natural, or artificial affecting the environment is part of at least 9 of the 17 SDGs covering the impact of the environment but also the social and economic sides, as seen in Table 1. (United Nations, 2020)

Table 1: SDGs involved in fighting pollution

SDG Goals	Indicators
3: Good Health and Well-being	Coverage of essential health services; Access to clean and fresh air and water.
6: Clean Water and Sanitation	Proportion of people using safely managed drinking water services; Proportion of domestic and industrial wastewater flows safely treated;
7: Affordable and Clean Energy	Rate of reliance on clean fuels and technology; Installed renewable energy-generating capacity.
9: Industry, Innovation, and Infrastructure	Level of CO_2 emissions. Rate of R&D investments.
11: Sustainable Cities and Communities	Urban population living in informal settlements or inadequate housing; Solid waste collected.
12: Responsible Consumption and Production	Food waste index; Recycling rates & renewable energy-generating instalments; Rates of hazardous chemical substances.
13: Climate Action	Disaster risk reduction strategies; Total greenhouse gas emissions.
14: Life Below Water	Plastic debris density; Average marine acidity (pH);
15: Life on Land	Rate of deforestation; Mountain Green Cover Index.

Pollution is affecting the European population, one in eight deaths is due to environmental pollution. Specifically, 90% of these deaths are due to chronic diseases - cancer being the most common. Also, air pollution alone is responsible for about 400,000 premature deaths a year. The most affected people are the elderly, children, people with medical problems or disabilities. Also, educated households are more likely to live in a modern environment with electrification, or cleaner energy sources, hence women and children are less exposed to indoor air pollution. At the same time, plants and animals are affected to the same extent. It has been shown that out of a total of 8 million species of plants and animals on our planet, over one million of them are endangered. (EU, 2020, Zeroing Action Plan)

Therefore, this topic has a high importance for the whole society, and to protect the environment from pollutants, to restore ecosystems and biodiversity and to change the current situation, the European Commission developed in May 2021 an action plan to combat and reduce to zero pollution of water, air, soil, consumer products, marine pollution, and noise pollution, until 2050. This plan is involving all actors part of the society including organizations of any type. For situations where pollution cannot be completely prevented at source, it must be minimized, and then remedial measures will be taken; in case of damages, the solution would be to offer compensations. (Union, 2021, EU Action Plan)

As stated by Bhupendra (2015) the companies must come on the market with innovative solutions to increase their competitive advantage. Organizations must be able to integrate and deploy the resources in a way that encourages the fight against pollution. Several variables must be considered, besides the implementation of the SDGs, the culture within the region they do business, the technology used, the human resources possibility of learning and even the power of investment of the business in projects maintaining the environment safe and unharmed.

Companies play an important role for the target planned at the European level. To reduce pollution, it is necessary to introduce on the market eco-friendly technologies that will support the interaction between the companies and the environment. For a start, the European Commission has developed a document in this regard that presents digital solutions and a set of good practices that can serve as a bear for inspiration and innovation in the business environment. (Union, 2021, Digital Solutions for Zero Pollution)

Using a set of practices are encouraging the companies to fight against pollution and transform the European market leading to a resource-efficient and competitive economy and decreasing the greenhouse gasses until the mid of the century. There are several factors which are degrading the natural environment (air, water, and soil) are usually related to how the industry is managing the processes and activities and its interactions. The practices must be adaptable enough to be accepted by the customers and creative to attract more customers, hence these practices must have innovative characteristics.

The main two key aspects to be achieved by global markets are implementation of low-emissions technologies and sustainable products and services, hence the achievement to be climate neutral and circular economy. (Keim, 2019)

Stratos (2021) state the major impact of the industry on the environment is caused mainly by the remaining waste from industrial activities. The production of materials, raw materials, processing leave behind waste. However, Industry creates jobs, provides food, transportation, services and many other facilities and necessities of modern life, and solutions are found to fight ecosystem pollution.

Air, soil, and water pollution appears often due to waste. Garbage contains toxic, radioactive substances or even organic matter. Organic waste increases the production of methane, a gas that is harmful to humans, animals, and plants. Also, decomposing and contamination of water and soil appears when the substances can seep into the groundwater. All industrial activities use raw materials or materials derived from it, from paper, metal, plastic, or glass. Some of them are more polluting than others. However, some of them could be easier to recycle, others may not.

Hazardous waste needs special disposal areas. Industries generate huge amounts of hazardous waste every year leading to more pollution: more and more spaces are needed where they can be disposed of without affecting the urban and rural environments. (Stratos, 2021)

Even if the production of waste cannot be stopped, it can be managed efficiently, so that the negative impact on the environment is as small as possible. Technology is a way of finding and implementing solutions to prevent, fight and control the pollution, namely encouraging the implementation of waste management, recycling and laws encouraging the fight over pollution.

3. Research methodology

This paper attempts to present detail understanding of pollution practices by companies present on the Romanian market which are taking decisions and implementing the Green Deal and the Sustainable Development Goals into their strategies. The companies studied are part mostly of the retail industry and tech industry having a big impact toward the environment.

The methodology consisted in comparing the measures taken by these companies within their sustainability strategy and through projects. There were identified 4 companies in Romania, present in the region with a background and experience on the market from industries directly affecting the environment, the food industry, petrochemical industry, and IT.

OMV Petrom, Lidl Romania and Kaufland Romania are part of the top five companies with the highest turnover from Romania, even though Bosch does not have such a significant place, only in top 30, there is an interest related to the IT field in Romania, and one of the industries more relevant for the country's economy. The most important industries as mentioned by the Trade Registry of Romania with about 60 billion euro are: retail sale in non-specialized stores of food, beverages or tobacco, construction works for residential and non-residential buildings, freight transport, retail sale of automotive fuel in specialized stores and pharmaceutical goods.

Best practices

According to the sustainability report for the period March 2020-February 2021, one of the most important objectives of Lidl Romania and Kaufland Romania's sustainability strategy is to reduce its environmental footprint. Lidl Romania has achieved collaborating only with transport suppliers using Euro 5 and Euro 6 vehicles, equipping Lidl stores built in fiscal year 2020 with charging stations for electric cars, increasing product suppliers

in Romania, improving certain products or packaging and the like. Moreover, starting with the previous year, Lidl Romania became a member of the Sustainable Romania Coalition and actively participates, together with the other partners, in the meetings organized by the Department for Sustainable Development of the Romanian Government, looking for solutions to contribute to the SDGs. (Lidl Romania, 2021)

For Kaufland Romania several of the pillars of the community investment strategy are related to a greener and cleaner environment, sustainable environment, and eco-driving support. Similarly with the path taken by Lidl Romania, Kaufland Romania started a partnership with Renovatio in fighting pollution using green mobility under the form of a public network of car charging stations in Romania, expanded on the Bucharest - Chisinau route. The stations are located in the parking lots of Kaufland stores in 30 cities in Romania, allowing electric car users to travel along the country, linking practically Western Romania from Arad to the South-East in Constanta. (Kaufland Romania)

Lidl Romania took another measure; implemented in 2020, for customers, new charging points for electric vehicles (EV). Lidl increased the number from 33 to 104 stations build from 2019 to 2020 and made them available for the Lidl customers. (Lidl Romania, 2021)

According to Eurostat, over 75% of EU citizens believe that environmental issues have a direct effect on their health and life. To comply with the EU action plan to reduce air, water and soil pollution, Lidl Romania and its suppliers of fruit and vegetables have reduced their crop protection products to zero or replaced them with other substances recommended by experts based on risk parameters. (Lidl Romania, 2021)

At the same time, the concern for the collection, sorting and recycling of packaging is constant within Lidl and Kaufland, especially since their core business involves a significant amount of packaging. For example one measure taken by Lidl was to change the cash registers, these days the paper used for the vouchers are made without chemical dyes that can be recycled; thus, reducing the negative impact of using rolls of voucher paper and plastic to wrap those rolls. (Kaufland Romania)

The comparison from Table 2 showing the quantities of the inorganic waste collected by Lidl and Kaufland in Romania, it is different. As seen in the table, there is a gap of plastic several tons used by Kaufland in comparison to Lidl, however Lidl prefers to use more cardboard and paper hence it collects more of it. Kaufland collects more steel over the time, because of the campaigns collecting waste in their parking lots, which Lidl is not doing. Both companies tend to increase their collection of packaging and their rates of recycling.

Table 2: The quantities of inorganic waste collected by Lidl Romania and Kaufland Romania

Types of inorganic waste	Lidl	Kaufland	Lidl	Kaufland
	2019	2019	2020	2020
Plastic	1,605	9,950	2,054	10,308
Cardboard and paper	32,413	17,677	39,701	19,353
Steel (metal)	242	2,587	588	2,062
Wood	2,680	3,090	3,928	3,074
Waste electrical and electronic equipment	277	118.7	196	195
Battery	9	98	36	99
Total (tons)	37,226	33,520.7	46,503	35,091

Besides the inorganic waste, there is an important issue about the oil polluting water from the households. Both companies are raising the awareness about this matter, however there are no visible measures on this side.

Lidl Romania also supports stopping food waste. According to the United Nations Environment Program, food waste in Romania resulting from the annual sale of food exceeds 248.000 tons, which means about 13 kg per capita, and at the level of household consumption, the volume is much higher and more worrying, respectively 1.353.000 tons per year or 70 kg per inhabitant.

Regarding the plastic pollution problem, Kaufland launched in Romania the project “Broscuța” (The turtle shaped container) – collection system, for collecting empty bottles of hygiene or cleaning products, which will be recycled to protect the environment. The customer can deposit empty plastic bottles of beauty and personal care products as well as empty containers for cleaning products for the kitchen, bathroom, floors or windows. The collected packaging is periodically picked up by a company specialized in collection, and transported to the

factory in Romania for recycling, through a three-step process: sorting of materials at the automatic station, preparation for recycling and actual recycling through thermoforming. The initiative comes as a solution to the need for a circular economy, to counter the phenomenon of the uncontrolled spread of plastic. (Kaufland Romania)

From the perspective of a company with an expertise in sensor technology, software, and services, Bosch Group has as a strategic goal to provide solutions for a connected life, through products and solutions that either include artificial intelligence (AI) or have been developed or manufactured using it.

The Bosch Group comprises Robert Bosch GmbH and its approximately 440 regional subsidiaries and companies in more than 60 countries. Including business and service partners, as well as the global production, engineering and sales network, Bosch covers almost every country in the world, including Romania. The basis for the company's future growth is its power of innovation. Bosch contributes to its technology and knowledge throughout the value chain, increasing its influence on reducing greenhouse gas emissions, and its business operations have reached climate neutrality since 2020.

The company has a different approach compared with the other two mentioned previously. They use a global strategy for sustainability, which is focused more on minimizing the impact of their operations on the environment without involving the community and stakeholders using visibility campaigns. Bosch is focused minimizing the material and wastewater through treatment in-house, using processes such as ultrafiltration to separate solids and liquids or physical-chemical treatment methods depending on the local conditions.

In 2020 Bosch Group purchased a total of 1,762 tons of key materials, such as steel (1,3 tons), aluminum (197 kg) and plastic (265 kg). They recycled around 4.6 % of the total volume of plastic purchased. In 2020 Bosch group managed to recycle 521.9 kg of the material resources. (Bosch, 2021)

The final example is related to a company, OMV Petrom, from the petrochemical industry, as Romania is a country with such resources. To minimize its environmental impact, OMV Petrom has implemented several innovative measures such as: reducing water abstraction and improving water efficiency, recycling / recovery of generated waste as much as possible, protection of biodiversity with the help of a mobile application enabling employees to easily identify protected species observed within their operational boundaries.

For example, in 2019, our total Water Withdrawal decreased by 55% compared to 2010, and by 2% compared to 2018. Also, the Freshwater Intensity of OMV Petrom decreased by 4.7% in 2019 vs. 2018 based on a 7.2% decrease in Downstream Oil (excluding Power Plants), a 4.7% increase in Power Plants (CCPP Brazi, OMV Petrom City Power Plant) and a 7.3% decrease in Upstream.

In 2019, compared to 2018, OMV Petrom recycled / recovered 53% of the total waste generated during the year. Also, in 2019, OMV Petrom, in partnership with Oceanic Club, launched the mobile application, enabling employees to easily identify protected species. This project contributes to improve the monitoring of biodiversity conservation and increase awareness on this topic. (OMV Petrom, 2021)

4. Results and findings

There are many aspects which can be analyzed related to pollution, following the data extracted from the 2020 sustainability reports. A mapping of the projects implemented for fighting against pollution can be done. For this a list of pollution practices was identified for each one of the companies and the related SDGs, as see below in table 3.

Table 3: Mapping the pollution practices from the analyzed companies

Company Name	Industry Type	Pollution Problem	Pollution Practices	SDG goals
Lidl Romania	Food Retail	Air Water Soil	Developing the charging infrastructure for electrical cars Remove harmful substances from food Replacing refrigerated display cases with modern ones Implementing a system for remote monitoring of water consumption Joint use of reusable pallets for carbon footprint decrease Donating bakery products not bought at the end of the day	9, 11, 12, 13

Company Name	Industry Type	Pollution Problem	Pollution Practices	SDG goals
Kaufland Romania	Food Retail	Air Water Soil	Eco-driving support, forming a public network of car charging stations in Romania, Bucharest - Chisinau route. Reducing the plastic packaging Collection system of plastic bottles, glass containers and aluminum cans for recycling and the self- service machine Encouraging tourists to stop throwing waste on the beach and to choose to collect it separately in the specially designated areas. Launching the turtle shaped container for beauty and cleaning products packaging	9, 11, 12, 13
Bosch Romania	IT	Air Water	Levels of air pollutants in the relevant business processes and manufacturing Using plastics based on recyclates Introduction of vacuum distillation and ultrafiltration for wastewater Usage of centrifugal treatment for oil elimination from waterwaste	6, 7, 9, 12, 14
OMV Petrom	Gas and Oil	Air Water Soil	Water Management Plans to reduce the water withdrawal and improve the water efficiency Waste Management to recycle / recover the waste generated as much as possible Biodiversity protection initiative - a mobile application which can identify protected species observed within their operational boundaries	9, 7, 11, 13, 14

Innovative practices

The characteristic of innovativeness is represented by the eagerness of the organization to gradually changes the process while simultaneously preparing for a drastic transformation in the use of technology to develop goods and projects that are environmentally justifiable (Bhupendra, 2015). There should be a shift from the current mindset **and technology to cleaner technologies and an eco-friendly mindset.**

Table 4: Measures taken against pollution

Company Name	Pollution Prevention	Pollution Control
Lidl Romania	Installing charging points for EVs. Use of biodegradable materials. Sanitation activities in the Danube Delta and in cities on the Danube - waste collection. Changing the billing machines in the supermarkets.	Analysis of the resulting effects before the installation of prevention measures and after in the Sustainability Reports.
Kaufland Romania	Installing charging points for EVs. Replacing plastic nets with cellulose nets, reducing the density of certain packaging. Organizing teaching sessions regarding basic environmental information in a pleasant seaside setting. Developing volunteering programs to collect waste from polluted rivers and lakes in Romania. Introducing a collection system, for collecting empty bottles of hygiene or cleaning products, which will be recycled to protect the environment.	Monitoring the measures taken. Maintaining the infrastructure. Coming with proactive solutions for future pollution problems.
Bosch Romania	Reduce carbon footprint intensity for operations. In-house wastewater treatment.	Monitoring the wastewater and improving the technologies for treatment.
OMV Petrom	Reduce carbon footprint intensity for operations. Triple volume of recycled polyolefins. Increase waste reuse and recycling from operations. Reduce freshwater withdrawal.	Monitoring the biodiversity conservation. Monitoring the impact of OMV Petrom's activities (pollution levels) on both groundwater and surface water. Analysis of the resulting effects before the installation of prevention measures and after in the Sustainability Reports.

The companies analyzed are introducing measures against pollution as a reactive approach, mostly because the environment already has suffered and because the need to follow the SDGs to reduce the environment harm.

5. Conclusions

The quality of water, soil, air and their protection from pollution are interdependently related to the health of the environment, plants, animals and humans. Large companies in Romania are trying to implement innovative solutions or practices to improve the current situation. The industrial activity has generated, for the most part, the consequences that can be seen and felt at present.

To save the planet from pollution and ensure a healthy environment for the current generation, but also for future generations, we need constant involvement and desire, ambition to want, to do, to change. In addition to pollution, people must be careful to ensure a balanced use of resources.

At the same time, the Sustainable Development Goals must be met, and the system must be designed and adapted so that it works in a sustainable way, and the economy moves from a linear model to a circular, efficient, responsible, innovative one.

The topic of pollution will be considered a hot topic on the long run, sadly this could not be the peak of it, hence some solutions should be sought. The EU is continuously trying to understand this phenomenon and trying to implement regulations accordingly, and probably the research quest is not done.

As further directions of research could be considered some analysis for each type of pollution (soil, air and water) correlated to a comparison of EU pollution indicators and a specific European region, for example Eastern Europe, or even comparisons between regions. Another direction could be to identify the patterns of pollution, because is already happening, the inhabitants of a region and the organizations behave in certain way, and the questions is what they do to stop pollution if that region is already affected by a medium or high level of it.

References

Bhupendra, K. V. (2015) 'What drives successful implementation of pollution prevention and cleaner technology strategy? The role of innovative capability', *Journal of Environmental Management*, 155, pp. 184–192. doi: 10.1016/j.jenvman.2015.03.032.

Bosch, *Bosch Today*, (2021) https://www.bosch.ro/media/our_company/bosch_today_2021_ro_final_final.pdf (accessed on 20th of March 2022)

Bosch, *Sustainability Report* (2021) https://assets.bosch.com/media/global/sustainability/reporting_and_data/2020/bosch-sustainability-report-2020-factbook.pdf (accessed on 10th of April 2022)

Greenpeace Romania, (2021) *The new global air quality report reveals substantial changes in 2020*, (March), https://www.greenpeace.org/romania/articol/5641/noul-raport-mondial-despre-calitatea-aerului-dezvaluie-modificari-substantiale-in-2021/ (accessed on 23th of March 2022)

Kaufland Romania, (2021), *Sustainability report for the financial year 2020*, https://media.kaufland.com/images/PPIM/AP_MarketingDocument/rum/94/35/Asset_10159435.pdf (accessed on 5th of April 2022)

Keim, R. G. (2019) 'The Future Is Now', *Journal of clinical orthodontics: JCO*, 51(1), pp. 9–10. https://sustainabledevelopment.un.org/content/documents/24797GSDR_report_2019.pdf

Lidl Romania, (2021) *Sustainability report for the financial year 2020*, https://corporate.lidl.ro/sustenabilitate/rapoarte-csr (accessed on 3rd of April 2022)

OMV Petrom, *Environment*, https://www.omvpetrom.com/en/sustainability/health-safety-security-and-environment/environment (accessed on 22nd of March 2022)

OMV Petrom, *Sutainability Report*, (2021) https://www.omvpetrom.com/ro/sustenabilitate/rapoarte-de-sustenabilitate (accessed on 20th of March 2022)

Romanian Trade Registry, (2021), https://economedia.ro/date-oficiale-de-la-registrul-comertului-ce-companii-din-romania-au-afaceri-mai-mari-de-100-de-milioane-de-euro.html#.Yl2x3ehBxPY (accessed 10th of April 2022)

Stratos, (2021) *Environmental impact of the industry: how it can be controlled,* (September), https://stratos.ro/impactul-industriei-asupra-mediului-cum-poate-fi-controlat/ (accessed on 27th of February 2022

Union, E. (2021) *A European Green Deal*, (July), (https://ec.europa.eu/info/strategy/priorities-2019-2024/european- -dealen (accessed on 26th of March 2022)

Union, E. (2021) *Digital Solutions for Zero Pollution,* (May), https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/swd-digital-solutions_en.pdf (accessed on 20th of March 2022)

Union, E. (2019) *Evaluation of placement policy implementation environmental. Romania country report.,* (April), https://ec.europa.eu/environment/eir/pdf/report_ro_ro.pdf (accessed on 16th of March 2022)

Union, E. (2021) *EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil',* (May), https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/communication_en.pdf (accessed on 15th of March 2022)

Union, E. (2021) *Questions and answers on the Zeroing Action Plan*, (May), (https://ec.europa.eu/commission/presscorner/detail/ro/qanda_21_2343) (accessed on 27th of March 2022)

United Nations. (2020). Annex: Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development. *Work of the Statistical Commission Pertaining to the 2030 Agenda for Sustainable Development*, 1–21. https://unstats.un.org/sdgs/indicators/Global Indicator Framework after 2019 refinement_Eng.pdf%0Ahttps://unstats.un.org/sdgs/indicators/GlobalIndicatorFramework_A.RES.71.313Annex.pdf

Consumer Innovativeness: Cross-Cultural Differences and Influence on Acceptance of Product Service Systems

Anna Németh
Business Economy and Management, Faculty of Economics and Administration, Masaryk University, Brno, Czech Republic
491281@mail.muni.cz

Abstract: Product Service Systems are considered a new, circular business model that could help businesses be sustainable while maintaining economic growth at the same time. Consumer innovativeness can predict and influence acceptance of such novel business models. However, differences in innovativeness can vary across countries and should be considered in research. This study aims to examine differences and influence of consumer innovativeness on consumer acceptance of Product Services Systems based on data collected from Czech Republic, Sweden and Hungary. For the analysis pay-per-wash was chosen, as washing machines are one of the most used everyday products. This paper takes a descriptive and quantitative approach while using regression as a data analysis method. The findings enrich current scarce knowledge of differences and influence of consumer innovativeness on consumer acceptance of Product Service Systems, especially considering that Central- and Eastern European countries are underrepresented in the literature. For the managerial contribution, the study offers insights for more efficient consumer segmentation and targeting for introduction of pay-per-wash services.

Keywords: product service systems, consumer innovativeness, cross-cultural research

1. Introduction

Nowadays the consumption patterns of the Western countries have become unsustainable (European Environment Agency, 2020). Researchers have been focusing on trying to find ways to overcome this issue and companies have also been searching for alternative ways to satisfy the need of their consumers while being more sustainable (Stål and Corvellec, 2018). Transitioning from the current linear model to a circular economy one can offer a solution for this problem. Product Service Systems (PSS) are the business models to support the realization of circular economy. The essence of PSS is that companies keep the ownership of the products while they rent or lease them for the consumers; and in the meantime creating more durable products. In addition, they become more environmental friendly because one product serve multiple consumers (Tukker, 2015; Retamal, 2017; Catulli et al., 2020). However, the consumer adaptation and acceptance of such business models are still under researched (Catulli et al., 2017). Moreover, companies who wish to transit to circular business models lack information on consumers who would adopt them, so they cannot develop marketing strategies (Perren and Kozinets, 2018).

In this paper, pay-per-wash (washing machine) was selected as a representation of Product Service Systems since washing machines are one of the most popular and everyday used household appliances (Yuan et al., 2016, Hischier et al., 2020).

One of the key factors that companies' success relies on is innovation (Pauwels et al., 2004), however majority of innovations fail (Srinivasan et al., 2009). In order to make a new innovation profitable, companies need to focus on fulfil their consumers' needs and create value for them. That is why research focus turned on consumer innovativeness (Goldsmith and Hofacker, 1991; Im et al., 2003). It is defined as consumer's tendency to adopt new products (Tellis et al, 2009).

The goal of this study is two folded: on the one hand, it seeks to present whether consumer innovativeness predicts adaptation of pay-per-wash across three countries: Czech Republic, Sweden and Hungary. In addition, this paper aims to show the differences of consumer innovativeness. On the other hand, for the managerial side, this paper attempts to learn about the characteristics of the consumers who would adopt pay-per-wash services in order to assist the segmentation and targeting strategies of companies.

In the first section of the paper, literature review will be provided as a background for the paper, then by running multiple linear regressions, the influence of consumer innovativeness on intention to adopt pay-per-wash will be assessed. Lastly, it will be studied whether demographics predict consumer innovativeness across countries and if so, what characteristics the innovator has.

2. Literature review

The circular economy (CE) phenomenon was launched to overcome the problem of increasing consumption and decreasing non-renewable resources. CE is still a new concept, scientists have not agreed on one definition (Edbring et al., 2016). According to the European Commission, circular economy is defined as an economy "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimized" (2015, p. 2).

In order to help the transition to circular economy, Product Service System were introduced. Although, research on this topic started 25 years ago, this area is still not deeply researched. PSS is a business model that combines products and services while reduces environmental effects (Goedkoop et al., 1999). It promotes the "use of products" instead of the ownership of the products (Baines et al., 2007).

In the literature, three types of PSS can be found. Catulli et al. (2014) define them in the following ways:

Product-oriented PSS: "ownership of the product (material artifact) is transferred to customers and services are provided to help ensure product performance over a given period of time."

Use-oriented PSS: "ownership rights related to the product are retained by the service provider and the customer purchases use of the product over a specified period of time." This business model includes renting and leasing. In my doctoral dissertation, I will focus on this type of Product Service System model.

Result-oriented PSS: "the product required for service delivery is owned by the service provider. However, in contrast to use orientated PSS the customer purchases an outcome/ result of service provision, which is specified in terms of performance not in terms of product use over a period of time." (Catulli et al., 2014, p. 2) This paper focuses on use-oriented PSS.

There are two main beneficiaries of the Product Service System: consumers and the environment. For the consumers, PSS provides two benefits: from the product side PSS delivers value for the consumer by providing highly customized quality products (Cook et al., 2006). PSS can also offer a sense of uniqueness to its consumers which enables value creation. As for the service side, taking away the responsibility of maintenance, reparation of products and administrative task can also deliver value for the consumers (Manzini et al., 2001; Rocchi, 2005; Baines et al., 2007).

From the environmental perspective, due to the nature of PSS, manufacturers and producers become more aware of their products' quality and maintenance requirements since they monitor them, recycle and refurbish them. This increases the products' lifetime and reduces waste (Mont, 2004; Baines et al., 2007).

The current PSS literature is mainly focused on the business side, however in recent years, researchers have started to study PSS from the consumers' perspective. Still, little is known about the consumer side, especially adaptation and acceptance of PSS business models.

2.1 Measures of innovativeness

This paper adopts the theoretical framework and developed measurement for consumer innovativeness from Tellis et al., 2009. Based on extensive research on the literature, they identified ten dimensions to measure consumer innovativeness. These measures are the followings:

- *Novelty seeking*

Novelty seeking is described in different ways such as a personality trait or an "internal drive" that persuade people to search for new (Pearson, 1970), but researchers agree that it leads to innovative behavior, to willingness to accept new products (Hirschman, 1980; Roehrich, 2004)

- *Risk taking*

Risk is known as a key component of consumer behaviour (Conchar et al., 2004). Apart from that, it also plays an important role to promote consumer innovativeness (Raju, 1977).

- *Variety seeking*

It is a personality trait that affects the consumer's desire to try new or different products (Steenkamp & Baumgartner, 1992) and it leads to consumer innovativeness (Hartman & Samra, 2008).

- *Opinion Leadership*

It refers to a consumer's desire to affect the decision making of other consumers (Childers, 1986). Midgley and Dowling (1993) argue that opinion leaders are innovators and they have no social dependence.

- *Stimulus variation*

There is a group of consumers who have a need for stimulation and they prefer the unfamiliar (Tellis et al., 2009). This trait also leads to innovativeness (Hebb, 1955; Hirschman & Wallendorf, 1979).

- *Habituation*

Ram (1989) argues that consumers' refusal to adopt new products could be a habitual behaviour. Research shows that almost half of the time consumer behaviour is motivated by habits (Wood et al., 2002). Consumers are more likely to be on the safe side and stick with the well-known products and habits instead of trying something new (Kotler, 2001; Meijkamp, 2000; Schmidt, 2015).

- *Nostalgia*

Nostalgia means glorifying the past and preferring old products (Tellis et al., 2009). Researchers argue that this has a negative influence on consumer innovativeness (Steenkamp et al., 1999).

- *Suspicion*

"Suspicion is consumers' fear or doubt of the intentions of marketers of new products and services" (Tellis et al., p. 4). Catulli (2012) also support this proposition; during his research, respondents raised concerns about the supplier. Consumers have concerns about the reliability of the products and businesses (Meijkamp, 2000; Ylä-Mella et al., 2015).

- *Effort*

"The term "effort" refers to consumers' reluctance to expend time and effort to adopt a new product." (Tellis et al., 2009, p. 5).

- *Frugality*

The cheaper the innovation the more quickly consumers will adopt it (Tornatzky & Klein, 1982; Kapoor et al., 2014). However, when a new product is launched, it has a high cost that innovators has to pay (Golder & Tellis, 1997).

3. Methodology

This paper takes a quantitative approach because it "seek explanations and predictions that will generate to other persons and places. The intent is to establish, confirm, or validate relationships and to develop generalizations that contribute to theory" (Leedy & Ormrod, 2001, p. 102). This paper attempts to establish and confirm a relationship between consumer innovativeness and consumer acceptance of pay-per-wash. Additionally, descriptive research design was chosen due to the novelty of the circular economy phenomenon and it can also be applied to compare groups, in this case countries.

3.1 Sample and data collection

The research consists of three samples: Czech Republic, Sweden and Hungary. Data was collected through a Czech professional research agency in October, 2021. Quota sampling was used and the final sample size amount to 816-821 respondents in each country. Detailed descriptive statistics about the sample can be seen in Table 1:

Table 1: Demographics

Demographics	Czech Republic (N=816)	Sweden (N=821)	Hungary (N=820)
Age range			
18-23	8.1%	7.7%	8.7%
24-30	12.6%	11.7%	13.4%
31-40	21.3%	16.9%	19.6%
41-50	23.4%	16.4%	23.2%

Demographics	Czech Republic (N=816)	Sweden (N=821)	Hungary (N=820)
51-60	16.5%	16.0%	14.8%
61 or above	18.0%	31.3%	20.4%
Gender			
Male	50.9%	50.8%	47.2%
Female	49.1%	49.2%	52.8%
Education			
Primary education	34.4%	20.6%	16.6%
High school diploma	40.3%	31.4%	56.0%
BA or higher	25.2%	48.0%	27.4%

3.2 Measurement

A questionnaire was created to obtain the attitudes and opinions of the populations. The questionnaire was adopted from the work of Tellis et al. (2009) because they developed a cross-cultural item scale to measure consumer innovativeness.

The questionnaire included 10 statements, each representing a construct of consumer innovativeness described in the Literature review section above.

Participants were asked to indicate how much they agree or disagree with statements on a 1-5 Likert scale. The Likert scale was coded as 1 meaning “Strongly disagree” and 5 meaning “Strongly agree”. In the statistical analysis each scale was treated as an interval variable.

3.3 Data analysis

Multiple linear regression analysis was carried out because it is an appropriate method to use to find out whether consumer innovativeness significantly predicts adaptation of pay-per wash. The variables are measured on an interval scale and the assumptions of normal distribution, non-multicollinearity, no autocorrelation and homoscedasticity were met.

3.3.1 Czech Republic

Table 2: Results of regression in Czech Republic

	Standardized beta coefficients	P-value
Stimulus variation	.057	.173
Habituation	-.002	.956
Variety seeking	.080	.064
Effort	.063	.082
Risk taking	.197	**<.001**
Nostalgia	-.038	.296
Opinion leadership	.023	.600
Suspicion	.025	.482
Frugality	.033	.352
Novelty seeking	.128	**.004**

The overall regression was statistically significant (R^2 =0.149, F(df 10, df 805)=14.042, p<0.001).

The effect size is 0.18 which indicates a medium effect.

It was found that Risk taking and Novelty seeking significantly predicted Intention to use pay-per-wash.

However, it was found that Stimulus variation, Habituation, Variety seeking, Effort, Nostalgia, Opinion leadership, Suspicion and Frugality did not significantly predict Intention to use pay-per-wash.

3.3.2 Sweden

Table 3: Results of regression in Sweden

	Standardized beta coefficients	P-value
Stimulus variation	.114	**.003**
Habituation	.091	.013
Variety seeking	.148	**<.001**
Effort	.060	.085
Risk taking	.102	.010
Nostalgia	-.117	**.001**
Opinion leadership	.027	.464
Suspicion	-.002	.943
Frugality	-.018	.613
Novelty seeking	.161	**<.001**

The overall regression was statistically significant (R^2 =0.185), F (df 10, df 810)=18.440, p<0.001).

The effect size is 0.23 which indicates a medium effect.

It was found that Stimulus variation, Variety seeking, Nostalgia and Novelty seeking significantly predicted Intention to use pay-per-wash. However, Nostalgia has a negative impact on Intention to use pay-per-wash.

Not significant predictors were Habituation, Effort, Risk taking, Opinion leadership, Suspicion and Frugality.

3.3.3 Hungary

Table 4: Results of regression in Hungary

	Standardized beta coefficients	P-value
Stimulus variation	.069	.133
Habituation	.035	.341
Variety seeking	.000	.993
Effort	.120	**.001**
Risk taking	.049	.245
Nostalgia	-.083	.025
Opinion leadership	.101	.010
Suspicion	-.014	.693
Frugality	-.006	.870
Novelty seeking	.234	**<.001**

The overall regression was statistically significant (R^2 =0.154), F (df 10, df 809) =14.736, p<0.001).

The effect size is 0.18 which indicates a medium effect.

It was found that Effort and Novelty seeking significantly predicted Intention to use pay-per-wash.

However, it was found that Stimulus variation, Habituation, Variety seeking, Nostalgia, Opinion leadership, Suspicion and Frugality did not significantly predict Intention to use pay-per-wash.

Tellis et al. (2009) argues that true representation of consumer innovativeness can be seen by reluctance. In the group of reluctance belongs effort, nostalgia, suspicion and frugality. According to Tellis et al. (2009), consumers overestimate their own innovativeness, so the ”Reluctance” group could show consumers real level of innovativeness. However, the analysis showed no significant results.
Since Novelty seeking seems to represent consumer innovativeness in every country, to assess the relationship between demographic characteristics and consumer innovativeness 4 categorizes of demographic characteristics on Novelty seeking were regressed.

Table 5: Results of regression on Novelty seeking

	Standardized beta coefficients	P-value
Gender	-.077	**<.001**
Education	.032	.112
Age	.208	**<.001**
Income	-.039	.054

The overall regression was statistically significant (R^2 =0.051), F (df 4, df 2452) =34.212, p<0.001).

The effect size is 0.05 which indicates a small effect.

It was found that Gender and Age significantly predicted Novelty seeking.

However, it was found that Education and Income did not significantly predict Novelty seeking.

4. Findings

This paper aimed to examine whether consumer innovativeness predict adaptation of pay-per-wash services across countries. It focused on three countries: Czech Republic, Sweden and Hungary. Consumer innovativeness was measured by 10 constructs created by Tellis et al. (2009) and data was collected by a professional agency through online questionnaire.

Multiple linear regression was applied as it can assess the relationship between consumer innovativeness and adaptation of pay-per-wash. The results shows that in Czech Republic Risk taking and Novelty seeking are two factors of consumer innovativeness that significantly predict intention to use pay-per-wash. In Sweden Stimulus variation, Variety seeking, Nostalgia and Novelty seeking significantly predicted Intention to use pay-per-wash. However, Nostalgia has a negative impact on Intention to use pay-per-wash. And for Hungary, Effort and Novelty seeking significantly predicted Intention to use pay-per-wash.

Sweden seems to be the most innovative country with the most significant predictors and highest R^2 value (R^2 =0.185) and effect size (f^2=0.23). Novelty seeking appears to be a significant predictor in all three countries.

The results show difference from the literature because only a few constructs of consumer innovativeness were significant influencers. This offers space for further research not only in the circular economy context but also in the linear economy one.

The other aim of the study was to see whether demographic characteristics influence consumer innovativeness across countries. The results of such analysis can reveal the characteristics of the innovators.

Tellis et al. (2009) claims that consumers intend to overestimate their own innovativeness, so in order to find out about the characteristics of the innovators, Effort, Nostalgia, Suspicion and Frugality should be explored to show the true level of innovativeness. However, regressing on those variables had no significant results. As Novelty seeking was a variable that was significant for all three countries, it was used to see if demographic characteristics could predict it. The results show that gender and age significantly predict Novelty seeking. It seems that across the three countries innovative consumers are likely to be young women.

For the theoretical side, this paper deepens the current scarce knowledge of consumer acceptance of circular economy by arguing that consumer innovativeness can predict consumers' acceptance of pay-per-wash services. However, with restrictions, since not all theoretic based constructs influence acceptance. Novelty seeking is a construct of consumer innovativeness that significantly predict consumers' intention to use pay-per-wash in all three countries.

For the managerial side, demographic characteristics can help companies to target and segment their consumers. Result shows that across the three countries innovative consumers are likely to be young women.

Acknowledgements

This research was supported by the Student Grant System of Masaryk University, and I would like to thank them for their support.

References

Baines, T., Lightfoot, H. & Evans, S. (2007) "State-of-the-art in product-service systems", *The* Proceedings *of the Institution of Mechanical Engineers*, *Part B: Journal of Engineering Manufacturing,* vol. 221, pp. 1543-1552.

Baumann, C., Elliott, G. and Hamin, H. (2011) "Modelling customer loyalty in financial services", *The International Journal of Bank Marketing*, Vol. 29, No. 3, pp. 247–267.

Catulli, M. (2012) "What uncertainty?: Further insight into why consumers might be distrustful of product service systems", *Journal of Manufacturing Technology Management,* Vol. 23, No. 6, pp. 780-793.

Catulli, M., Cook, M., & Potter, S. (2014) *What value do consumers really expect from Product Service Systems? Reflections on how a different conception of value could facilitate the implementation of PSS in consumer markets.* Paper presented at Sustainable Innovation 2014 - 19th International Conference, Copenhagen, Denmark.

Catulli, M., Cook, M., & Potter, S. (2017) "Consuming use orientated product service systems: a consumer culture theory perspective", *Journal of Cleaner Production*, Vol. 141, pp. 1186-1193.

Catulli, D., Reed, N., Tzilivakis, J., & Green, A. (2020) *Extending the Life of Infant Mobility Products:* Implementing a Product Service System: Report on DEFRA ABR112. University of Hertfordshire.

Childers, T. L. (1986) "Assessment of the psychometric properties of an opinion leadership scale", *Journal of Marketing Research,* Vol. 23, No. 2, pp. 184–188.

Cook, M., Bhamra, T., & Lemon, M. (2006) "The transfer and application of Product Service-systems: from academia to UK manufacturing firms", *Journal of Cleaner Production,* Vol. 14, No. 17, pp. 1455-1465.

Conchar, M. P., Zinkhan, G. M., Peters, C., & Olavarrieta, S. (2004) "An Integrated Framework for the Conceptualization of Consumers' Perceived Risk", *Journal of the Academy of Marketing Science*, Vol. 32, No. 4, pp. 418-436.

Edbring, E. G., Lehner, M., & Mont, O. (2016) "Exploring consumer attitudes to alternative models of consumption: Motivations and barriers", Journal of Cleaner Production, vol. 123, pp. 5-15.

European Commission, Closing the loop - An EU action plan for the Circular Economy, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2015, COM(2015) 614 final.

European Environment Agency, Resource-efficient Green Economy and EU policies, Luxembourg: Publications Office of the European Union, 2014

Goedkoop, M. (1999). Product Service systems, Ecological and Economic Basics.

Golder, P. N. & Tellis, G. J. (1997) "Will It Ever Fly? Modeling the Growth of New Consumer Durables", *Marketing Science*, Vol. 16, No. 3, pp. 256–70.

Goldsmith, R. E. & Flynn, L. R. (1992) "Identifying innovators in consumer product markets", *European Journal of Marketing*, Vol. 26, No. 12, pp. 42–55.

Goldsmith, R. E. & Hofacker, C. F. (1991) "Measuring consumer innovativeness", *Journal of Academic Marketing Science*, Vol. 19, pp. 209–221.

Hartman, J. B. & Samra, Y. M. (2008) "Impact of personal values and innovativeness on hedonic and utilitarian aspects of web use: an empirical study among United States teenagers", *International Journal of Management*, Vol. 25, No. 1, pp. 77–94.

Hebb, D. O. (1955) "Drives and the C.N.S. (Central Nervous System)," *Psychological Review*, Vol. 62, No. 4, pp. 243–54.

Hepper, E., Wildschut, T., Sedikides, C., Robertson, S., & Routledge, C. D. (2020) "Time capsule: Nostalgia shields psychological wellbeing from limited time horizons", *Emotion*, Vol. 21, No. 4, pp. 1–59.

Hirschman, E. C. (1980). "Innovativeness, novelty seeking and consumer creativity", *Journal of Consumer Research,* Vol. 7, pp. 283– 295.

Hirschman, E. C. & Wallendorf, M. (1979) "Correlations Between Three Indicators of Breadth and Variation in Sources of Stimulation," Advances in Consumer Research, Vol. 6, H. Keith Hunt, ed. Ann Arbor, MI: Association for Consumer Research, pp. 111–17.

Hischier, R., Reale, F., Castellani, V., & Sala, S. (2020) "Environmental impacts of household appliances in Europe and scenarios for their impact reduction", *Journal of Cleaner Production*, Vol. 267, 121952

Hull, C. L. (1943) *Principles of behavior: An introduction to behavior theory*, New York: Appleton-Century-Crofts.

Im S., Bayus B. L., & Mason, C. H. (2003) "An empirical study of innate consumer innovativeness, personal characteristics, and new-product adoption behavior", Journal of Academic Marketing Science, Vol. 31, No. 1, pp. 61–73.

Jia, L., Song, X., & Hall, D. (2022) "Influence of Habits on Mobile Payment Acceptance: An Ecosystem Perspective", *Information System Frontiers,* Vol. 24, pp. 247–266.

Kapoor, K. K., Dwivedi, Y. K., & Williams, M. D. (2014) "Examining consumer acceptance of green innovations using innovation characteristics: A conceptual approach", International Journal of Technology *Management & Sustainable Development*, vol. 13, No. 2, pp. 135–160.

Kotler, P. (2001). *Marketing Management*, Boston: Pearson Education Canada.

Krishen, A. S., Bui, M., & Peter, P. C. (2010) "Retail kiosks: how regret and variety influence consumption", *International Journal of Retail & Distribution Management*, Vol. 38, No. 3, pp. 173–189.

Leedy, P. D. & Ormrod, J. E. *Practical Research: Planning and Design*. Upper Saddle River, N.J: Merrill Prentice Hall, 2001. Print.

Manning, K. C, Bearden, W. O., & Madden, T. J. (1995). "Consumer innovativeness and the adoption process", *Journal of Consumer Psychology*, Vol. 4, No. 4, pp. 329–345.

Manzini, E. Vezzoli, C., & Clark, G. (2001) "Product service-systems: using an existing concept as a new approach to sustainability", *Journal of Design Research,* vol. 1*,* pp. 27-40.

Meijkamp, R. (2000). Changing consumer behaviour through eco-efficient services: an empirical study of car sharing in The Netherlands, shorted version. PhD thesis, Delft University of Technology, Delft.

Midgley, D. F. & Dowling, G. R. (1978) "Innovativeness: The Concept and Its Measurement," *Journal of Consumer Research*, Vol. 4, pp. 229–242.

Mitchell, P. (2015) *Employment and the circular economy - Job Creation through resource efficiency in London*, Report produced by WRAP for the London Sustainable Development Commission, the London Waste and Recycling Board and the Greater London Authority.

Mont, O., Product Service-Systems: Panacea or myth? Ph.D. Thesis, Lund Univ., 2004

Pauwels, K., Silva-Risso, J., Srinivasan, S., & Hanssens, D. M. (2004) "New products, sales promotions, and firm value: the case of the automobile industry", *Journal of Marketing*, Vol. 68, pp. 142–156.

Pearson, P. H. (1970) "Relationships between global and specific measures of novelty seeking", *Journal of Consulting and Clinical Psychology*, Vol. 34, No. 2, pp. 199– 204.

Perren, R. & Kozinets, R. V. (2018) "Lateral exchange markets: How social platforms operate in a networked economy", *Journal of Marketing*, Vol. 82, No. 1, pp. 20-36

Raju, P. S. (1977), "*Theoretical Perspectives on Exploratory Behavior: A Review and Examination of Their Relevance for Consumer Research*," Working Paper #67, Working Series in Marketing Research, Pennsylvania State University, University Park.

Ram, S. (1989) "Successful Innovation Using Strategies to Reduce Consumer Resistance: An Empirical Test", *Journal of Product Innovation Management*, 6, pp 20-34.

Retamal, M. & Schandl, H. (2018) "Dirty Laundry in Manila: Comparing Resource Consumption Practices for Individual and Shared Laundering", *Journal of Industrial Ecology*, Vol. 22, pp. 1389-1401.

Rocchi, S., Enhancing Sustainable Innovation by Design, Ph.D. Thesis, Erasmus Univ. Rotterdam, 2005

Roehrich, G. (2004) "Consumer innovativeness: Concepts and measurements", *Journal of Business Research*,
Vol. 57, No. 6, pp. 671-677,

Routledge, C., Wildschut, T., Sedikides, C., & Juhl, J. (2013) "Nostalgia as a resource for psychological health and wellbeing", *Social and Personality Psychology Compass*, Vol. 7, No. 11, pp. 808–818.

Schmidt, D. (2015) "Product-Service Systems for Influencing Customer Barriers and Customer Acceptance", *Journal of Economics, Business and Management*, Vol. 3, No. 10, pp. 990-993.

Srinivasan, S., Pauwels, K., Silva-Risso, J., & Hanssens, D. M. (2009). "Product innovations, advertising, and stock returns", *Journal of Marketing*, Vol. 73, pp. 24–43.

Steenkamp, J-B. E. M. & Baumgartner, H. (1992) "The Role of Optimum Stimulation Level in Exploratory Consumer Behavior," *Journal of Consumer Research*, Vol. 19, pp. 434–48.

Steenkamp, J-B. E. M., Hofstede, F., & Wedel, M. (1999) "A cross-national investigation into the individual and national cultural antecedents of consumer innovativeness", *Journal of Marketing,* Vol. 63, pp. 55-69.

Sudhir, R., Sachin K. R., Sanjeev P., & Abu B. A. H. (2021) "Promoting through Consumer Nostalgia: A Conceptual Framework and Future Research Agenda", *Journal of Promotion Management*, Vol. 27, No. 2, pp. 211-249.

Stål, H. I. & Corvellec, H. (2018) "A decoupling perspective on circular business model implementation: illustrations from Swedish apparel", *Journal of Cleaner Production*, Vol. 171, pp. 630-643.

Tellis, G. J., Yin, E., & Bell, S. (2009) "Global Consumer Innovativeness: Cross-Country Differences and Demographic Commonalities", Journal of International Marketing, Vol. 17, No. 2, pp. 1–22.

Tornatzky, L. G. & Klein, K. J. (1982) "Innovation characteristics and innovation adoption-implementation: A meta analysis of findings", IEEE Transactions on Engineering Management, vol. 29, No. 1, pp 28–43.

Tukker, A. (2015) "Product services for a resource-efficient and circular economy – A review", *Journal of Cleaner Production*, vol. 97, pp. 76–91.

Verplanken, B., Aarts, H., & van Knippenberg, A. D. (1997) "Habit, information acquisition, and the process of making travel mode choices", *European Journal of Social Psychology*, Vol. 27, No. 5, pp. 539–560.

Wang, E. S. T. (2015) "The role of player innovativeness in adopting new online games: bidimensional and hierarchical perspectives", *International Journal of Technology Marketing,* Vol. 10, No. 3, 236*.*

Wood, W., Quinn, J. M., & Kashy, D. A. (2002) "Habits in everyday life: Thoughts, emotions, and action", *Journal of Personal Social Psychology*, Vol. 83, No. 6, pp. 1281–1297.

Ylä-Mella, J., Keiski, R. L., & Pongracz, E. (2015) "Electronic waste recovery in Finland: consumers' perceptions towards recycling and re-use of mobile phones", *Waste Management,* Vol*.* 45, pp. 374-384.

Yuan, Z., Zhang, Y., & Liu, X. (2016) "Life cycle assessment of horizontal-axis washing machines in China", *International Journal of Life Cycle Assess*, Vol. 21, pp. 15–28.

Born Green: Drivers and Competencies of Green Entrepreneurship

Pedro Pimentel and Maria José Sousa
ISCTE - IUL - University Institute of Lisbon, Portugal
pedro.m.pimentel@gmail.com
maria.jose.sousa@iscte-iul.pt

Abstract: Sustainable development is one of the most prominent discussions of our times and promoting green new ventures can help reduce ecological footprints and meet the climate change goals. Despite its importance for the next decades, the study of green entrepreneurship (GE) is still very poor and being an emerging field of study can be considered still in its infancy. (Demirel et al, 2019; Sher et al, 2020). The current paper aims at providing a contribute to management science and business management practice by focusing on the research questions: (a) what are the most relevant theoretical frameworks researching drivers that trigger green entrepreneurial intention (GEI), and (b) what are the main theoretical frameworks investigating competencies that might favour or enhance the specific form of green entrepreneurial intention. Several theories have been developed to explain the classic entrepreneurial intention (EI) being the most noted the theory of planned behaviour (TPB) (Ajzen, 1991), and theory of entrepreneurial event (TEE) (Shapero and Sokol, 1982). A different stream of literature focus on individual competencies that can allow key issues to be captured and influence entrepreneurial intentions which are variable and can be acquired and learned over time (Mitchelmore and Rowley, 2010; Man et al, 2002). Nevertheless, these models do not contemplate on the role of the entrepreneurial intentions for a specific form like GE (Sher et al, 2020). We conducted a systematic literature review aiming at analysing quantitatively and qualitatively the relevant articles in indexed journals based on the PRISMA approach - Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Main findings are that recent relevant studies mainly adapt TPB to the determinants of GE by inserting new specific precedent variables. As to GE competencies, main authors depart from classic theoretical frameworks and finetune their approach to the more specific and broader dimensions of GE.

Keywords: green entrepreneurship, drivers, competencies, higher education, born green

1. Introduction

Nobody argues the importance of entrepreneurship. The development of a culture of entrepreneurship in society is a basic tool for the economic and social development to improve the competitiveness of a country (Robles and Rodriguez, 2014). And yet the study of green entrepreneurship is still undoubtedly poor (Potluri and Phani, 2020) although fundamental for the necessary change in business management in order to meet the climate change goals and all of the environmental challenges for the next decades.

Green entrepreneurship (GE) is an emerging field of study and still in its infancy (Demirel et al, 2019; Potluri and Phani, 2020) and being a theme with immense topicality the growth of peer-reviewed articles in indexed journals has grown exponentially over the last years.

Furthermore, research on GE is also gaining increased visibility due to social awareness of corporate responsibility toward environment, and the growing importance of ecological sustainability in strategic business development (Demirel et al, 2019) and it's becoming an important subfield of entrepreneurship (Gast et al, 2017).

"Born green" firms, used interchangeably with "green start-ups", follow the need for a greener approach to business providing practical and innovative solutions for pursuing both economic and environmental goals (Demirel et al, 2019).

According to recent articles in top ranking journals further research on green entrepreneurship (GE) is undoubtedly needed both from the academic perspective and managerial perspective namely in what regards its explanations/motivations and ways to promote it including via Higher Education (HE) (Fichter and Tiemann, 2018). There is still a lack of a theoretical framework for GE, so this field needs to be analysed, organised, and synthetized to bring clarity (Terán-Yépez, et al, 2020).

This paper intends to provide a contribute to management science by reflecting the status of literature on GE drivers and competencies fields also providing a better understanding of what are the main drivers that trigger green entrepreneurial intention (GEI), what are the main competencies to engage in green new ventures and establish future challenges for research.

The contribution of this study consists of examining what are the most adequate and specific theoretical models and variables applicable both to the drivers of green entrepreneurial intention and to the competencies that enhance green entrepreneurial intention.

Research questions are (a) what are the most relevant theoretical frameworks researching drivers that trigger green entrepreneurial intention (GEI), and (b) what are the main theoretical frameworks investigating competencies that might favour or enhance the specific form of green entrepreneurial intention.

2. Green Entrepreneurship drivers and competencies

Green Entrepreneurship (GE) can be defined (among many other definitions) as the entrepreneurship process that combines profit orientation with technological innovations that addresses global environment issues (Potluri and Phani, 2020).

On the other hand, drivers are factors, personality characteristics, traits, leading to Green Entrepreneurial Intention (GEI) (Sher et al, 2020). With that perspective they depend on the individual characteristics, personality, and upbringing (family, social, economic) and cannot be taught.

Differently from drivers, entrepreneurial competencies (EC) are sets of acquired abilities, skills, characteristics, and behaviours necessary to engage in effective new ventures (Mitchelmore and Rowley, 2010). With that perspective in mind most scholars defend that they can be acquired and learned over time and that education and especially higher education plays an important role in the acquisition of those competencies.

(Classic) entrepreneurship intentions and its drivers are extensively studied and there is also vast literature on entrepreneurship skills and competencies. However, the green entrepreneurial intention (GEI) is poorly studied and moreover there is scarce literature on this new subfield of research (Demirel et al, 2019; Potluri and Phani, 2020, Gast et al, 2017) namely in what respects to its drivers and necessary competencies.

Several theories have been developed to explain the classic entrepreneurial intention (EI) and two different streams of literature emerge: (a) Drivers/Traits approach and (b) Competencies based approach.

2.1 Entrepreneurial drivers' approach

This approach emphasizes personality traits, characteristics, behaviours and perceptions, and most commonly used models are theory of planned behaviour (TPB) (Ajzen, 1991), and theory of entrepreneurial event (TEE) (Shapero and Sokol, 1982).

In TPB – Theory of planned behaviour entrepreneurial intention (EI) is influenced by (1) Attitude, (2) Perceived social norms, (3) Perceived behavioural control. On the other hand, in theory of entrepreneurial event (TEE) entrepreneurial intention (EI) is triggered by event(s) and influenced by drivers like (1) Perceived propensity, (2) Perceived desirability, and (3) Perceived feasibility.

Nevertheless, these models do not contemplate on the role of the entrepreneurial intentions for a specific form like green entrepreneurship (GE) and, therefore, existing entrepreneurial intention models create a research gap being unable to provide the answer for the green (sustainable) entrepreneurial research (Sher et al, 2020).

With that in mind most relevant recent studies have adapted some theories like classic entrepreneurship theory and mainly TPB - theory of planned behaviour to the specific characteristics of GE namely in introducing new antecedent variables of GE drivers like self-efficacy, environmental values, education, attitude, and sustainable orientation (Vuorio et al, 2018; Sher et al, 2020; Romero-Colmenares, 2022).

2.2 Competencies approach

On this approach a focus on individual competencies can allow key issues to be captured and influence entrepreneurial intentions (EI). The competencies approach identifies the competencies of individuals which are variable and can be acquired and learned over time (Mitchelmore and Rowley, 2010; Man et al, 2002).

Lans et al (2014) identifies five generic competencies as basis of EI: (1) Opportunity competencies, (2) Self-efficacy competencies (3) Business competencies, (4) Industry-specific competencies, and (5) Social/Environmental competencies. On a more macro perspective recently the European Commission defined EntreComp - the European Entrepreneurship Competence Framework developing an integrated set of fifteen individual competencies that can favour EI (McCallum et al, 2018).

However, despite extensive research on topic of entrepreneurship competencies and skills have been conducted which includes the works of Man et al (2002), Gibb and Hannon (2006), Linan (2008), Mitchelmore and Rowley (2010), Boyles (2012), Kyndt and Baert (2015), among many others, the competencies for the specify form of green entrepreneurship are still poorly studied.

Recent relevant studies identified key individual competencies for sustainable entrepreneurship (SE) as (1) Systems thinking competence, (2) Embracing diversity and interdisciplinary competence, (3) Foresighted thinking competence, (4) Normative competence, (5) Action competence, (6) interpersonal competence, and (7) Strategic management competence (Lans et al, 2014). Building upon these findings Bloom et al (2018) proposed a competence framework for sustainable entrepreneurship composed of six key competences basically merging two variables (strategic management and action competence) into one single "strategic action competence". Nevertheless, these authors clearly recognize the need for further empirical evidence on these findings.

2.3 The role of higher education

Several authors posit the moderating role of Higher Education (HE) on EI and recent studies suggest that a growing number of universities are embracing the notion that sustainability should and can be integrated into the university educational and support system for entrepreneurship (Fichter and Tiemann, 2018).

Findings of recent studies may reveal that attitude towards sustainable entrepreneurship, perceived entrepreneurial desirability and perceived entrepreneurial feasibility complement students' sustainability-driven entrepreneurial intentions (Sher et al, 2020).

Moreover, according to some authors future findings on GE research would support the government, policy makers, and university authorities in developing awareness and improved curriculum that could offer greater inclination toward green and sustainable education (Soomro et al, 2020).

3. Sustainable or green entrepreneurial intentions

Intentions precede human behaviour as they are a mental state that refer to the readiness to perform a given behaviour (Ajzen, 1991). Therefore, entrepreneurial intentions can be defined as self-acknowledged conviction of the individual to start a new business and to plan to accomplish in the future (Lortie and Castogianni, 2015; ; Agu et al, 2021, Romero-Colmenares, 2022).

In the context of sustainability dimensions green entrepreneurial intentions can be acknowledged as "a mental state that shows conviction and commitment by a person to set up in the future a new business venture that creates economic, social and environmental values" (Agu et al, 2021).

In studying the specific dimensions of GE we distinguish a sustainable entrepreneur from a conventional entrepreneur. The classic entrepreneur mainly focuses on economic aspects while the green entrepreneur widely focuses on economic, social, and environmental dimensions, therefore conferring him, a broader set of goals and a broader view and mentality (Arru, 2020; Romero-Colmenares, 2022).

4. Methodology

This paper adopts bibliometric analysis aiming at analysing quantitively and qualitatively the relevant articles in indexed journals. We conducted a systematic literature review based on PRISMA approach (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) in the following five steps: (a) definition of the field of study, (b) database selection, (c) research criteria, (d) relevance/exclusion criteria, (e) codification of recovered material, (f) quantitative/qualitative analysis of the information. Methods and results are described on table 1.

Table 1: Methodology flowchart and results

Step 1 Definition of the field of study	Drivers and competencies of green entrepreneurship	
Step 2 Database selection	Scopus	
Step 3 Research criteria	(1) "Green entrepreneur*" OR "sustainable entrepreneur*" OR ecopreneur* OR eco-entrepreneur* AND drivers OR determinants on title, abstract or keywords.	(2) "Green entrepreneur*" OR "sustainable entrepreneur*" OR ecopreneur* OR eco-entrepreneur* AND competenc* OR skills OR knowledge OR know-how on title, abstract or keywords.
Step 4 Relevance/exclusion criteria	Published > 2002(i) and <1st Q 2022 (145 publications)	Published > 2002(i) and <1st Q 2022 (192 publications)
	(i) only articles (ii) only journals (iii) publication phase final; (iv) in English; Duplicates removed. (111 articles)	(i) only articles (ii) only journals (iii) publication phase final; (iv) in English; Duplicates removed. (134 articles)
Step 5 Codification	Keywords; Cluster of Authors; Number of Citations; csv and ris format analysed in Scimat, excel, VOSviewer	Keywords; Cluster of Authors; Number of Citations; csv and ris format analysed in Scimat, excel, VOSviewer
Outputs	Descriptive Figures, Tables, Strategic Diagrams	Descriptive Figures, Tables, Strategic Diagrams
Step 5 Examination of Results	Analysis and Discussion of Results: Descriptive Analysis and Content Analysis	Analysis and Discussion of Results: Descriptive Analysis and Content Analysis

(i) First document from query is published in 2003; Source: Authors

The results presented the most relevant sources/journals, countries, affiliations, subjects, authors, co-authors, citations, keywords, co-occurrences, and more recent models, theoretical frameworks, and variables to better understand the phenomena of specific green entrepreneurship intention.

5. Results and discussion

Research on scientific production of a specific field is relevant for understanding the evolution, research trends, organizing past research and suggest future research lines (Aghelie et al, 2016; Terán-Yépes, 2020). With those objectives in mind first we establish the summarized results of the descriptive analysis performed on evolution of literature, sources, authors, and citations and secondly a content analysis mainly focused on keywords, co-authorship, research fields, theoretical frameworks, and main research trends.

5.1 Evolution of scientific literature production

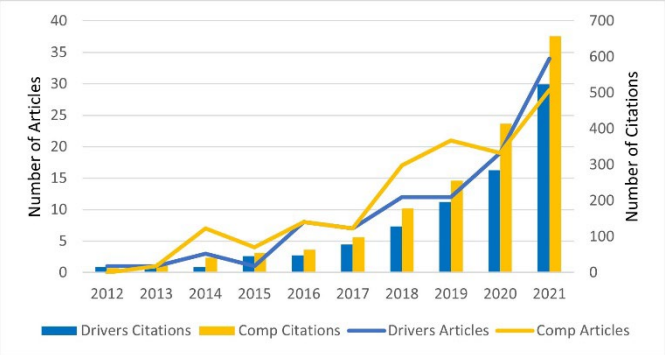
From the search criteria after the exclusion parameters, we obtained a total of 111 articles for green entrepreneurship drivers (GED) and 134 articles for green entrepreneurship competencies (GEC) with respectively 1561 and 2024 citations as detailed on table 2.

Table 2: Final databases

Data	GE Drivers	GE Competencies
Number of Articles	111	134
Number of Journals	54	74
Number of Authors	307	386
Number of Affiliations	241	286
Number of Countries	49	59
Number of Citations	1561	2024

Source: Authors based on Scopus 2022

Data obtained in this study seems to confirm that GE drivers and GE competencies are emerging fields of study as the number of published articles has been increasing constantly since 2012 being the prior publications number merely residual. Moreover, recent years are more productive as 73,9% of total GED articles and 70,1% of GEC articles were published in the period 2017-2022. Citations have grown in parallel from 2012 onwards and these findings are consistent with previous studies (Terán-Yépez et al, 2020).



Source: Authors based on Scopus 2022; Software: Scimat, Excel

Figure 1: Evolution of published articles and citations from 2012 to 2021

Figure 1 and table 2 show that the most recent years (2018-2021) are the most productive with an average of 19,25 articles per year for GED and 21,5 articles published for GEC, well above the averages for the last ten complete years (2012-2021), enhancing the embryonic stage of both topics. Furthermore, low average number of citations per article on the last ten years, 9,47 for GED and 8,14 for GEC, as detailed on table 3 might also be explained by the exploratory stage of the research.

5.2 Sources/journals

This study retrieved data from 54 indexed journals for GED and 74 indexed journals for GEC database as table 2 illustrates. Most productive journals for GE drivers literature are Sustainability (29 articles), Journal Of Cleaner Production (4 articles), International Journal of Entrepreneurial Behaviour and Research (6 articles), Entrepreneurship And Sustainability Issues (4 articles) that globally represent 38,7% of total articles published.

As to GE competencies Sustainability (24 articles), Journal Of Cleaner Production (11 articles), International Journal of Entrepreneurial Behaviour and Research (5 articles), Small Business Economics (4 articles), Entrepreneurship and Sustainability Issues 4 (articles), International Journal of Management Education (3 articles), and International Journal of Social Ecology and Sustainable Development (3 articles) represent 40,3% of retrieved literature. Nevertheless, fragmentation is one of the most prominent characteristics of sources analysed as vast majority of journals only account for 1 article published. Only a minority accounts for 2 or more publications and we observed an average of articles per journal of 1,29 for GED and 1,39 for GEC.

Table 3: Characteristics of articles on GE drivers and GE competencies from 2002 to 2022 (First Quarter)

	Drivers					Competencies				
Year	A	C	C/A	J	A/J	A	C	C/A	J	A/J
<2012	8	31	3,88	7	1,14	13	12	0,92	12	1,08
2012	1	16	5,22	1	1,00	0	12	1,85	0	-
2013	1	21	6,80	1	1,00	1	28	3,71	1	1,00
2014	3	16	6,46	3	1,00	7	41	4,43	7	1,00
2015	1	46	9,29	1	1,00	4	55	5,92	4	1,00
2016	8	48	8,09	8	1,00	8	63	6,39	8	1,00
2017	7	78	8,83	7	1,00	7	98	7,73	5	1,40
2018	12	128	9,37	6	2,00	17	179	8,56	7	2,43
2019	12	196	10,94	8	1,50	21	255	9,53	14	1,50
2020	19	285	12,01	13	1,46	19	414	11,93	13	1,46
2021	34	523	13,09	15	2,27	29	657	14,40	14	2,07
20221Q	5	173	14,06	5	1,00	8	210	15,10	8	1,00
AVG	9,36	139,09	9,47	6,18	1,29	11,00	182,91	8,14	7,36	1,39

A: Number of Articles; C: Number of Citations; C/A: Average Citations per article (citation total since 2003/total articles since 2003; J: Number of Journals; A/J: Average number of articles per journal; AVG: Total average from 2013 to 2021; Source: Authors based on Scopus 2022; Software: Scimat and Excel

5.3 Authors, citations, and main frameworks

Most cited authors on retrieved literature are important to establish the structure of past research and detect main research trends. Table 4 highlights the most cited authors on the analysed period. On the topic of GE drivers Wagner, M. and Kuckertz, A. play a key role, but their most relevant and cited article is from 2010. Focusing on more recent literature most prominent authors are Vuorio, A.M., Kraus, S., Jabeen, F.,Tur-Porcar, A., and Fischer, D. all with just one published article from 2017 onwards on retrieved literature.

Most important theoretical frameworks used are TPB – theory of planned behaviour specifically adapted to best depict GE intention namely in what concerns the antecedents of GE drivers like self-efficacy, environmental values, education, and SE orientation. TPB is prominently used by Vuorio, A.M, among others, and SE orientation is analysed by Jabeen, F., Tur-Porcar, A., and Soo Sung, C. Entrepreneurship Theory is used by Kuckertz, A, and Wagner, M. among others adapting its conventional approach to the GE phenomena.

Table 4: Most cited authors on GE drivers

Authors	Article	Citations	C/A	Pub Years	Focus / Framework
Kuckertz, A.	3	362	120,7	2010-2012	Sustainability orientation of HE students on GEI; Entrepreneurship Theory
Vuorio, A.M.	1	80	80,0	2018	Drivers of entrepreneurial intentions in SE; Adapted TPB - Theory of Planned Behaviour
O'Neill, K.	2	78	39,0	2014-2016	GE narratives and Evolving nature of becoming a green entrepreneur
Crals, E.	1	74	74,0	2005	Financial conditions for implementation of SE business practices by SMEs
Kraus, S.	1	58	58,0	2018	SMEs internal culture and resources are determinants for adopting SEO
Randjelovic, J.	1	53	53,0	2003	Emergence of Green Venture Capital
Jabeen, F.	1	42	42,0	2017	Factors influencing mindset in choosing entrepreneurship as employment
Tur-Porcar, A.	1	40	40,0	2018	Environmental/Business and Behavioural/Human Relations Factors based on TPB.
Fischer, D.	1	31	31,0	2018	Regulatory Focus Theory
Sunny, S.A.	1	27	27,0	2019	How institutional factors affect entrepreneurial firm formation in the USA
Soo Sung, C.	1	27	27,0	2018	Sustainability orientation and opportunity recognition on SEI

C/A: average number of citations; Source: Authors based on Scopus 2022 and content analysis

On the topic of GE competencies Carayannis, E.G. is the most cited author, as described on table 5, with an average of 115 citations per article being his focus the relation between innovation, knowledge, and the environment and not directly GE intention. The most recent cited authors are Lans, T., Jiang, W, Demirel, P., and Fichter, K., commonly referred as being the main reference authors in recent years.

Most important recent models referred are the Seven Competencies Framework for SE used by Lans, T, among others, Patzer and Shepherd's Opportunity Recognition Model and Quintuple Helix framework used by Carayannis, E.G.

From retrieved data analysing the twenty most cited authors only one author (Fischer, D) is observed in both databases which suggests that, as expected, there appears to be two separate streams of literature on GE intention, the first focusing on main drivers and the second focusing on competencies and skills, with little characteristics, variables, and theoretical frameworks in common.

5.4 Keywords and co-authorship occurrences, clusters, and networks

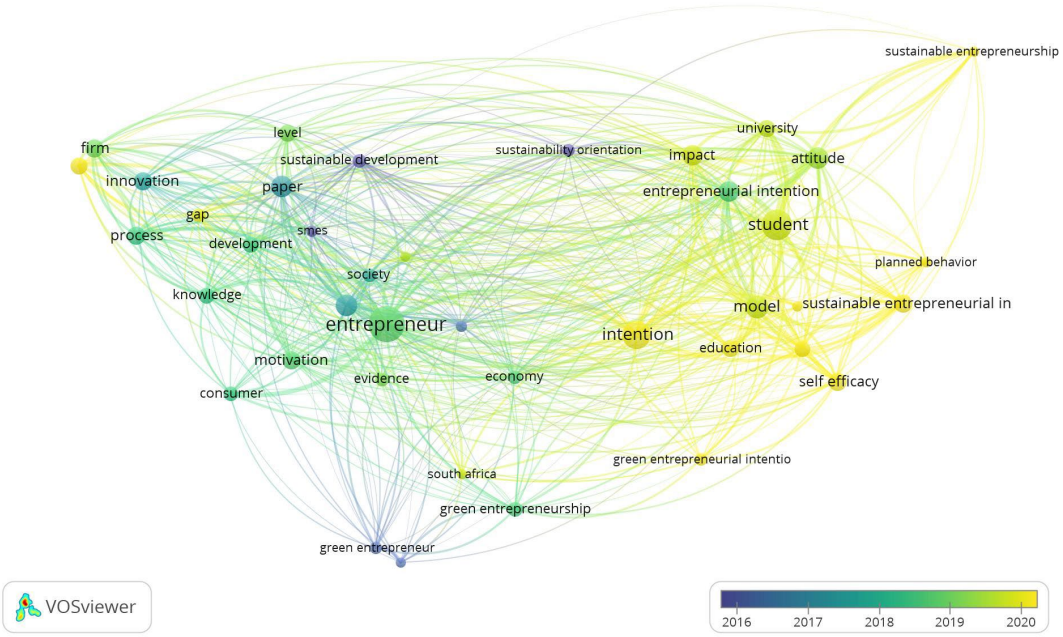
Figure 2 represents the overlay visualization of GE drivers database with VOSviewer software. Main results present main 40 keywords on title and abstract fields. We can observe a network of 579 links and 3 main clusters of keywords. Main keywords are entrepreneur, intention, students/university/education, SE and SE intention and GE and GE intention, among others. Moreover, most recent keywords suggest that recent research is

highlighting intention/entrepreneurial intention, student/education/university, planned behaviour, self-efficacy, SE and SE intention all of them aggregated in the second cluster thus indicating recent research trends.

Table 5: Most cited authors on GE competencies

Authors	Articles	Citations	C/A	Pub Years	Focus / Framework
Carayannis, E.G.	4	460	115,0	2010-2017	Quintuple Helix framework; Learning competencies
Lans, T.	4	307	76,8	2014-2018	Competencies Framework for SE: Seven competencies construct
Jiang, W	1	109	109,0	2018	GEO - Green entrepreneurial orientation impact on performance
Demirel, P.	1	66	66,0	2019	Factors that shape Born Green Ventures
Fichter, K.	3	64	21,3	2018-2022	Factors influencing university support systems for SE
Silajdžić, I.	1	64	64,0	2015	Public policies, institutions, and society shaping GE
HaviernikovÃ¡, K.	2	41	20,5	2019-2020	Competency risks in SMEs cluster operation
Fischer, D.	1	31	31,0	2018	Role of regulatory focus in SE and SE motivation
Hanohov, R.	1	31	31,0	2018	Opportunity Recognition In SE; Patzelt and Shepherd's Model
Lotfi, M.	1	30	30,0	2018	Green market positively effects GE and SE
Raudeliuniene, J.	1	30	30,0	2014	Macro key success factors for SE

C/A: average number of citations; Source: Authors based on Scopus 2022 and content analysis



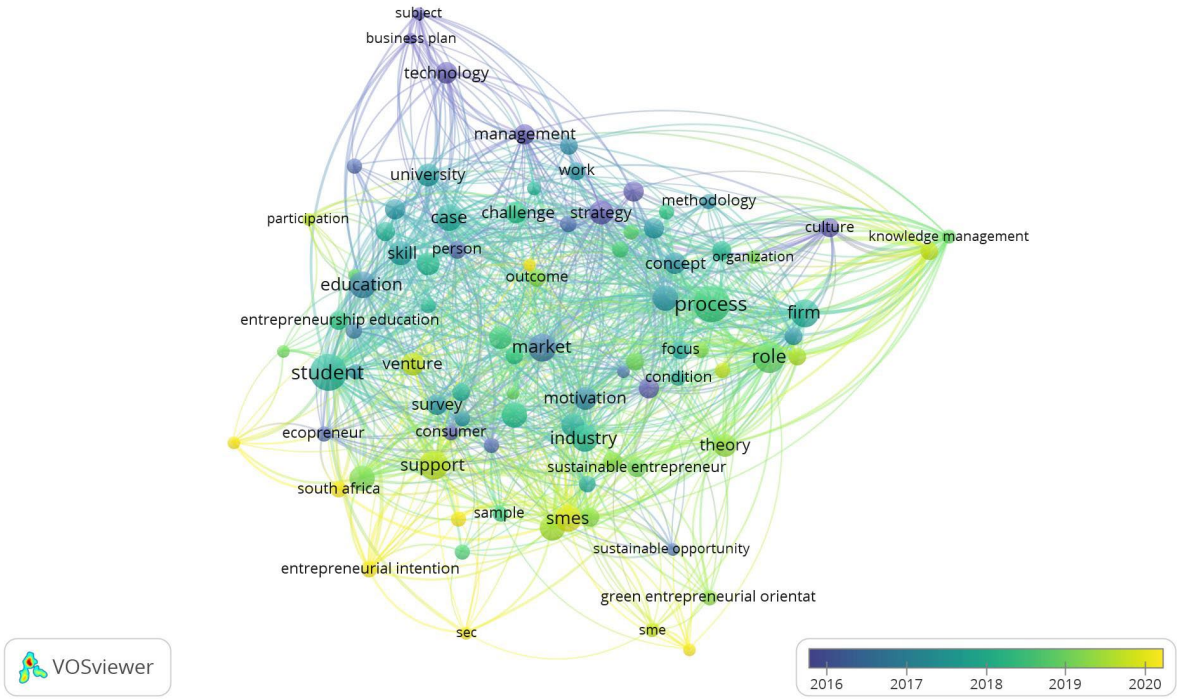
Source: Authors based on Scopus 2022, Software VOSviewer on analysis of titles and abstracts

Figure 2: Overlay of GE drivers literature keywords occurrences network

When analysing GE competencies (Figure 3) we observed 89 keywords, 5 clusters, and 2428 links. Main keywords are students/education/university, process, market, industry, support, smes, intention, among others. Most recent occurrences are intention/entrepreneurial intention, student, theory, support, smes, green entrepreneurship, green entrepreneurial orientation, entrepreneurial ecosystem, ecopreneurship, among others.

As to co-authorship analysis of both databases presented highly dispersed clusters of co-authorship and almost no links or networks between each cluster. That might suggest that there are several co-authorships between scholars with the same research field and theoretical approach but scarce collaboration between the (closed)

groups of authors. That can be explained with the topic being an exploratory field of research and very few cooperation between clusters of authors is observed as the research topics are poorly consolidated and further empirical evidence is needed.



Source: Authors based on Scopus 2022, Software VOSviewer on analysis of titles and abstracts

Figure 3: Overlay of GE competencies literature keywords occurrences and network

6. Conclusions, limitations and future research

Despite the recent growth of scientific publications green entrepreneurship is still an emerging field of study. Main authors point to the need of further research, major gaps in literature, and above all need for further empirical studies and evidence. Moreover, although entrepreneurial intention is largely studied there are no clear models on how to approach GE intention. Some authors argue that the green entrepreneur has a broader set of goals and a broader view when compared with the classic (more economic oriented) entrepreneur (Romero-Colmenares, 2022).

Therefore, some main theories like classic entrepreneurship theory and mainly TPB - theory of planned behaviour are being adapted to the specific challenges and characteristics of GE (Vuorio et al, 2018; Sher et al, 2020; Romero-Colmenares, 2022) namely in what concerns the antecedents of GE drivers like self-efficacy, environmental values, environmental education, and sustainable orientation.

The role of GE competencies on GE intention is relatively unclear yet and the study of GE competencies is mostly linked to sustainable development, corporate social responsibility, and education/learning processes and not clearly focused on how competencies can favour or enhance GE intention. Some important theoretical backgrounds have been adapted to GE like the Opportunity Recognition Model (Patzelt and Shepherd, 2011 or the Quintuple Helix framework (Carayannis, 2010). Notwithstanding most recent articles underline and build upon the seven competencies framework for sustainable entrepreneurship (Lans et al, 2014; Bloom et al, 2018) not only producing empirical studies but also finetuning the model to best fit the specificity of GE.

There appears to be two separate streams of literature on GE intention. The first focus on main drivers and the second focus on competencies and skills mostly necessary for sustainable development and performance. Notably little authors, characteristics, and theoretical frameworks are common to the two research streams and the overlapping of the two databases/queries only presented eleven articles with very few citations. Future

research could question the possible links between them namely by questioning if competencies play a moderator role between the GE drivers and the GE intention.

The role of education and higher education is much in focus on recent literature and keywords as student, education, university are clearly highlighted, and many empirical studies are built upon questionnaires on students and/or focus groups comprised of professors, experts, and alumni.

Future research should also aim at identifying the similarities and differences between the different streams of though bringing more clarity to the topic of green entrepreneurship and solve theoretical and definitional dilemmas (Gast et al, 2017)

The limitations of this study are mainly linked to the choice of database (Scopus) and definition of inclusion/exclusion criteria on queries and therefore the sample may differ. Also concerns about the objectivity of the content data analysis as its interpretation can be considered subjective. Nevertheless, Scopus is a widely used database for GE topic and almost 84% of articles of WoS can be found in Scopus (Terán -Yépes, 2020). Also, we are convinced that this study analyses a very representative sample of literature on a very broad time range. We believe that the conclusions of this study are useful for understanding the evolution, detecting research trends, consolidate past research and suggest future research lines on green entrepreneurship, its main drivers and main competencies, clearly emerging fields of research.

References

Aghelie, A., Sorooshian, S. and Azizan, N. A. (2016) "Research gap in sustainopreneurship", *Indian Journal of Science and Technology*, 9(12), pp. 1–6.

Agu, A. G. *et al.* (2021) "Drivers of sustainable entrepreneurial intentions among university students: an integrated model from a developing world context", *International Journal of Sustainability in Higher Education*, 22(3), pp. 659–680.

Ajzen, I. (1991) "The theory of planned behavior", *Organizational behavior and human decision processes*, 50(2), pp. 179–211.

Arru, B. (2020) "An integrative model for understanding the sustainable entrepreneurs" behavioural intentions: an empirical study of the Italian context.", *Environment, Development & Sustainability*, 22(4), pp. 3519–3576.

Boyles, T. (2012) "21st century knowledge, skills, and abilities and entrepreneurial competencies: A model for undergraduate entrepreneurship education", *Journal of Entrepreneurship Education*, 15, p. 41.

Carayannis, E. G. and Campbell, D. F. J. (2010) "Triple Helix, Quadruple Helix and Quintuple Helix and how do knowledge, innovation and the environment relate to each other?: a proposed framework for a trans-disciplinary analysis of sustainable development and social ecology", *International Journal of Social Ecology and Sustainable Development (IJSESD,* 1(1), pp. 41–69.

Demirel, P. *et al.* (2019) "Born to be green: new insights into the economics and management of green entrepreneurship", *Small Business Economics*, 52(4), pp. 759–771.

Fichter, K. and Tiemann, I. (2018) "Factors influencing university support for sustainable entrepreneurship: Insights from explorative case studies.", *Journal of Cleaner Production*, 175, pp. 512–524.

Gast, J., Gundolf, K. and Cesinger, B. (2017) "Doing business in a green way: A systematic review of the ecological sustainability entrepreneurship literature and future research directions", *Journal of Cleaner Production*, 147, pp. 44–56.

Gibb, A. and Hannon, P. (2006) "Towards the entrepreneurial university", *International Journal of Entrepreneurship Education*, 4(1), pp. 73–110.

Kyndt, E. and Baert, H. (2015) "Entrepreneurial competencies: Assessment and predictive value for entrepreneurship", *Journal of Vocational Behavior*, 90, pp. 13–25.

Lans, T., Wesselink, R. and Blok, V. (2014) "Learning apart and together: Towards an integrated competence framework for sustainable entrepreneurship in higher education", *Journal of Cleaner Production*, 62, pp. 37–47.

Linan, F. (2008) "Skill and value perceptions: how do they affect entrepreneurial intentions?", *International entrepreneurship and management journal*, 4(3), pp. 257–272.

Lortie, J. and Castogiovanni, G. (2015) "The theory of planned behavior in entrepreneurship research: what we know and future directions", *International entrepreneurship and management journal*, 11(4), pp. 935–957.

Man, T. W. Y., Lau, T. and Chan, K. F. (2002) "The competitiveness of small and medium enterprises: A conceptualization with focus on entrepreneurial competencies", *Journal of business venturing*, 17(2), pp. 123–142.

McCallum, E. *et al.* (2018) *EntreComp into action-Get inspired, make it happen: A user guide to the European Entrepreneurship Competence Framework*. Joint Research Centre.

Mitchelmore, S. and Rowley, J. (2010) "Entrepreneurial competencies: a literature review and development agenda", *International journal of entrepreneurial Behavior & Research*.

Patzelt, H. and Shepherd, D. A. (2011) "Recognizing opportunities for sustainable development", *Entrepreneurship Theory and Practice*, 35(4), pp. 631–652.

Potluri, S. and Phani, B. V. (2020) "Incentivizing green entrepreneurship: A proposed policy prescription (a study of entrepreneurial insights from an emerging economy perspective)", *Journal of Cleaner Production*, 259.

Robles, L. and Zárraga-Rodríguez, M. (2015) "Key competencies for entrepreneurship", *Procedia Economics and Finance*, 23, pp. 828–832.

Romero-Colmenares, L. M. and Reyes-Rodríguez, J. F. (2022) "Sustainable entrepreneurial intentions: Exploration of a model based on the theory of planned behaviour among university students in north-east Colombia", *International Journal of Management Education*, 20(2).

Shapero, A. and Sokol, L. (1982) "The social dimensions of entrepreneurship", *University of Illinois at Urbana-Champaign"s Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

Sher, A. *et al.* (2020) "Fostering sustainable ventures: Drivers of sustainable start-up intentions among aspiring university students in Pakistan", *Journal of Cleaner Production*, 262.

Soomro, B. A., Ghumro, I. A. and Shah, N. (2020) "Green entrepreneurship inclination among the younger generation: An avenue towards a green economy", *Sustainable Development*, 28(4), pp. 585–594.

Terán-Yépez, E. *et al.* (2020) "Sustainable entrepreneurship: Review of its evolution and new trends", *Journal of Cleaner Production*, 252, p. 119742.

Vuorio, A. M., Puumalainen, K. and Fellnhofer, K. (2018) "Drivers of entrepreneurial intentions in sustainable entrepreneurship", *International Journal of Entrepreneurial Behaviour and Research*, 24(2), pp. 359–381.

Masters Research Papers

The Effect of Entrepreneur's Fear of Failure on Firm's Entrepreneurial Orientation

Merihan Attia[1] and Iman Seoudi[2]
[1]Entrepreneurship department, Business & Entrepreneurship faculty, Universities of Canada in Egypt, New Administrative Capital, Egypt
[2]Innovation department, Faculty of Management Technology, GUC, Cairo, Egypt
Merihan.attia@uofcanada.edu.eg
Iman.Seoudi@guc.edu.eg

Abstract: This study focuses on the fear of failure (FF) in entrepreneurship and its effect on the entrepreneurial orientation (EO) as a strategic orientation in firms. There has been much research on EO as a predictor of organizations' performance since it is considered a manifestation of the entrepreneurial direction inside the organization. Yet, the research on the relationships between individual-level variables and EO itself still has room for contribution, especially the internal aspects related to the entrepreneur or the manager. Therefore, this research aims to explore FF in entrepreneurship and its inhibiting and motivating roles. In addition, given that the firm is the unit of analysis in this study, this research explained how an entrepreneur's FF affects the EO of the firm amidst the COVID-19 outbreak. The study administered a quantitative research design using a structured questionnaire. The results showed a positive influence of the entrepreneur's fear of failure on the firm's entrepreneurial orientation manifested in the firm's innovativeness dimension. However, the other two dimensions that contribute to the firm's EO representation (proactiveness & risk-taking) showed insignificant relationships with the entrepreneur's FF.

Keywords: entrepreneurial orientation, fear of failure, upper echelons theory, innovativeness, proactiveness, risk-taking

1. Introduction

Various studies investigated startup failure reasons in an attempt to help predict sources of failure and consequently, avoid early failures. Yet, most of the research focused more on the economic aspects of the business such as poor financial planning and weak business models (Arenius & Minniti, 2005), or demographic factors such as age, gender, and educational background. Knott and Posen (2005) pointed out that 80%-90% of startups fail during the first three years. However, after 10 years of ongoing efforts, Patel (2015) observed that still 90% of the newly founded startups eventually fail. One of the suggested reasons that needs to be further studied is other psychological factors (in addition to the demographic and economic reasons) that contribute to business failure. Therefore, it is crucial to widen the research elements and consider the psychological reasons for their significant influence in predicting the behavior of entrepreneurs' strategic orientation and business performance (Covin, Greene, & Slevin, 2006; Lumpkin & Dess, 1996). Hence, this study focuses mainly on fear of failure (FF) as one of the psychological barriers that has been attached to the entrepreneurship journey. Also, this study examines the impact of fear of failure on strategic business direction known for the firm's entrepreneurial orientation.

This research aims to add to the EO's theoretical understanding by emphasizing the role of the entrepreneur's emotions, specifically FF on the firm's EO. The researcher presents this contribution in three parts. First, the researcher elucidates how FF is related to a firm's EO building on the upper echelons theory where it shows that the firm's output is influenced by the amount of manifestation of the CEO's personality traits and behaviors. Second, the researcher tracks the effect of FF on each dimension of EO (innovativeness, proactiveness, and risk-taking), while considering the dual nature of FF that may be inhibiting or motivating depending on the context of the challenging situation faced by the entrepreneur. Finally, the researcher focuses on the impact of FF on the EO of new businesses that are still in their early stages where 80-90 percent of them face their ultimate failure during their first three years of working (Knott & Posen, 2005).

2. Literature review

2.1 Entrepreneurial Orientation

Entrepreneurial orientation (EO) is one of the most salient concepts in entrepreneurship. As a concept that is derived primarily from the strategic management literature (Lumpkin & Dess, 1996), researchers denoted EO as "strategic posture" because they thought that the overall posture "orientation of the firm" mainly depends

on the direction of the firm's top executives with all other activities following their posture (Basso et al., 2009). Researchers defined EO in different ways, but the most common one is that EO is the firm's decision-making practices, managerial philosophies, and strategic behaviors that are entrepreneurial by nature (Basso et al., 2009).

Until this moment, there are two distinct directions that researchers have adopted for EO. The unitary direction where the EO of the firm is considered part of the organizational attribute to show how the firm is being entrepreneurial through manifesting the three dimensions of innovativeness, risk-taking, and proactiveness. Covin and Slevin (1989) labeled this "a basic unidimensional strategic orientation" because some researchers considered the three dimensions as facets of the same direction (Cogliser et al., 2008). The other direction is the multidimensional one, where its introducers viewed the EO the same way they viewed entrepreneurship itself in the organization. Their meaning of entrepreneurship was the diversity of actions, perspectives, approaches, and the different combinations of internal and external factors that radically change the organization's main strategy. Following on this lead, the multidimensional approach proposed that each of the EO dimensions can exist independently and represent EO without affecting the other dimensions; all combinations of the EO dimensions are valid inside the organizations and the presence of any dimension is a representation of the EO (Rauch, Wiklund, Lumpkin, & Frese, 2009).

Many researchers studied EO to discover its effect on overall organizational performance (Lumpkin & Dess, 1996; Rauch et al., 2009). The literature on EO revealed a prevailing and significantly strong positive relationship between EO and performance. This relationship proved its strength in different contexts and research operationalizations (Krauss, Frese, Friedrich, & Unger, 2005; Rauch et al., 2009). Companies that manifest entrepreneurial behavior achieve a relatively higher performance than those rivals who follow a traditional conservative approach. Hence, the higher the EO in the organization, the better the performance (Rauch et al., 2009). Meanwhile, other researchers expanded their research on EO and its relationship with different variables, not only organizational performance. For example, EO and entrepreneurial intent (Robinson & Stubberud, 2014) or the role of affect in EO (Bernoster, Mukerjee, & Thurik, 2020). Some articles dealt with EO as a holistic strategic posture of the organization and focused on the practices and behavior of the entity overlooking the characteristics of the individuals (Krauss et al., 2005). When researchers focused on the idea of EO as a psychological concept, they focused on the "key players", as introduced by Lumpkin and Dess (1996), which are the business founders, owners, or managers, and how their concepts and ideas are the actual drivers of the EO inside an organization (Krauss et al, 2005).

2.2 Fear of Failure

Fear of failure (FF) is considered the most pre-eminent kind of fear in entrepreneurship (Bosma, Acs, Autio, Coduras, & Levie, 2008). Although FF is considered a significant complex variable (Conroy & Coatsworth, 2004), particularly in the entrepreneurship field (Cacciotti, Hayton, Mitchell, & Giazitzoglu, 2016), it is still developing. Several researchers agreed on its confusing nature and admitted that it is understudied and should gain more focus in entrepreneurship literature (Mitchell & Shepherd, 2011; Cacciotti & Hayton, 2015; Cacciotti et al., 2016). The available research on FF within the entrepreneurship journey examines this variable from the first phase until the entrepreneur starts the business, but then the examination of this variable is disregarded in the stages after that (where there are numerous decisions and situations that engage the entrepreneur's cognition and emotional abilities and stimulate the feeling of FF resulting in a certain behavior (Cacciotti & Hayton, 2014).

The most well-known definition in psychology literature was introduced by Murray (1938) as "A disposition to avoid failure" (p.192). Some studies considered FF as a risk-associated attitude or a reflection of high-risk aversion (Arenius & Minniti, 2005; Bosma et al., 2008). Early studies of FF in entrepreneurship used the latter definition to perceive FF as a reflection of the risk of starting a business and discover the results of the inhibitory effect of FF on the decision to start a business or to be an entrepreneur (Arenius & Minniti, 2005; Cacciotti & Hayton, 2014). Despite the negative connotation that is attached to FF, there is an opposing opinion on its impact (Hayton et al., 2013; Cacciotti & Hayton, 2014; Cacciotti et al., 2016). A new direction of FF has evolved as a result of accumulated and thorough research on its impact on the entrepreneur's behavior; with a new -more collective- definition of FF which is " A temporary cognitive and emotional reaction towards environmental stimuli that are apprehended as threats in achievement contexts" (Cacciotti & Hayton, 2014, p.37). This direction endorses the idea that FF has a positive as well as a negative effect on the entrepreneur's

behavior or decision (e.g. Hayton et al., 2013). Mitchell and Shepherd (2011) were the first to claim the duality of FF's nature when they methodologically revealed that FF's effect depends on the source of fear. The study showed that fear of upsetting important others has an approaching influence of entrepreneurial actions (Hayton et al., 2013).

In entrepreneurship and psychology literature, there are inconsistencies in how researchers implied FF in their studies as a state or a trait. This is due to the different input of definitions and the different implementation of approaches (Cacciotti & Hayton, 2015). Two main common approaches greatly contributed to the FF research: the personological approach and the motivational approach (Hayton et al., 2013). The personological approach deals with FF as an individual trait, a stable disposition that distinguishes one person from another. The application of the achievement motivational theory supports this approach (McClelland et al., 1953) where everyone has a separate inner motive that controls their achievement behavior. On the other hand, studies that followed the motivational approach grounded their implication of FF on the cognitive-motivational-relational theory (the appraisal theory of emotions) and considered FF as a negative emotion (Lazarus & Lazarus, 1991). Alternatively, they considered it as a temporary experience resulting from a change in the environmental cues which threaten the individual and consequently lead to psychological behavior (Hayton et al., 2013; Cacciotti & Hayton, 2015). The studies favored FF to be a state more than a trait because each time the threats (environmental cues) change, the cognitive and emotional appraisals of the individual change and so does the behavior. In fact, it is more beneficial for future research to proceed with FF as a state, not as a trait for endorsing its double nature effect of inhibition and motivation (Cacciotti & Hayton, 2015).

2.3 Relationship between Entrepreneurial Orientation and Fear of Failure

The most recent premise of the upper echelons' theory is that "executives' experiences, values, and personalities greatly influence their interpretations of the situations they face and, in turn, affect their choices" (Hambrick, 2007, p.334). Donald Hambrick and Phyllis Mason (1984) introduced this theory which suggests that the psychological side, represented by the human cognitive base and values, acts as a screen that filters the actual information received in the situation and releases it according to how it was interpreted and perceived by the executive. This eventually reflects on the decision they make. This is in line with what Cacciotti et al. (2016) later discussed: when the individual encounters a situation that triggers his/her FF, he/she passes through a cognitive appraisal process which later affects the strategy he/she follows and the decisions he/she makes. Some similarities are noticed between the theorizing of the upper echelon's theory and the effect of FF on the entrepreneur's decision which eventually influences the firm's direction and performance.

Business founders who embrace an EO in their firms, sustain good performance and avoid failure. Moreover, EO maintains a positive quality of the organization's performance and helps companies overcome the obstacles and hardships within the entrepreneurial process (Gilmore & Carson, 2000). Lumpkin and Dess (1996) claimed that EO is a set of unique behaviors in itself that is moderated by its dimensions (innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness) (as cited in Covin & Lumpkin, 2011). Many studies support this direction of EO for several reasons, the foremost reason is the organization's entrepreneur. An entrepreneur is recognized by his/her actions, not traits, and the same applies to the organization. An organization is recognized as entrepreneurial by the actions of its leaders rather than its organizational-level attributes (Covin & Lumpkin, 2011). For this matter, emotions greatly influence the entrepreneur's behavior (Wolfe & Shepherd, 2015) and are highly related to defining the entrepreneur's decision. Mitchell and Shepherd (2011) argued that the entrepreneur's behavior is the output of personal characteristics such as FF, and the external trigger made by the environment such as a failure-related situation (Kollmann, Stöckmann, & Kensbock, 2017). Therefore, the researcher suggests that the business founder's FF and the firm's EO are related.

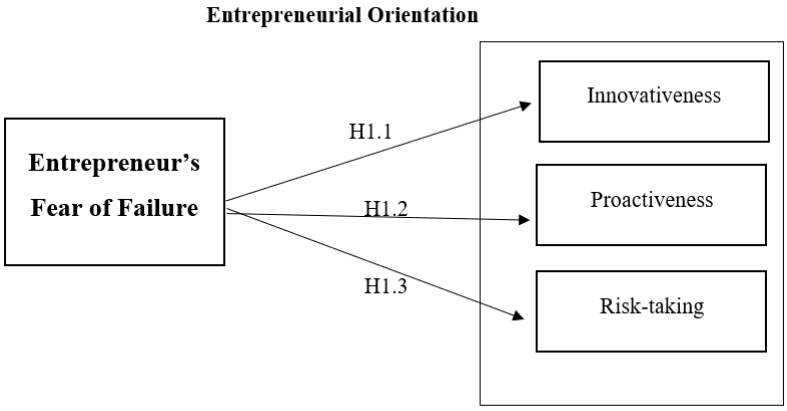
3. Research model

This research suggests that a great deal of the firm's EO (especially small businesses) and its performance depends on the lead individual himself/herself (Altinay & Wang, 2011). Small businesses represent a reflection of the values, behaviors, emotions, and actions of their leaders (Lumpkin & Dess, 1996; Gilmore & Carson, 2000). Some scholars claimed that part of the firm's success depends on the entrepreneur's need to achieve the goals they set (Ogunleye & Osagu, 2014), which explains why the entrepreneur's need for achievement is considered one of the factors that were found to predict the EO of the firm (Kijkasiwat, 2020). Given that one

of the definitions of FF is " the non-attainment of one's level of aspiration" (Birney, Burdick, & Teevan (1969, p3), the aim of this research is to emphasize the role of the entrepreneur's FF during the entrepreneurial journey and test its effect on firm-level innovativeness (H1.1), proactiveness (H1.2), and risk-taking (H1.3).

On an individual level, FF inhibits the employees' innovativeness inside firms (Kuyatt, 2011; Gülbahar, 2017). Therefore, if the impact of FF was effective on a higher managerial level such as the business owner, it will eventually affect their decisions, the employees, and the firm's overall innovation, which supports the proposed hypothesis that an entrepreneur's FF has a negative effect on the firm's innovativeness (H1.1). Furthermore, the research argued that fear of failure is one of the main reasons for procrastination (Schouwenburg, 1992). Thus, the researcher suggests the entrepreneur's FF has a negative influence on the entrepreneur's decisions and consequently, affects the firm's proactiveness (H1.2). Finally, seeing as FF is a reflection of risk-taking decisions, it inhibits the entrepreneur from taking bold actions as hypothesized in (H1.3). Accordingly, this research aims to investigate an untapped research gap explaining the relationship between the entrepreneur's FF and the firm's EO. This is done by following the multidimensional/additive approach of EO proposed by Lumpkin and Dess (1996), which considers each dimension as a representation of the EO's existence inside the firm. Furthermore, the research mainly focuses on the early stages of operating businesses (from three to five years), where a high business failure rate is witnessed within the context of the COVID-19 pandemic in Egypt. It is worth mentioning that this is the first research to tackle the effect of FF on EO in general. The conceptual framework below (Figure 1) demonstrates these relationships, in addition to the research question and hypotheses of the study.

3.1 Conceptual framework



(Developed by the researcher)

Figure 1: Conceptual framework of the study

3.2 Research questions and hypotheses

*RQ1***:** What is the relationship between the entrepreneur's fear of failure (FF) and the firm's entrepreneurial orientation (EO)?

- *H1:* There is a negative relationship between the entrepreneur's fear of failure and the firm's entrepreneurial orientation.
- H1.1**:** There is a negative relationship between the entrepreneur's fear of failure and the firm's innovativeness.
- H1.2**:** There is negative relationship between the entrepreneur's fear of failure and the firm's proactiveness.
- H1.3**:** There is a negative relationship between the entrepreneur's fear of failure and the firm's risk-taking.

4. Research methodology

This study applies a quantitative approach in collecting data through the structured questionnaire technique. The target population in this study is entrepreneurs who established and currently run their own early-stage businesses in the Egyptian market. The entrepreneurs were required to be the leading individuals and the decision-makers for their startups, not entrepreneurs who have a supporting role within the startups. This questionnaire consists of four sections. The first two sections are the scales related to the FF and EO respectively. This is followed by the third section, which is the social desirability scale. It was important to add this to the questionnaire to avoid any bias in the answers of the participants. Finally, the fourth section and the last one is about the demographics. This questionnaire forms a total of 54 questions: A 21-item scale of FF developed by Cacciotti et al. (2020), a 9-item scale adopted from Miller (1983) and Covin, and Slevin (1989), and a 10-item scale which is a short version of the Marlowe-Crowne social desirability bias scale, In addition to 14 demographic questions. The questionnaire was distributed mainly online; it was sent on e-platforms such as email and social media platforms such as Instagram, Facebook, and LinkedIn. A major deciding factor was the circumstances of the COVID-19 pandemic. It was highly difficult to reach out to entrepreneurs face-to-face in their offices because most of the offices were closed and the work was shifted to online work. The data collection period lasted three months (from May to August 2021). The researcher sent the questionnaire to more than 250 business founders in addition to the network shares, which is difficult to be tracked and translated to a tangible number. However, the actual number of participants was 152, which constitutes a response rate from approximately 50% to 60%. As this research is new to the Egyptian context, the scales were examined for validity and reliability by using the Statistical Package of Social Science (SPSS V.25). The results showed that both achieved and surpassed the cut-off values. In addition, correlation and regression analyses were administered using SPSS V.25 as well.

5. Results and discussion

The empirical analysis of this study is highly important and relevant the most because it tested the FF of the entrepreneurs during a very hard time when the entrepreneurs went through the COVID-19 experience. The COVID-19 pandemic has threatened the survival of many SMEs in Egypt due to several challenges such as the lockdown, the government's new rules and regulations, the fast change of business models, and the uncertainty of the next phases. This made entrepreneurs and business owners more afraid than before of numerous sources of failure which threaten the existence of their business. Therefore, it is a convenient time to study the relationship of the entrepreneur's FF with the firm's EO and its dimensions. This section's main objective is to provide the findings of this research and discuss it in light of the research presented in the literature review with an aim to provide a vital direction for future research to benefit from what is presented and build on it in the future.

RQ1: What is the relationship between the entrepreneur's fear of failure (FF) and firm's entrepreneurial orientation (EO)?

Separating the EO subcomponents and analyzing them paved the way for presenting the multi-dimensional approach of EO and enabled the researcher to gain a deeper understanding of the relationship between FF and each dimension of innovativeness, proactiveness, and risk-taking in the firm. Following the EO construct adopted by Miller (1986) and Covin and Slevin (1989), the three hypotheses represented the three dimensions that constitute the EO and their relationships with FF underly further details for the study sample in the Egyptian context.

H1.1: There is a negative relationship between FF and innovativeness.

Bernoster et al. (2020) claimed that affect has more influence on innovativeness and risk-taking dimensions than proactiveness dimension. Martins et al. (2018) pointed out that FF has a negative effect on innovativeness. Kuyatt (2011) also argued that FF has a negative impact on employees' ability to innovate inside organizations. Although the results showed that there is a relationship between the entrepreneur's FF and the firm's innovativeness ($P=0.003$ ($P<0.05$) $b= 0.289$), yet it is a positive relationship rather than a negative one as hypothesized. This finding may be due to the following rationale. This study treated FF as a dispositional state, not a stable personality characteristic (Cacciotti & Hayton, 2015) where its effect is short-termed and triggered by some incidents during the period that the entrepreneur leads the startup and makes decisions for operation. Therefore, the state of FF might not affect the innovativeness of the firm at all. In fact, the reason for the positive impact of FF could be related to the fact that FF has a dual effect since FF is

involved with cognitive and emotional appraisals of threats which direct the individual towards different behaviors such as fight, flight, or freeze. Mitchell and Shepherd (2011) argued that individual appraisals of threats and situations can direct the individual towards different behaviors. Hence, the positive impact that FF has on entrepreneurial behavior exists (Hayton et al., 2013; Cacciotti & Hayton, 2014). In fact, Hayton et al. (2013) demonstrated that one of FF elements–upsetting important others–pushed entrepreneurs towards engaging in more entrepreneurial actions. Entrepreneurs who are afraid to fail, work on their ideas very hard and try to innovate, create new models, and offer something new in order to survive another day in the competition. Moreover, in a very competitive entrepreneurial scene, such as the one in Egypt, people at a young age are encouraged to be more innovative and start their independent career paths as indicated by the GEM report (2021b). Being innovative is no longer a choice and if the idea is not innovative enough or the business does not provide creative and enhanced products or services for customers, it will not have a chance for survival. Therefore, as the results show ($P=0.003$ ($P<0.05$) $b= 0.289$), the higher FF the founder manifests, the more innovative the firm behaves because the founder is fighting for the firm's survival through its innovation. The next paragraph will discuss the results for both H1.2 & H1.3 since they share the same results and analysis.

H1.2: There is a negative relationship between FF and proactiveness.

H 1.3: There is a negative relationship between FF and risk-taking.

This research investigated the relationship between FF and the other two dimensions of EO–proactiveness, and risk-taking–as stated in H1.2 and H1.3. Unlike the first dimension, the result showed no correlation between the FF of the entrepreneur and the firm's two dimensions (proactiveness & risk-taking) with values of $P= 0.90$ and 0.183 respectively. This result is aligned with the study of the influence of the entrepreneur's socio-cultural characteristics on the firm's EO. The results showed no influence of the socio-cultural characteristics such as religion and experience on the firm's proactiveness and risk-taking (Altinay & Wang, 2011). However, the results refuted the study of Martins et al. (2018) which showed a negative relationship between FF and both proactiveness and risk-taking. Yet, a comparison of the results is partially inadmissible because the EO construct in the study of Martins et al. (2018) was not on the firm level (which this research provided), it was on the individual level. Hence, the findings indicated that an entrepreneur's FF does not affect the proactiveness of the firm and its ability to take initiatives in the market, nor its direction towards risky calls.

According to this research, the relationship between the entrepreneur's FF and proactiveness & risk-taking dimensions did not exist due to the following possible factors. One reason is that many factors can interfere with the direction of the entrepreneur, such as employees working within the startup, laws, and regulations of the country, among other variables such as the involvement of important others and their opinions. Hence, factors can interfere between the founder's initial direction or decision and the actual output. This means that FF is not the only influencer on the final direction of the firm. Another reason is the nature of the Egyptian culture as an emerging efficiency-driven country. Risk-taking behavior is relatively discouraged (Kreiser & Davis, 2010) and in an Islamic-dominant society, people are more risk-averse as claimed by Farid (2007). Last but not least, a relevant possible reason could be the COVID-19 pandemic. Proactiveness and risk-taking attitudes were not the priority, but innovativeness was.

6. Conclusion

In conclusion, this research shed the light on an ignored yet essential area in entrepreneurship literature: the entrepreneurial FF and its influence on a firm's strategic-level construct: EO. This research also aimed to highlight the FF's new influence of being an emotion or a state and its dual nature (motivator and inhibitor). Part of this study's findings supported this direction showing that FF affects the innovativeness of the firm. This indicated that the more FF the entrepreneurs in Egypt have, the more they invest in developing innovative and creative ideas, products, and services to keep their businesses operating during the COVID-19 pandemic. Following an EO multidimensional approach, the findings highlight the presence of a positive relationship between FF and EO. Yet, the findings also showed that the entrepreneurs' FF does not affect either the proactiveness or the risk-taking attitudes of the firm. This is justified by the overall risk-taking attitude in the Egyptian culture and the effect of the COVID-19 pandemic situation while the study was conducted.

References

Altinay, L. and Wang, C.L., 2011. The influence of an entrepreneur's socio-cultural characteristics on the entrepreneurial orientation of small firms. Journal of Small Business and Enterprise Development, 18(4), 673694.

Arenius, P. and Minniti, M., 2005. Perceptual variables and nascent entrepreneurship. Small business economics, 24(3), pp.233-247.

Bernoster, I., Mukerjee, J. and Thurik, R., 2020. The role of affect in entrepreneurial orientation. Small Business Economics, 54(1), pp.235-256.

Birney, R.C., Burdick, H. and Teevan, R.C., 1969. Fear of failure. Van Nostrand-Reinhold Company.

Bosma, N., Acs, Z.J., Autio, E., Coduras, A. and Levie, J., 2008. Global entrepreneurship monitor. Executive report, 125.

Cacciotti, G. and Hayton, J.C., 2014. Fear of failure and entrepreneurship: a review and direction for future research. Enterprise research Centre, research paper, 24(1), pp.1-62.

Cacciotti, G. and Hayton, J.C., 2015. Fear and entrepreneurship: A review and research agenda. International Journal of Management Reviews, 17(2), pp.165-190.

Cacciotti, G., Hayton, J.C., Mitchell, J.R. and Giazitzoglu, A., 2016. A reconceptualization of fear of failure in entrepreneurship. Journal of Business Venturing, 31(3), pp.302-325.

Chua, H.S. and Bedford, O., 2016. A qualitative exploration of fear of failure and entrepreneurial intent in Singapore. Journal of Career Development, 43(4), pp.319-334.

Cogliser, C.C., Brigham, K.H. and Lumpkin, G.T., 2008. Entrepreneurial orientation research: A review of theory, measurement, and data-analytic practices (Summary). Frontiers of entrepreneurship research, 28(13), p.5.

Conroy, D.E. and Coatsworth, J.D., 2004. The effects of coach training on fear of failure in youth swimmers: A latent growth curve analysis from a randomized, controlled trial. Journal of Applied Developmental Psychology, 25(2), pp.193-214.

Covin, J.G., Green, K.M. and Slevin, D.P., 2006. Strategic process effects on the entrepreneurial orientation sales growth rate relationship. Entrepreneurship theory and practice, 30(1), pp.57-81.

Covin, J.G. and Lumpkin, G.T., 2011. Entrepreneurial orientation theory and research: Reflections on a needed construct. Entrepreneurship theory and practice, 35(5), pp.855-872.

Covin, J.G. and Slevin, D.P., 1989. Strategic management of small firms in hostile and benign environments. Strategic management journal, 10(1), pp.75-87.

Farid, M., 2007. Entrepreneurship in Egypt and the US compared: directions for further research suggested. Journal of Management Development, , 26(5), pp. 428-440.

Global Entrepreneurship Monitor (GEM). (2021). Egypt National Report 2017-2018 (Report No.50724). Retrieved from https://www.gemconsortium.org/report/50724

Gilmore, A. and Carson, D., 2000. The demonstration of a methodology for assessing SME decision making. Journal of Research in Marketing and Entrepreneurship, *2*(2), pp.108-124.

GÜLBAHAR, Y., 2017. A theoretical investigation on innovative work behaviours and fear of failure. International Journal of Entrepreneurship and Management Inquiries, 1(1), pp.40-59.

Hambrick, D.C. and Mason, P.A., 1984. Upper echelons: The organization as a reflection of its top managers. Academy of management review, 9(2), pp.193-206.

Hayton, J.C., Cacciotti, G., Giazitzoglu, A., Mitchell, J.R. and Ainge, C., 2013. Understanding fear of failure in entrepreneurship: A cognitive process framework. Frontiers of Entrepreneurship Research, 33(6), p.1.

Kijkasiwat, P., 2021. The influence of behavioral factors on SMES'owners intention to adopt private finance. Journal of Behavioral and Experimental Finance, 30, pp.100-476.

Knott, A.M. and Posen, H.E., 2005. Is failure good?. Strategic Management Journal, 26(7), pp.617-641.

Kollmann, T., Stöckmann, C. and Kensbock, J.M., 2017. Fear of failure as a mediator of the relationship between obstacles and nascent entrepreneurial activity—An experimental approach. Journal of Business Venturing, 32(3), pp.280-301.

Krauss, S.I., Frese, M., Friedrich, C. and Unger, J.M., 2005. Entrepreneurial orientation: A psychological model of success among southern African small business owners. European journal of work and organizational psychology, 14(3), pp.315-344.

Kreiser, P.M. and Davis, J., 2010. Entrepreneurial orientation and firm performance: The unique impact of innovativeness, proactiveness, and risk-taking. Journal of small business & entrepreneurship, 23(1), pp.39-51.

Kuyatt, A., 2011. Managing for innovation: Reducing the fear of failure. Journal of Strategic Leadership, 3(2), pp.31-40.

Lazarus, R.S., 1991. Emotion and adaptation. Oxford University Press.

Hambrick, D.C., 2007. Upper echelons theory: An update. Academy of management review, 32(2), pp.334-343.

Li, Y., 2011. Emotions and new venture judgment in China. Asia Pacific Journal of Management, 28(2), pp.277298.

Lumpkin, G.T. and Dess, G.G., 1996. Clarifying the entrepreneurial orientation construct and linking it to performance. Academy of Management Review, 21(1), pp.135-172.

Martins, I., Monsalve, J.P.P. and Martinez, A.V., 2018. Self-confidence and fear of failure among university students and their relationship with entrepreneurial orientation: Evidence from Colombia. Academia Revista Latinoamericana de Administración, 31(3), pp. 471-485.

Miller, D., 1986. Configurations of strategy and structure: Towards a synthesis. Strategic management journal, 7(3), pp.233-249.

Mitchell, J.R. and Shepherd, D.A., 2011. Afraid of opportunity: The effects of fear of failure on entrepreneurial action. Frontiers of Entrepreneurship Research, 31(6), p.1.

Murray, H.A., 1938. Explorations in Personality. A Clinical and Experimental Study of Fifty Men of College Age, New York (Oxford University Press) 1938.

Ogunleye, A.J. and Osagu, J.C., 2014. Self-efficacy, tolerance for ambiguity and need for achievement as predictors of entrepreneurial orientation among entrepreneurs in Ekiti state, Nigeria. European Journal of Business and Management, 6(17), pp.240-250.

Patel, N. (2015, Jan 16). 90% of startups fail: Here's what you need to know about the 10%. Forbes.

Rauch, A., Wiklund, J., Lumpkin, G.T. and Frese, M., 2009. Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. Entrepreneurship theory and practice, 33(3), pp.761-787.

Schouwenburg, H.C., 1992. Procrastinators and fear of failure: An exploration of reasons for procrastination. European Journal of personality, 6(3), pp.225-236.

Enterpreneurial Strategies for the Female Sector: Leveraging Instagram Sales During the Pandemic

Rafaela Elias, Luciana Reis, Thaise Delfino and June Fernandes
Federal University of Ouro Preto, João Monlevade, Brazil
rafaela.elias@aluno.ufop.br
lucianapaula@ufop.edu.br
thaise.delfino@aluno.ufop.edu.br
june@ufop.edu.br

Abstract: The COVID-19 pandemic significantly influenced the purchasing behavior of consumers, who began to see in the tools available in the virtual environment the necessary allies to satisfy their consumption desires. Given the relevance achieved by the virtual environment, organizations began to explore more intensively the various digital platforms to enhance their reach to their customers. The traditional electronic commerce then evolved into what we call Social Commerce (S-commerce), which allowed a substantial increase in the way of interacting and promoting sales. Despite the limitations and incipient studies on how organizations use their strategies and explore digital media tools to leverage sales, it is perceived as relevant to understand how the process of joining these organizations to digital media and the influence they have passed to exercise in the reformulation of its strategies and business models. Focusing on the Instagram environment, the objective of this research is to characterize the sales strategies used by three female-owned enterprises, through Instagram, during the pandemic by COVID-19. As a methodological research strategy, the study of multiple cases was used. Three Brazilian female-owned enterprise were analyzed, being: a jewelry company, a women's adult footwear company and a beauty salon. The entrepreneurs responsible for the companies were submitted to a semi-structured questionnaire, which was conducted in loco. As a result, it was observed that the most used Instagram tools are feed resources, stories and metrics. On the other hand, the sales strategies most used by entrepreneurs were e-WOM, recommendations and feedbacks and, finally, encouraging user participation. In conclusion, it was noticed that both the entrepreneur and the company that wants to implement sales strategies in digital media, need to understand the functions and objectives of the set of tools made available by Instagram. Once the functionalities present in these resources are understood, entrepreneurs and managers can formulate their strategies in an assertive way, being more efficient in their commercial transactions, since the actions aim to promote involvement with the public that follows the business. Instagram proved to be a tool with great potential for business in the female sector.

Keywords: Instagram, sales strategy, female sector, social commerce, COVID-19

1. Introduction

The years 2020 and 2021 were marked by the pandemic of the new coronavirus (SARS-CoV-2: COVID-19) which led to changes in buying and selling behavior due to restrictions on isolation and closing of trade (Attar, Shanmugam and Hajli, 2020; Bhatti *et al.*, 2020; Anacleto *et al.*, 2021; Le, 2021). Many companies have adopted social networks as a marketing and sales strategy in their business model, characterizing Social Commerce (S-commerce). In this context, Instagram is one of the most widespread networks, comprising tools capable of boosting sales and facilitating communication with consumers (Bhattacharyya and Bose, 2020; Kristian *et al.*, 2020; Anacleto *et al.*, 2021; Molina-Prados, Muñoz-Leiva and Prados-Peña, 2021).

However, the lack of knowledge of the tools and strategies that can be used on Instagram makes it difficult to leverage sales at a time when entrepreneurs had to reinvent themselves quickly to survive in the market (Anacleto *et al.*, 2021). Studies point out that it is not enough only using Instagram just to have a virtual presence, it is necessary to develop research that helps to understand and explore the new features offered by each tool, which in theory can improve the techniques and strategies applied to digital marketing on electronic retail (Pinheiro and Macêdo, 2021; Dolega, Rowe and Branagan, 2021).

Instagram is in constant development and therefore has a dynamic character, however, new studies must be developed regularly to keep up with consumer trends and needs (Corrêa, 2018; Bhattacharyya and Bose, 2020). Furthermore, in the context of female sector, the search for studies that aim to improve the techniques and strategies applied to digital marketing represents a way to diversify sales channels, gain visibility and remain in the market (Gonçalves *et al.*, 2019; Soares, 2020; Escher, 2021).

To fill these gaps, the objective of this research is to characterize the strategies adopted by the female-owned enterprises, working in the female sector, to leverage sales through Instagram, during the pandemic moment.

As practical contributions, it is clear that this study can help entrepreneurs in making decisions about the best Instagram tools and strategies useful to leverage the business. In addition, the study can guide practitioners to rethink the way to undertake, especially through Instagram. Based on the cases analyzed, the study demonstrated how the main tools available, when associated with negotiation strategies, help to improve sales operations and consolidate S-commerce as a business model.

The article is structured in six sections: i) this brief introduction, ii) theoretical background, iii) methodology, iv) data presentation v) discussion, and vi) conclusion.

2. Theorical backgroud

E-commerce (eletronic commerce) has shown a significant growth rate in Brazil and in the world, being also driven by the pandemic. Digital platforms have strongly influenced consumer relations, which in theory allows us to infer that S-commerce will continue to rise (Anacleto *et al.*, 2021; Karine, 2021). In this context, Instagram stood out worldwide for integrating several online store profiles, especially among micro-entrepreneurs (Addo *et al.*, 2021). Its followers are attracted by the features of the app and the popularity of the network (Alkhowaiter, 2016). In addition, it is observed that S-commerce has become a differentiated marketing tool to improve sales, since it facilitates contact with the consumer and reaches people from different regions (Bhattacharyya and Bose, 2020; Shin, Park and Kim, 2020; Herzallah *et al.*, 2021).

2.1 Instagram tools

S-commerce is characterized by electronic commerce through social networks and has innovated the way consumers and companies have conducted their business (Esmaeili and Hashemi, 2019; Kanani and Glavee-Geo, 2021). Instagram has made marketing strategies possible for organizations through a set of tools that support strategies and promote user engagement, as can be seen with: *feed*, *stories*, IGTV, *reels*, live streaming, paid traffic and metrics (Corrêa, 2018; Addo *et al.*, 2021; Shah *et al.*, 2021; Szeto *et al.*, 2021; David *et al.*, 2022). Table 1 presents the summary of these tools.

Table 1: Instagram tools

Tools	Description
Feed	Through photos and videos, it facilitates user interaction and engagement and allows the entrepreneur to customize their profile (Corrêa, 2018; Priyaningrum, Pawito and Wijaya, 2020; Sarker *et al.*, 2020; Yadav and Mahara, 2020; Shah *et al.*, 2021; David *et al.*, 2022).
Stories	Feature that allows the user to show everyday moments through photos and videos, with content deleted after 24 hours (Terra, 2017; David *et al.*, 2022).
IGTV (Instagram TV)	Tool for long videos of up to 60 minutes for verified or high-reach accounts. It is used for corporate profiles and *influencers* (Haenlein *et al.*, 2020; David *et al.,* 2022).
Reels	Intended for the creation of short (up to 15 seconds) videos, with sound and visual effects. Enables the creation of organic content stimulating engagement with the target audience (Szeto *et al.*, 2021).
Live streaming	Allows recording and streaming of live videos. Businesses and content creators can entertain their followers from home and achieve more visibility through partnerships (Addo *et al.*, 2021; Corrêa, 2018).
Paid traffic	Used by business accounts to boost feed posts. The entrepreneur can customize the post targeting (Corrêa, 2018).
Metrics	It is the engagement data made available by Instagram, providing knowledge of consumers' preferences, needs and desires, using the efforts of this interaction to develop efficient publishing strategies and increase engagement (Ferraz and Gerais, 2019).

2.2 Sales strategies through Instagram

The digital transformation environment has led companies to associate the use of Instagram tools with sales strategies as a way to help them differentiate from the competition (Iivari, Sharma and Ventä-Olkkonen, 2020; Anacleto *et al.*, 2021). Among the strategies made possible by the Instagram platform and used by the enterprises, seven stand out: paid ads, keeping users' attention with quality posts, strategic alliances with other companies and *influencers*, e-WOM, celebrities with many followers, recommendations and feedbacks, and stimulation to user participation. Table 2 summarizes these strategies.

Table 2: Strategies through Instagram

Strategies	Description
Paid ads	Precisely segments a potential customer the moment they become interested in a product. Improves the performance of marketing strategies (Corrêa, 2018; Ferraz and Gerais, 2019; Chen and Huang, 2020).
Keep users' attention with high quality posts related to important topics	High quality posts related to important topics to manage user consumption. Enables followers to like, comment, share and make a purchase on a particular page (Chen and Huang, 2020).
Strategic alliances with other companies and *influencers*	The partnership with other companies and influencers attracts varied audiences interested in the profile contente. Through shared tags it is possible to reach a large number of followers in order to increase store exposure(Chen and Huang, 2020).
Electronic Word of Mouth (e-WOM)	It is any statement by consumers, positive or negative, about a product, service or company (Ali, Hussin and Dahlan, 2020; Grange, Benbasat and Burton-Jones, 2020; Hossain and Kim, 2020).
Celebrities with a lot of followers	It is the involvement of celebrities who have a large following. The link between entrepreneurs and these celebrities boosts the business brand for several users (Latiff and Safiee, 2015).
Recomendations/feedbacks	Can be constructive or destructive about the company's services or products that affect brand loyalty. It is essential to position the entrepreneur in the face of feedbacks (Solem, 2016; Khoa and Nguyen, 2020; Addo *et al.*, 2021).
Encouraging user participation	It is the forced interaction of users with Instagram tools, enhancing user engagement and facilitating brand repositioning, leading to sales leverage (Alonso-Dos-Santos, Jiménez and Carvajal-Trujillo, 2019; Abdelsalam *et al.* 2020; Ali, Hussin and Dahlan, 2020; Sarker *et al.*, 2020; Lin, 2021).

3. Methodology

The work has an essentially qualitative approach and was conducted through the case study method in the context of three companies in the women's sector: jewelry, shoes and beauty salon. The case study is an empirical investigation within its real-life context (Yin, 2009), in which the researcher is the key instrument of the study (Godoy, 1995). The research involves collecting field data through interviews and applying questionnaires to obtain information from the users studied (Burgess, 2002; Yin, 2009). It is an exploratory research that seeks to understand the use of strategies to leverage sales by Instagram, used by three female-owned enterprises.

Data collection was carried out through a questionnaire conducted in semi-structured interviews, at two different times. The first interview collected exploratory data and the second confirmed, validated and collected additional information and synthesized the ideas. Table 3 presents a characterization of the companies and the duration of the interviews.

Table 3: Characterization of the companies interviewed

Company	Sector	Time to market	Duration of interviews
A	Jewelry	7 years	Moment 1: 60 minutes Moment 2: 35 minutes Direct observation of the activity
B	Shoes	6 years	Moment 1: 50 minutes Moment 2: 47 minutes Direct observation of the activity
C	Beauty salon	5 years	Moment 1: 45 minutos Moment 2: 50 minutes Direct observation of the activity

To collect information related to Instagram strategies and tools used by three female-owned enterprises during the pandemic moment, a questionnaire was structured containing three parts: i) characterization of companies and entrepreneurs related to the use of Instagram (9 questions), ii) mapping of Instagram tools (4 questions) and iii) mapping the strategies that encourage users to complete sales through Instagram (5 questions).

For data analysis, the interviews were transcribed in order to identify patterns of responses and similarities between the micro-enterprises studied.

4. Data presentation

4.1 Characterization of respondents

Entrepreneurs from companies A, B and C were interviewed in order to understand the tools and strategies used to leverage sales. The interviewee from company A has incomplete higher education while companies B and C are already graduated. All have businesses on Instagram unlinked from their personal use accounts.

The interviewees have been using Instagram for more than 3 years and dedicate between 1 to 5 hours a day to use the application in order to increase the approach, keep and attract new customers, which proves to be effective in boosting the business. Although the pandemic was not the reason for the beginning of interactions with Instagram, it provided a significant increase in sales for these companies and a greater capture of new customers.

4.2 Characterization of Instagram tools

In order to understand the use of the tools, Table 4 was structured, which presents the entrepreneurs' perspections regarding the purpose of the Instagram tools.

Table 4: Entrepreneurs' perception according to the purposes of the tools

Tools	Resume of perceived purposes
Feed	Serve as a showcase for displaying products and services provided by the company.
Stories	Bringing the company closer to the customers by showing the day-to-day of the entrepreneurs.
IGTV	As they are longer contents, it makes it possible to inform customers about a specific subject (for example tips, messages for commemorative dates, etc).
Reels	Approach customers in more lively and interactive ways.
Live streaming	Get a live interaction with the customer to showcase products and services and share knowledge.
Paid traffic	Capture new customers.
Metrics	Gain knowledge of your target audience, their preferences and what these customers want to see on their profile.

The most used tools were the "feed", "stories" and "metrics". According to them, “feed” and “stories” have a great potential to obtain followers engagement in the business and a significant feedback from the customers. The “metrics” are fundamental to analyze the data collected by the social network. It is possible to analyze users' interest in the content presented and the need for changes in strategies to increase feedback. It was also noticed that “live streaming” and “reels” are little used, but when handled, the feedbacks exceeded the expectations of the interviewees.

It was observed that the only tool not used was “paid traffic”, by entrepreneur B. The reason is related to the lack of knowledge about how to make the announcement, observing the needs of your business. For the entrepreneur, it was possible to reach users through interaction only with the other tools.

In addition to the tools mentioned in the literature, the entrepreneurs reported frequent use of “direct” and “highlights”. The “direct” is a form of communication between the entrepreneur and the customer. In relation to the “highlights”, entrepreneur A addresses that it aims at the fixed exposure of some products available in her business, while entrepreneurs B and C emphasize that it serves to pass on some information about the enterprise, such as: payment method, time scheduling, address, promotions, tips, among others.

4.3 Characterization of sales strategies by Instagram

Table 5 presents the entrepreneurs' perceptions regarding the purposes of the strategies to leverage sales.

Table 5: Strategies under the perception of entrepreneurs

Strategies	Resume of perceptions
Use of paid ads	Reach new customer.
Keep users’ attention with high quality posts	Get costumer interaction through posts to maintain the profile engagement.
Strategic alliances with other companies and *influencers*	Expand business profile for new customers.

Strategies	Resume of perceptions
e-WOM	Obtain knowledge about feedbacks regarding products and services, in order to fidelize de customer.
Celebrities with a lot of followers	Reach potential new customers.
Recommendations and feedbacks	Analyze criticis and eulogies to make improvements to strengthen the brand and fidelize the customer.
Encourage user participation	Generate proximity and connection with the customers for possible profile engagement.

Regarding the sales strategies used by the entrepreneurs, it was found that the main ones were: i) “keep users' attention with high quality posts”, ii) “e-WOM”, iii) “recommendations and feedbacks” and iv) “encourage user participation”.

To “keep the attention of users”, entrepreneur A, reported that she kept content available whose target audience was interested in viewing, such as the products available for purchase, knowledge of the pieces, self-esteem tips, among others. The entrepreneur mentioned that as a result of sharing quality content, greater interaction with the customer is obtained, which increases engagement with the company's profile.

The “e-WOM” allows reaching a wider range of consumers who have a real interest in the company's products and services. As it is a tool in which customers can recommend the products and services they have tried, it represents an interesting strategy that allows influencing other followers.

The “recommendations and feedbacks” allow entrepreneurs to know the preferences of customers and their opinions. Through destructive criticism it is possible to repair the error and implement the necessary improvements.

Finally, “encouraging user participation” enables greater profile engagement, increasing content delivery to a greater number of users. Participation includes commenting on the feed, responding to stories and interacting during the live.

On the other hand, the strategy “celebrities with many followers” was considered the least used. Entrepreneurs A and B never used, and reported that they were never interested in establishing this type of partnership, since such functions do not focus efforts only on the female audience, since celebrities have a heterogeneous audience. Entrepreneur C, who uses it occasionally, mentions that she did not obtain a positive result. According to entrepreneur C, this strategy made it possible to increase the number of followers without converting into sales, due to the fact that new followers live in regions different from the place where the business is located.

In addition to the strategies presented in Table 5, Entrepreneur A reports that “It is necessary to have a differential in relation to its competitor (...), strategies that differentiate it from other ventures, such as: online service outside business hours, face-to-face service on Sundays, free deliveries within the city, search for a lower value for shipping goods throughout Brazil (...) among other strategies” (Entrepreneur A).

4.4 Use of Instagram at the pandemic moment

With reference to the use of Instagram and in order to understand the adaptations that entrepreneurs made in the business, the pandemic moment was divided into three: i) Moment 1 (December/2019 to January/2020) - characterized by uncertainty and lockdown, ii) Moment 2 (January/2020 to December/2021) - characterized by the start of vaccination, and iii) Moment 3 (January/2022 to March/2022) - characterized by mass vaccination and decline in the number of cases and deaths.

Table 6 illustrates the purpose of the actions and the respective Instagram tools adopted by female-owned enterprises at different times of the pandemic.

In this scenario, involving the 3 pandemic moments presented, it was possible to observe that the entrepreneurs focused on increasing interaction and proximity with customers, intensifying both existing online relationships (Entrepreneur A), and the search for a new online relationship (Entrepreneur C). For this, they used “feed”, “stories”, “reels” and “lives”. At moment 1, Entrepreneur C, whose activities were carried

out 100% in person, began to offer online products, such as mentoring and offering knowledge to customers. At moment 3, there was a focus on facilitating the purchase of customers through Instagram using the "shop storie" (Entrepreneur A) and the "outlet" (Entrepreneur B).

Table 6: Historical account of the pandemic moments

	Moment 1	Moment 2	Moment 3
Company A	Bring knowledge of the manufacture of the pieces and show the importance of self-esteem for women through Feed and Stories.	Get new customers and increase the company's revenue, using the lives. A way to show details about products and get closer to customers.	Get closer to the customer and offer discounted products using the Stories Store.
Company B	Migrate 100% of sales from face-to-face to online using Feed and Stories.	Get closer to customers and increase sales, weekly launching products on Stories and Reels.	Get closer to the customer using the outlet practice and the development of lives, always posting high quality content through Feed and Stories.
Company C	Bringing knowledge about planning, management and deepening the services provided, using online mentorships through lives.	Seek new strategies to capture new customers during the return of the face to face. Show the complete process of all services provided through Feed and Stories.	Continuously post content through Feed and Stories. Seek new knowledge through training courses for the implementation of actions to increase revenue.

5. Discussion

As a result, it was observed that during the pandemic, the businesses studied had a significant increase in sales and greater capture of new customers. This was only possible from the use of Instagram. The main findings of the research were:

1) Regarding the tools

The most used tools were the "feed", "stories" and "metrics". They measured the interaction between the entrepeneur and the customer, as well as between the customers themselves, providing recommendations, feedbacks and opinions about products and services (Yadav and Mahara, 2020). In this way, it can be abstracted that Instagram technologies are capable of enhancing social interactions, being considered an important component of S-commerce, thus resulting in greater volumes of commercial activities (Esmaeili and Hashemi, 2019; Attar, Shanmugam and Hajli, 2020; Abdelsalam *et al.* 2020; Shekhar and Jaidev, 2020; Addo *et al.*, 2021).

The "paid traffic" and "reels" tools are rarely used, but when properly used, they allow for a good level of customer engagement (Sarker *et al.*, 2020). Entrepreneurs often use the "direct" of the Instragram, which is a form of communication between the entrepreneur and the customer.

2) Regarding the strategies

The four main strategies (Abdelsalam *et al.*, 2020; Attar, Shanmugam and Hajli, 2020; Addo *et al.*, 2021) used were: i) "keep users' attention with high quality posts", ii) "e-WOM", iii) "recommendations and feedbacks" and, finally, iv) "encourage user participation". The strategy "Celebrities with many followers" was considered the least used. The complementary strategies identified were: greater flexibility in opening hours and free deliveries within the city.

3) Regarding the use of Instagram in the pandemic moment

The actions focused on increasing interaction and proximity with customers through the use of "feed", "stories", "reels" and "lives". Subsequently, the focus became to facilitate the purchase made by customers through Instagram, using the "shop storie" (Entrepreneur A) and Outlet (Entrepreneur B) functions. Entrepeneur C, as it was a 100% physical company, saw on Instagram the possibility of continuing the business in a time of lockdown, developing mentorships and taking knowledge to customers. Instagram proved to be a tool with great potential for business.

6. Conclusion

This article presented the tools and strategies used on Instagram by three female-owned enterprises in the female sector, during the COVID-19 pandemic, to sales leverage. The research has as findings the identification of the main tools and sales strategies through Instagram, a partir da perpesctiva empírica vivenciada por female-owned enterprise. It was observed that the combination of tools and strategies made possible through Instagram provided the engagement and social interaction of customers (Sarker *et al.*, 2020) with the profiles of the companies, contributing to boost sales in the female sector (Abdelsalam *et al.* 2020; Addo *et al.*, 2021).

It was observed that the knowledge of women entrepreneurs in relation to some of these tools is still limited, which represents a vast environment to be explored to strengthen the adoption of social commerce. Instagram proved to be a tool with great potential for business of the female sector. The non-use of some tools, whether due to lack of knowledge, fear of using them and not achieving the desired result or even lack of resources, may be postponing possibly satisfactory results and making companies miss valuable momentary market opportunities.

In this way, the research contributes to the theory of social commerce and serves as a guide for other entrepreneurs who want to use sales strategies through Instagram to leverage sales. In addition, Instagram technologies promote an enhancing of social interactions to improve sales on digital commerce (Shekhar and Jaidev, 2020; Addo *et al.*, 2021).

This work also has some limitations. The female-owned enterprises are from the same region where they were interviewed. Another aspect is that only the social network Instagram was studied at the time of the pandemic. This same research applied in other regions and markets could present differences in the results, as well as the approach using other social networks. As future work, it is also suggested to research medium and large companies to compare the results. Finally, this study can help entrepreneurs and businessmen to improve their business strategies, as well as assist in the proper selection of Instagram tools that have been shown to be useful for leveraging the analyzed ventures.

Acknowledgements

We would like to thank the Federal University of Ouro Preto (UFOP/ Brazil) (www. ufop.br), Foundation for Research Support of the State of Minas Gerais (FAPEMIG), Coordination for the Improvement of Higher Education Personnel (CAPES) and National Council for Scientific and Technological Development (CNPq), for the support and funding during the development of the research. The authors also would like to thank the editors of the Journal and their reviewers, who contributed to the improvement of this article.

References

Abdelsalam, S., Salim, N., Alias, R.A. and Husain, O. (2020) "Understanding online impulse buying behavior in social commerce: a systematic literature review", *IEEE Access*, Vol 8, pp 89041-89058.

Addo, P.C., Fang, J., Asare, A.O. and Kulbo, N.B. (2021) "Customer engagement and purchase intention in live-streaming digital marketing platforms", *The Service Industries Journal*, Vol 4, Nos. 11-12, pp 767–786.

Ali, Y.S., Hussin, A.R.C. and Dahlan, H.M. (2020) "Electronic Word of Mouth engagement in social commerce platforms: An empirical study", *Information Development*, Vol 36, No. 3, pp 438-456.

Alkhowaiter, W. (2016) "The power of Instagram in building small businesses", In *Conference on e-Business, e-Services and e-Society*, Vol 9844, pp 59-64.

Alonso-Dos-Santos, M., Jiménez, M.A. and Carvajal-Trujillo, E. (2020) "Facebook commerce usage intention: a symmetric and asymmetric approach", *Information Technology and Management*, Vol 21, No. 3, pp 145-156.

Anacleto, A., Bornancin, A.P.D.A., Mendes, S.H.C. and Scheuer, L. (2020) "Between flowers and fears: the new coronavirus pandemic (COVID-19) and the flower retail trade", *Ornamental Horticulture*, Vol 27, No. 1, pp 26-32.

Attar, R.W., Shanmugam, M. and Hajli, N. (2020) "Investigating the antecedents of e-commerce satisfaction in social commerce context", *British Food Journal*, Vol 3, No. 3, pp 849-868.

Bhattacharyya, S. and Bose, I. (2020) "S-commerce: Influence of Facebook likes on purchases and recommendations on a linked e-commerce site", *Decision Support Systems*, Vol 138, p 113383.

Bhatti, A., Akram, H., Basit, H.M., Khan, A.U., Raza, S.M. and Naqvi, M.B. (2020) "E-commerce trends during COVID-19 Pandemic", *International Journal of Future Generation Communication and Networking*, Vol 13, No. 2, pp 1449-1452.

Burgess, R.G. (2002) *In the field: An introduction to field research,* Routledge.

Chen, L.C. and Huang, L.C. (2020) "The Motivation, Strategies, and Barriers for Adopting Social Media Marketing in the Flower Retailing Business", *Horticulturae*, Vol 6, No.4, p 80.

David, F.de.F.dos.S.; Silva, A.B.A. da; Baldasso, G.; Marculino, C.H.de.S.; Almeida, J.V.de.; Soltau, S.B, (2019) "A proposal to use Instagram in methodology applicable in High School disciplines", *Research, Society and Development*, Vol 8, No. 4, p e1684959.

Dolega, L., Rowe, F. and Branagan, E. (2021) "Going digital? The impact of social media marketing on retail website traffic, orders and sales", *Journal of Retailing and Consumer Services*, Vol 60, p 102501.

Escher, I. (2021) "Marketing digital na pandemia da covid-19: um estudo de caso na empresa Tribele Moda Feminina", PUC Goiás, https://repositorio.pucgoias.edu.br/jspui/handle/123456789/1898.

Esmaeili, L. and Hashemi G, S.A. (2019) "A systematic review on social commerce", *Journal of Strategic Marketing*, Vol 27, No. 4, pp 317-355.

Ferraz, M.D.A. and Gerais, F.M. (2019) "A utilização do instagram como ferramenta comercial por micro e pequenos empreendedores", UFV, Campus Florestal.

Godoy, A.S. (1995) "Introdução à pesquisa qualitativa e suas possibilidades", *Revista de administração de empresas*, Vol 35, No. 2, pp 57-63.

Gonçalves, C.A., Shigaki, H., Gomes, G.R.S., Rocha, A.A. and Romeiro Filho, E. (2019) "Loja física versus e-commerce: estudo comparativo sobre o consumo de semi joias", *Revista de Administração Unimep*, Vol 17, No. 2, pp 77-97.

Grange, C., Benbasat, I. and Burton-Jones, A. (2020) "A network-based conceptualization of social commerce and social commerce value", *Computers in Human Behavior*, Vol 108, p 105855.

Haenlein, M., Anadol, E., Farnsworth, T., Hugo, H., Hunichen, J. and Welte, D. (2020) "Navigating the New Era of Influencer Marketing: How to be Successful on Instagram, TikTok, & Co", *California management review*, Vol 63, No. 1, pp 5-25.

Herzallah, D., Leiva, F.M. and Liébana-Cabanillas, F. (2021), "To buy or not to buy, that is the question: understanding the determinants of the urge to buy impulsively on Instagram Commerce.", *Journal of Research in Interactive Marketing*, pp 2040-7122. https://doi.org/10.1108/JRIM-05-2021-0145.

Hossain, M.A. and Kim, M. (2020) "A comprehensive study on social commerce in social networking sites", *SAGE Open*, Vol 10, No. 2, pp 1-13.

Iivari, N., Sharma, S. and Ventä-Olkkonen, L. (2020) "Digital transformation of everyday life–How COVID-19 pandemic transformed the basic education of the young generation and why information management research should care?", *International Journal of Information Management*, Vol 55, p 102183.

Karine, H.A.J.I. (2021) "E-commerce development in rural and remote areas of BRICS countries. *Journal of Integrative Agriculture*, Vol 20, No. 4, pp 979-997.

Khoa, B.T. and Nguyen, M.H. (2020) "Electronic loyalty in social commerce: Scale development and validation", *Gadjah Mada International Journal of Business*, Vol 22, No. 3, pp 276-300.

Kristian, H., Bunawan, S.G., Wang, G. and Sfenrianto, S. (2020) "Social User Behavior Analysis of Purchasing Decisions in Instagram Online Store", *International Journal of Emerging Trends in Engineering Research*, Vol 8, No. 2, pp 598-601.

Latiff, Z.A. and Safiee, N.A.S. (2015) "New business set up for branding strategies on social media–Instagram", *Procedia Computer Science*, Vol 72, pp 13-23.

Le, X.C. (2021) "What triggers mobile application-based purchase behavior during COVID-19 pandemic: evidence from Vietnam", *International Journal of Emerging Markets*. Vol ahead-of-print No. ahead-of-print. https://doi.org/10.1108/IJOEM-12-2020-1594.

Lin, C.C. (2021) "Investigating Complimentary E-Marketing Strategy for Small-and Medium-Sized Enterprises at Growth Stage in Taiwan", *Information*, Vol 12, No. 9, pp 380.

Molina-Prados, A., Muñoz-Leiva, F. and Prados-Peña, M.B. (2021) "The role of customer brand engagement in the use of Instagram as a "shop window" for fashion-industry social commerce", *Journal of Fashion Marketing and Management: An International Journal*, pp 1361-2026, doi: 10.1108/JFMM-12-2020-0275.

Pinheiro, A.F. and Macêdo, M.E.C. (2021) "Digital Marketing: Sales Strategies with Digital Retail during COVID-19 Pandemic", *ID on line REVISTA DE PSICOLOGIA*, Vol 15, No. 55, pp 194-205.

Priyaningrum, R., Pawito, P. and Wijaya, M. (2020) "Social Information Process on Instagram to Develop Social Entrepreneur Women in Madiun Indonesia", *International Journal of Multicultural and Multireligious Understanding*, Vol 7, No. 9, pp 70-80.

Sarker, P., Hughe, L., Dwivedi, Y.K. and Rana, N.P. (2020) "Social commerce adoption predictors: A review and weight analysis", *Responsible Design, Implementation and Use of Information and Communication Technology,* Vol 12066, pp 176-191.

Shah, N., Nali, M., Bardier, C., Li, J., Maroulis, J., Cuomo, R. and Mackey, T.K. (2021) "Applying topic modelling and qualitative content analysis to identify and characterise ENDS product promotion and sales on Instagram", Tobacco control.

Shekhar, R. and Jaidev, U.P. (2020), "Antecedents of online purchase intention in the context of social commerce", *International Journal of Applied Management Science*, Vol 12, No. 1, pp 68-95.

Shin, N., Park, S. and Kim, H. (2020), *Consumer Satisfaction–Based Social Commerce Service Quality Management*, BRQ, Vol 24, pp 34-52.

Soares, K. (2020) "Marketing: Plano de Marketing para a empresa Bella Bijoux", Administração-Pedra Branca, UNISUL, Santa Catarina, https://repositorio.animaeducacao.com.br/handle/ANIMA/16108.

Solem, B.A.A. (2016) "Influences of customer participation and customer brand engagement on brand loyalty", *Journal of Consumer Marketing,* Vol 33 No. 5, pp 332-342.

Szeto, M.D., Presley, C.L., Pulsipher, K.J., Harp, T., Rundle, C.W., Sivesind, T.E., ... and Dellavalle, R. P. (2021), "Dermatologist influencers on social media: Instagram Reels and TikTok interactive short vídeos", *Journal of the American Academy of Dermatology*, Vol 85, No. 3, pp e185-e188.

Terra, V. (2017), "Representação e imagem: o Instagram como ferramenta de produção de novos sentidos", *Rio de Janeiro*.

Yadav, R. and Mahara, T. (2020), "Interactions and Participation on Social Commerce Websites: Exploratory Study", *Global Business Review*, Vol 21, No. 4, pp 1127-1152.

Yin, R.K. (2009), "*Case study research: Design and methods"*, Vol 5. sage.

A Case Study of the Entrepreneurial Education in a Sino-Foreign University in China

Yimei Mi
Xi'an Jiaotong-Liverpool University, Suzhou, China
Yimei.Mi20@student.xjtlu.edu.cn

Abstract: This paper mainly focuses on entrepreneurial education in higher education. A case study is presented in this paper to investigate the current situation of entrepreneurial education in Chinese universities. The primary research method of this case study is interviewing. Four participants were interviewed in this paper, and they are students from the target Sino-foreign university, which was constructed by Xi'an Jiaotong University (XJTU) and Liverpool university in the UK. The results indicate that this Sino-foreign university provides a professional platform for students to establish their own businesses. Compared with other traditional universities, this university educates students with more innovative ideas and gives them more opportunities to practice their business' ideas. Moreover, this Sino-foreign university also designs entrepreneurship education as a module in students' learning activities. The students can join in the competition for earning a shop in the opening student entrepreneurship parks and start their businesses.

Keywords: entrepreneurial education, Chinese higher education, Sino-foreign university, case study, interviews, entrepreneurship parks

1. Background

The topic of this paper very attractive because a lot of Chinese students have no idea about entrepreneurial education before studying at this Sino-foreign university. It surprised me that there has a place on campus called Student Enterprise Park. There are many companies and enterprises created and owned by students at this university. I have noticed them several times, but I have no idea how those enterprises work. Thus, I decided to interview the students familiar with this specific area on the campus.

However, I found one problem: some of the shops there are not open to the public. And postgraduate student like me knows very little about this Enterprise Park. For investigating the working system of this Enterprise Park and the functions of the shops, this research mainly adopts the research method of interviews.

This study explores entrepreneurial education in higher education in China and foreign counties like the USA. A comparison between the target case university of XJTLU and the American University is presented in the analysis. Moreover, this study will focus on the existing problems of entrepreneurial education in Chinese higher education. The research questions are as follows.

2. Research questions

- 1. What kind of entrepreneurial education is provided by the target Sino-foreign university?
- 2. What can be the challenges faced by the student entrepreneurs?

3. Literature review

Entrepreneurial education

The meaning of being entrepreneurial is dissimilar for different people (Lackéus, 2015). Gartner (1990) believes entrepreneurship is innovatively producing an organization for creating values but not aiming at profits. However, based on this definition, Shane and Venkataraman (2007) argue that creating an innovative organization could not be included in entrepreneurship; it can happen in remaining organizations.

Moreover, entrepreneurship is "a process by which individuals – either on their own or inside organizations – pursue opportunities without regard to the resources they currently control" (Stevenson & Jarillo, 1990, p. 23).

Lackéus (2015, p. 9) states that the broad definition of entrepreneurship is about "personal development, creativity, self-reliance, initiative taking, action orientation, i.e. becoming entrepreneurial".

What definitions and methods are used will intensely influence the educational goals, focus on viewers, the content of curriculum design, the methods and approaches of teaching, and the evaluation procedures of students, resulting in an extensive variety of ways (Mwasalwiba, 2010).

Additionally, "Entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value created can be financial, cultural, or social" (Moberg et al., 2012, p.14). Regarding the education field, entrepreneurial education is defined by Moberg et al. (2012, p. 14) as "Content, methods and activities supporting the creation of knowledge, competencies and experiences that make it possible for students to initiate and participate in entrepreneurial activities value creating processes".

Based on the scholars' opinions and statements, one of the critical characteristics of entrepreneurship is creating values.

Entrepreneurship is the transformation and acquisition experienced by an individual entrepreneur through interaction with the environment and the changes and values formation caused by the entrepreneur throughout their behaviour (Lackéus, 2015). Therefore, studying and value formation are the two critical features of entrepreneurship (Lackéus, 2015).

Allowing students to create values for external stakeholders will lead to their growth of entrepreneurial capabilities, irrespective of the value creation has been achieved successfully or not (Lackéus, 2015). Concerning the "Learning by doing" concept of the famous educational philosopher John Dewey, Lackéus (2015) suggests labelling it as a "learning by creating value" approach based on the entrepreneurial field (Lackéus et al., 2013). Regarding the research aims of this case study, the paper aims to figure out the current situation of entrepreneurial education in Chinese universities. Thus, the literature about higher education and entrepreneurial education in China will be discussed next.

Entrepreneurial education in higher education

The transformation of universities into "entrepreneurial universities" described in the pieces of literature has become an increasing trend (Etzkowitz 2014). This can be seen in dissimilar cultures and regions, both developed and developing countries (Etzkowitz 2014).

It is suggested that universities need to adapt quickly to change; otherwise, they may fall behind (Davey et al., 2018). Universities need to change the traditional methods by formulating guidelines and policies that provide a more entrepreneurial theoretical style, allowing students to cooperate and exchange their ideas through this innovative learning method (Davey et al., 2018). This could help students improve creativeness and interdisciplinary information to adjust to the changing world (Davey et al., 2018). "*If universities adjust and create these open learning settings, they will avoid specialisation and be better prepared for the global market*" (Davey et al., 2018, p. 16).

Entrepreneurial education in the USA

Mu (2006) points out that more than 1,500 four-year universities and colleges in the United States provide entrepreneurship courses. It can be said that almost all universities participating in the American university rankings have opened entrepreneurship courses (Mu, 2006). Entrepreneurial education has become an essential part of American university education and even extends to middle school education, like forming practices at different levels from middle school to university, and this entrepreneurial education system is still expanding and deepening (Mu, 2006).

Entrepreneurship education courses in many American schools revolve around an entrepreneurial plan (Zhang, 2006). Undergraduates of Babson College must take entrepreneurial education courses from the beginning of their first year (Zhang, 2006). Students should write entrepreneurial plans in groups under the guidance of teachers and receive start-up funds of US$3,000 from the Entrepreneurship Education Center to conduct market research for customers, develop and sell products (Zhang, 2006). There will also have competitions between groups to see which group earns more money (Zhang, 2006). While students take entrepreneurship courses in the third and fourth grades, the Entrepreneurship Education Center provides students with incubator services and sets up an entrepreneurship seed fund (Zhang, 2006). Undergraduate entrepreneurship

teams and graduate entrepreneurship teams who are interested in starting a business can apply for between US$5,000 and 20000, venture funds that vary between the U.S. dollar (Zhang, 2006).

It is evident from the statistics and evidence that the universities in America provide the students with various supports. The system is of the case university is quite similar. Though, there also have the differences. The following paragraph will explain more information.

4. Method

According to Bryman (2012, p. 66), "t*he basic case study entails the detailed and intensive analysis of a single case*". Moreover, the case study research aims to figure out the complex nature of the case through research questions, and the case can be the form of "*a single community*", "*a single school*" or "*a single family*" (Bryman, 2012, p. 66).

The primary research method in this paper is the unstructured interview. "*There may be just a single question that the interviewer asks. The interviewee is then allowed to respond freely, with the interviewer simply responding to points that seem worthy of being followed up*" (Bryman, 2012, p. 471). An unstructured interview is flexible and accessible for both interviewers and interviewees.

5. Findings

I interviewed four students in this paper. They are all students of XJTLU, including two males and two females. One of the males is a member of the Student Enterprise Development Association, and he is the minister of the Administration and Management Department. He needs to produce relevant publicity materials to provide online and offline publicity for the association and activities, manage the online official account platform, write-related tweets, shoot vents and video recordings. In this paper, he will be called Student W.

Another male, Student X, owns the one shop in Student Enterprise Park. Starting from high school, starting a business was written into his life goal. After entering XJTLU, he successively planned three entrepreneurial projects and experienced five entrepreneurial competitions, but the repeated setbacks did not make him give up. Today, the music studio he founded in XJTLU has nine core members, more than 40 signed part-time music producers, and has provided arrangement services for more than 7,000 musicians, including well-known musicians with nearly 10 million fans.

Student J participated in the entrepreneurs' competition held by the Career Development Office of XJTLU. And another female, Student H, is a member of the hip-hop club in XJTLU, and she bought the music demos from this music studio, and she recommends the other students-musicians to buy music products.

Before I interviewed them, I knew nothing about the Student Enterprise Park in XJTLU. After conducting the interview, I can connect the theories and knowledge learned with the practices.

6. Interviews with students

From the interview with Student W, many vital issues have been mentioned, including the working system of the Student Enterprise Park, the construction of the Enterprise Park, and the conditions for getting the right to use the shops in the park.

When talking about the working system of the Enterprise Park, Student W said: "S*tudents need to participate in the annual innovation and entrepreneurial competition, which is equivalent and open to every student who wants to use the shop to create their own company or enterprise. The students who win the prize can have the opportunity to use the shop in Student Enterprise Park, and the rent is free*".

Moreover, the support and guidance from the university are also beneficial for students who want to learn and know more about establishing their own companies. The student W talked about several aspects, including inviting mentors, giving entrepreneurial scholarships, and providing professional consultation.

Student W added that: "*The help provided by the school is that we have an instructor who the school employs, he will give us some guidance, and then at the same time, he will often give the whole school teachers and students some entrepreneurship classes, and invite many compelling provincial entrepreneurs, very famous*

entrepreneurs and entrepreneurs mentors for giving us some lectures, telling us some cases and examples about entrepreneurship mindset and knowledge including how to set up the project, what difficulties can be experienced in entrepreneurship, and the psychology help of entrepreneurship or the consultation of entrepreneurship. These activities help the school, giving students the opportunities to let them know more about the process of student entrepreneurship and how it can be established step by step. There are also entrepreneurial scholarships or project funds from research mentors".

This policy is similar to American universities like Stanford University and Babson College, where the Entrepreneurship Education Centre provides students with incubator services and sets up an entrepreneurship seed fund (Zhang, 2006). They all provide students with funding and scholarships to start up their businesses. However, it is different from Babson College designed the whole entrepreneurial education curriculum for undergraduate students. In XJTLU, only the students who know this entrepreneurial support will apply for the scholarships or participate in the innovative and entrepreneurial competition. Thus, it is a must to discuss adapting wide application of entrepreneurial education in different subjects, departments, and colleges in Chinese universities.

Student J is a postgraduate student who participated in an innovative and entrepreneurial competition. From the interviews, I knew that most of the participants in this competition were undergraduate students. I was curious about why she wanted to create her own business and how she intended to settle the company down. Thus, the data will be presented for analysing the causes.

Student J received the email from the Career Development Centre, "*as far as I knew for a long time, students can open a shop in the school, and it was a crucial competition, the top few students in the competition could get the right to use this shop for one year without payment. I cooperated with a few of my former friends, they are very optimistic about the shops in XJTLU, and they think it is a huge potential opportunity*".

She talked more about her business plan. Her project was bringing the beautiful certificate machine to campus. This kind of ID photo machine on the market can also be used to take photo stickers. It can be a 24-hour business in school and does not require human management. Built-in advertisements can also be sponsored to earn money. Theoretically speaking, this project can be implemented. Still, when participating in the competition, the participating jury felt that the technical content of this project was too few, and what they wanted was a very high-end project. For example, a more popular project is the intelligent translator of the School of Artificial Intelligence. Students and professors jointly develop this project at the school. This kind of science and technology will be more popular.

Like Stanford University, the students in XJTLU can cooperate with a mentor, usually the professors, but they can also be mentors outside the school. The mentors outside the schools are primarily outstanding leaders or entrepreneurs in a particular field. The students and mentors can develop and complete a project together, such as the AI brilliant translator mentioned by Student J. While completing scientific research projects, the students can also get the opportunity to start a business.

Student X has already won several competitions, and he owns the music studio in the Student Enterprise Park. In the interview, he pointed out that he started creating a local e-commerce website to sell local products in high school. However, it was difficult for high school students to run out of the company, and it finally failed. But he learned two things from this entrepreneurial experience: he wanted to start his own business and not create a new business again until he had enough experience, capital, and connections.

When talking about the first entrepreneurship inspiration in college life, he mentioned that the school invited him to participate in an entrepreneurship training organized by the Suzhou Municipal Government. He met some potential partners with the same vision. However, the team lacked the market experience, and they failed twice. After the failures, he started the music studio called "Less than Three Studios". Based on his understanding and persisting of the music, he became a music producer and met another group of musicians on campus. Due to persistence, innovation, and unwillingness to give up, he won the competition with the first prize. And now, he is focusing on spreading culture and even creating his own culture and has cooperated with the music clubs to create their hip-hop music style, and more rappers have joined this cooperation. The profits are currently growing steadily.

7. The entrepreneurial competence

Student W believed that the entrepreneur should have the following competencies: "*I think the entrepreneur should first be good at observing and having strategic thinking, ability, innovation, and persistence*." Additionally, the characteristics of Student X, including persistence, self-ability, knowledge, and innovative idea, he finally succussed after several times of failures. Table 1 shows the core entrepreneurial competencies.

Table 1: The core entrepreneurial competencies

	Main theme	Sub themes	Primary source	Interpretation used in this report
Cognitive competencies	Knowledge	Mental models	(Kraiger et al., 1993)	Knowledge about how to get things done without resources, Risk and probability models.
		Declarative knowledge	(Kraiger et al., 1993)	Basics of entrepreneurship, value creation, idea generation, opportunities, accounting, finance, technology, marketing, risk, etc.
		Self-insight	(Kraiger et al., 1993)	Knowledge of personal fit with being an entrepreneur / being entrepreneurial.
	Skills	Marketing skills	(Fisher et al., 2008)	Conducting market research, Assessing the marketplace, Marketing products and services, Persuasion, Getting people excited about your ideas, Dealing with customers, Communicating a vision.
		Resource skills	(Fisher et al., 2008)	Creating a business plan, Creating a financial plan, Obtaining financing, Securing access to resources
		Opportunity skills	(Fisher et al., 2008)	Recognizing and acting on business opportunities and other kinds of opportunities, Product / service / concept development skills
		Interpersonal skills	(Fisher et al., 2008)	Leadership, Motivating others, Managing people, Listening, Resolving conflict, Socializing
		Learning skills	(Fisher et al., 2008)	Active learning, Adapting to new situations, coping with uncertainty
		Strategic skills	(Fisher et al., 2008)	Setting priorities (goal setting) and focusing on goals, Defining a vision, Developing a strategy, Identifying strategic partners
Non-cognitive competencies	Attitudes	Entrepreneurial passion	(Fisher et al., 2008)	"I want". Need for achievement.
		Self-efficacy	(Fisher et al., 2008)	"I can". Belief in one's ability to perform certain tasks successfully.
		Entrepreneurial identity	(Krueger, 2005, Krueger, 2007)	"I am / I value". Deep beliefs, Role identity, Values.
		Proactiveness	(Sánchez, 2011, Murnieks, 2007)	"I do". Action-oriented, Initiator, Proactive.
		Uncertainty / ambiguity tolerance	(Sánchez, 2011, Murnieks, 2007)	"I dare". Comfortable with uncertainty and ambiguity, Adaptable, Open to surprises.
		Innovativeness	(Krueger, 2005, Murnieks, 2007)	"I create". Novel thoughts / actions, Unpredictable, Radical change, Innovative, Visionary, Creative, Rule breaker.
		Perseverance	(Markman et al., 2005, Cotton, 1991)	"I overcome". Ability to overcome adverse circumstances.

According to Lackeus (2014), the competencies are divided into three different themes. The sub-themes contain a variety of skills. From table 1, I find out that the interviewees mentioned or already have several competencies like innovativeness, perseverance, self-insight, entrepreneurial passion, and interpersonal skills.

Moreover, the staff and faculty in the university played the role of resources provider, instructors, and facilitators, and some of them are innovators. The students are more like the information-receiver, creators, innovators with self-driven, self-motivation, and self-interests. The most important thing is that they have enough knowledge and a good team.

However, from my observation, the other shops in Student Enterprise Parks operate poorly. Some of them will be replaced in the future, especially those with low turnover. "*University education is the most important condition for developing an innovation-oriented economy, and creating an innovation society requires the modernization of university education*" (Sołek-Borowska, 2018, p. 85). Furthermore, "*Entrepreneurship and innovation are widely regarded as an important basis for competitive advantage in a rapidly changing international business environment, enhancing the capabilities for sustainable business growth, economic activity and the wealth of nations*" (Sołek-Borowska, 2018, p. 87). Thus, it is a need for higher education to give students the opportunities and platforms to create values and help them to put innovative ideas into practice.

8. Conclusion

To sum up, XJTLU provides the platform, resources, entrepreneurial lectures, consultations, and competitions, where students can establish their businesses. All terms mentioned above are innovative and advanced compared with other traditional Chinese universities. This Student Enterprise Park and the design and ideologies around this entrepreneurial education and practice can positively affect the other universities. And this project can reflect that the innovation happened in Chinese higher education. The Chinese students are becoming more creative and excellent critical thinkers for facing uncertainty in the future.

Therefore, it is a need to expand the school's innovation and entrepreneurship education platform, combine entrepreneurial teaching into the framework of social practice and internship courses, opening student entrepreneurship parks, build entrepreneurship incubation bases, and provide necessary entrepreneurial guidance for individual and group entrepreneurship practices (Li & Lu, 2010). Moreover, expanding the off-campus innovation and entrepreneurship education service platform helps students get more exposure to society by signing an employment and entrepreneurship base for college students (Li & Lu, 2010). Innovation and entrepreneurship education need the support of an excellent social system (Li & Lu, 2010). The strengthening of the relationship between universities and enterprises provides internship opportunities for more students in social practice (Li & Lu, 2010).

The different stakeholders need to be aware that Entrepreneurial education is not only a mindset but also a 21st skill for the individual. Being innovative is about the learning attitude that everyone can be entrepreneurs or innovators with creativity, persistence, self-efficacy, and self-awareness.

Rui (2019) points out that with the publication of the 'China's Education Modernization 2035' by Chinese government, there are more emphasize and attentions on entrepreneurship education. This policy stressed the important position of universities to provide significant platform to Chinese students that they can receive enough entrepreneurship education to support their future careers plan and development (Rui, 2019).

Therefore, the government also plays an important role in improving entrepreneurship education in Chinese higher education. This policy also stressed out that the importance of training students' ability of creativity and apply the new technology and modern educational approaches to rise students' entrepreneurship awareness and help them to solve the problems (Rui, 2019). The financial investment from both local government and universities will be increased in the future. For instance, there are many enterprises cooperated with this Sino-foreign university to provide job opportunities and some of them are financed by local government. There are also career center and each department have their own curriculum design of EE based on the characteristics of the majors.

Therefore, the suggestions for applying EE in other Chinese universities, following suggestions can be taken (Rui, 2019).

- Reform the ideas of entrepreneurship education in colleges and universities.
- Adhere to the cultivation of innovative talents to improve the quality of training, improve the deficiencies of entrepreneurship education, and reform the content of education.
- Entrepreneurship education needs government support. The government can provide resources and platforms so that students can have more opportunities.
- Supervise the training of teachers in entrepreneurship education and strengthen the quality construction of entrepreneurship education in colleges and universities.
- Optimize the curriculum setting of entrepreneurships in colleges and universities, increase the investment and budget of entrepreneurship education funds, encourage, and help students to start their own businesses, and reduce restrictions and burdens.

References

Bryman, A. (2012). Social Research Methods. Oxford.

Davey, T., Meerman, A., Orazbayeva, B., Riedel, M., Galán-Muros, V., Plewa, C., & Eckert, N. (Eds.). (2018). The Future of Universities Thoughtbook: 40 Perspectives on how engaged and entrepreneurial universities will drive growth and shape our knowledge-driven future until 2040. University Industry Innovation Network.

Etzkowitz, H. (2014). Making a humanities town: knowledge-infused clusters, civic entrepreneurship and civil society in local innovation systems. Triple Helix, 2(1), 1-22.
Gartner, W. B. (1990). What are we talking about when we talk about entrepreneurship? Journal of Business Venturing, 5, 15-28.
Li, J. H., & Lu, X. D. (2010). Integrating innovation and entrepreneurship education into the talent training system of colleges and universities. Higher Education in China, 12(9), 9-11.
Lackéus, M., Lundqvist, M., & Williams Middleton, K. (2013). How can entrepreneurship bridge between traditional and progressive education?. ECSB Entrepreneurship Education Conference, 29-31.
Lackéus, M. (2014). An emotion based approach to assessing entrepreneurial education. The International Journal of Management Education, 12(3), 374-396.
Lackéus, M. (2015). Entrepreneurship in education: What, why, when, how. Background paper, 1-45.
Mu, Z. R. (2006). Discussion on the entrepreneurship education model for college students in my country. Higher Education Research, 27(11), 79-84.
Mwasalwiba, E. S. (2010). Entrepreneurship education: a review of its objectives, teaching methods, and impact indicators. Education+ training, 52, 20-47
Moberg, K., Stenberg, E., & Vestergaard, L. (2012). Impact of entrepreneurship education in Denmark-2012. Odense, Denmark: The Danish Foundation for Entrepreneurship–Young Enterprise.
Rui, G. X. (2019). Research on entrepreneurship education in the view of education modernization. Journal of Shaanxi Normal University, 5, 124-129.
Stevenson, H. H., & Jarillo, J. C. (1990). A paradigm of entrepreneurship: entrepreneurial management. Strategic management journal, 11, 17-27.
Shane, S., & Venkataraman, S. (2007). The Promise of Entrepreneurship as a Field of Research*. Entrepreneurship. Springer.
Sołek-Borowska, C. (2018). Understanding innovation. Innovation education–a students' perspective. Informatyka Ekonomiczna, 1(47), 85-96.
Zhang, X. P. (2006). Analysis on the Cultivation Model of Innovative Talents in American Universities. Chinese University Teaching, 3(8), 7-11.

Work in Progress Papers

Effectuation in Practice: How is it Embedded in Innovation-Driven Start-Ups?

Andreas Hinz, Stefan Philippi and Laila Kabous
Institute of Management, School of Business, FHNW, Windisch, Switzerland
andreas.hinz@fhnw.ch
stefan.philippi@fhnw.ch
laila.kabous@fhnw.ch

Abstract: Effectuation suggests that entrepreneurs decide which goals to pursue based on available means. Instead of following rigid plans and acquiring means as is the case with causation, they get to work immediately with available means and exploit arising opportunities. Various research directions of effectuation are discussed in the literature and this work-in-progress paper focuses on effectual behaviours. Drawing on the extant literature, typical behaviours relate to forming partnerships, exploiting contingencies, using experimentation and defining affordable loss. These behaviours appear to be relevant for innovation-driven entrepreneurs and this work seeks to examine how they are embedded in Swiss start-ups. To gain insights, semi-structured interviews will be conducted with entrepreneurs participating in an innovation competition in Switzerland.

Keywords: entrepreneurship, effectuation, behaviour, entrepreneurial means, innovation-driven start-ups

1. Introduction

Effectuation proposes that entrepreneurs identify available means and decide which goals to pursue with these (Perry, Chandler and Markova, 2012; Sarasvathy, 2001). This suggests that they are flexible to exploit arising opportunities by using available means, rather than following strict plans and acquiring means in line with causation (Perry, Chandler and Markova, 2012; Sarasvathy, 2001). This also suggests that they mitigate risks in dynamic ecosystems where acquired means can rapidly become obsolete (Read, Song and Smit, 2009; Sarasvathy, 2001).

Following a systematic categorisation of effectuation research (Dias, Iizuka and Boas, 2019), this work-in-progress paper corresponds to research that replicates effectuation in different contexts (Arend et al, 2015; Ghorbel and Boujelbène, 2013), specifically, in venture creation (Reymen et al, 2015). The literature on effectuation addresses various research directions including effectual behaviour, which this paper focuses on (Van Mumford and Zettinig, 2022; Werhahn et al, 2015; Chandler et al, 2011; Perry, Chandler and Markova, 2012; Sarasvathy, 2001). Drawing from the extant literature, effectual behaviours relate to forming partnerships, exploiting contingencies, using experimentation and defining affordable loss (Sarasvathy, 2001; Sarasvathy and Venkataraman, 2011; Chandler et al, 2011; Perry, Chandler and Markova, 2012).

These behaviours appear relevant for start-ups in highly dynamic innovation and technology sectors (Alzamora-Ruiz, del Mar Fuentes-Fuentes and Martinez-Fiestas, 2021; Frese, Geiger and Dost, 2020; Grégoire and Cherchem, 2020). This research is guided by the question of how effectual behaviours are embedded in innovation-driven start-ups across Switzerland. The paper seeks to contribute to this discussion and provide the basis for further research with start-ups participating in an innovation competition in Switzerland. The paper presents the reviewed literature on typical effectual behaviours and concludes by addressing further research and limitations.

2. Literature review

Entrepreneurial behaviour can be characterised by how start-ups use their means (Brettel et al, 2012; Perry, Chandler and Markova, 2012). Means relate to “what I know” (e.g., experience), “who I am” (e.g., skills) and “whom I know” (e.g., resource access). When entrepreneurs work with means, their behaviour can relate to effectuation and causation (Read, Song and Smit, 2009; Sarasvathy, 2001). Effectuation is defined as “processes that take a set of means as given and focus on selecting between possible effects that can be created with that set of means” (Sarasvathy, 2001). By contrast, causation is defined as “processes that take a particular effect as given and focus on selecting between means to create that effect” (Sarasvathy, 2001). In other words, effectuation is about designing possible effects by using particular means, while causation is about choosing means to create particular effects (Perry, Chandler and Markova, 2012). Regarding uncertainty, effectuation

focuses on controllable aspects of an unpredictable future, which implies that to the extent the future can be controlled, it does not need to be predicted (Fisher, 2012; Chandler et al, 2011; Sarasvathy, 2001). By contrast, causation focuses on predictable aspects of an uncertain future by defining goals, which suggests that to the extent the future can be predicted, it does not need to be controlled (Chandler et al, 2011; Sarasvathy, 2001).

Drawing from the extant literature, effectual behaviours are commonly described by how entrepreneurs form partnerships, exploit contingencies, use experimentation and define affordable loss (Read, Song and Smit, 2009; Sarasvathy, 2001; Sarasvathy and Venkataraman, 2011; Chandler et al, 2011; Perry, Chandler and Markova, 2012). These behaviours tend to be particularly relevant for innovation-driven entrepreneurs who compete in dynamic and competitive environments with fast technological obsolescence (Andries, Debackere and Van Looy, 2013; Alzamora-Ruiz, del Mar Fuentes-Fuentes and Martinez-Fiestas, 2021; Prajogo and McDermott, 2014; Grégoire and Cherchem, 2020).

2.1 Forming partnerships

Engaging with customers, suppliers and other stakeholders helps entrepreneurs to build complementary assets and access external means (Chandler, DeTienne and Mumford, 2007). This goes beyond competitive thinking and focuses on collaboration to transform uncertainty into opportunity (Kerr and Coviello, 2019; Reymen et al, 2015; Perry, Chandler and Markova, 2012; Read, Song and Smit, 2009). Partnerships enable entrepreneurs to have some control over future outcomes, which renders the need to predict them obsolete (Chandler et al, 2011; Sarasvathy, 2001). Innovation-driven start-ups often establish partnerships to engage in co-creation and to access resources (Alzamora-Ruiz, del Mar Fuentes-Fuentes and Martinez-Fiestas, 2021; Sjödin 2019; Grönroos and Voima, 2013; Van Mumford and Zettinig, 2022). Potential customers can be involved in product development, which improves the offering and builds trusted relationships (Frese, Geiger and Dost, 2020). Partnerships and commercial agreements also reduce risks among innovation-driven companies, for instance, due to pre-commitments from customers and other partners (Frese, Geiger and Dost, 2020; Laskovaia, Shirokova and Morris, 2017; Reymen et al, 2015).

2.2 Exploiting contingencies

Instead of following formal plans and making predictions, entrepreneurs can stay flexible and take advantage of contingent opportunities as they arise (Kerr and Coviello, 2019; Chandler, DeTienne and Mumford, 2007; Sarasvathy, 2001). Rather than pursuing clearly defined goals as is the case of causation, entrepreneurs deploy available means to exploit contingencies (Kerr and Coviello, 2019; Perry, Chandler and Markova, 2012). When they encounter opportunities flexibly, they can assess alternative approaches, modify processes and deploy resources differently to generate favourable value propositions (Read, Song and Smit, 2009). Innovation-driven start-ups need flexibility to make decisions in fast-changing environments (Frese, Geiger and Dost, 2020; Pöschl, 2022). Because of high pressure and uncertainty in technology sectors, entrepreneurs focus on capturing opportunities with available means rather than on rigidly planning for future events (Ghezzi, 2019; Pöschl, 2022). They can succeed in challenging environments which force them to adapt and use resources as effectively as possible (Baber, Ojala and Martinez, 2019).

2.3 Using experimentation

Entrepreneurs experiment with new product features or processes aiming to learn from mistakes and to iterate before settling on a course of action (Sarasvathy, 2001; Chandler et al, 2011; McMullen and Shepherd, 2006). Uncertainty forces them to learn by trial and error and work out feasible approaches in iterative steps (Chandler, DeTienne and Mumford, 2007). Experiments with poor results are halted in favour of other experiments (Chandler et al, 2011). Innovation-driven start-ups engage in experimentation (e.g., prototype testing) and embrace learning processes and strategies (Freel, 2000). Effectual logic equips entrepreneurs with openness to unexpected events and encourages innovative approaches in favour of experimentation (Ghezzi, 2019; Brettel et al, 2012; Chandler et al, 2011). These behaviours help entrepreneurs to succeed in dynamic technology sectors (Alzamora-Ruiz, del Mar Fuentes-Fuentes and Martinez-Fiestas, 2021). The higher the levels of investors' influence and perceived uncertainty in innovation-driven fields are, the more likely entrepreneurs are to experiment (Frese, Geiger and Dost, 2020).

2.4 Defining affordable loss

An assessment of how much loss the business can afford helps entrepreneurs to decide which experiments and projects to pursue (Hauser, Eggers and Güldenberg, 2020; Reymen et al, 2015; Chandler et al, 2011; Sarasvathy, 2001). Rather than focusing on the upside potential of an opportunity, this helps entrepreneurs to assess and manage risks and potential costs (Read, Song and Smit, 2009). Innovation-driven entrepreneurs tend to experiment regularly with affordable loss in mind, which highlights their efforts to make best possible use of limited means (Frese, Geiger and Dost, 2020; Dew et al, 2009). They focus on affordable loss to account for fast change and high uncertainty in the technology sector (Frese, Geiger and Dost, 2020; Chandler et al, 2011). This helps them to decide which opportunities and projects to pursue and invest in and consequently overcome resource constraints (Reymen et al, 2015; Shirokova et al, 2021).

3. Conclusion

Based on the extant literature, this work-in-progress paper addresses effectual behaviours and lays the foundation for a thorough literature review and empirical studies on the embeddedness in innovation-driven start-ups. The literature suggests that effectual behaviours relating to forming partnerships, exploiting contingencies, using experimentation and defining affordable loss are embedded in innovation-driven start-ups. Following the suggestion of Dias, Iizuka and Boas (2019) to explore the functionality and application of effectuation, further research will be done to contribute to the understanding of how effectual behaviours are applied and embedded in innovation-driven Swiss start-ups. Semi-structured interviews will be conducted with start-ups participating in an innovation competition in Switzerland. This may also uncover relevant leverage points for start-ups outside the technology sector and mature companies. While the aforementioned effectual behaviours have been widely discussed in the literature, interactions with start-ups may uncover other behaviours to be investigated. In terms of limitations, causation is not discussed in detail as it goes beyond the scope of this paper. However, some empirical evidence suggests that an ambidextrous approach featuring effectuation and causation is adopted by innovation-driven start-ups (Alzamora-Ruiz, del Mar Fuentes-Fuentes and Martinez-Fiestas, 2021; Frese, Geiger and Dost, 2020).

References

Alzamora-Ruiz, J., del Mar Fuentes-Fuentes, M. and Martinez-Fiestas, M. (2021) Together or separately? Direct and synergistic effects of Effectuation and Causation on innovation in technology-based SMEs. *International Entrepreneurship and Management Journal*, *17*(4), pp 1917-1943.

Andries, P., Debackere, K. and Van Looy, B. (2013) Simultaneous experimentation as a learning strategy: Business model development under uncertainty. *Strategic Entrepreneurship Journal*, 7(4), pp 288-310.

Arend, R. J., Sarooghi, H. and Burkemper, A. (2015) Effectuation as ineffectual? Applying the 3e theory assessment framework to a proposed new theory of entrepreneurship. *Academy of Management Review*, 40, pp 630-651.

Baber, W.W., Ojala, A. and Martinez, R. (2019) Effectuation logic in digital business model transformation: Insights from Japanese high-tech innovators. *Journal of Small Business and Enterprise Development*, 26(6/7), pp 811-830.

Brettel, M., Mauer, R., Engelen, A. and Küpper, D. (2012) Corporate effectuation: Entrepreneurial action and its impact on R&D project performance. *Journal of Business Venturing*, 27(2), pp 167-184.

Chandler, G. N., DeTienne, D. R. and Mumford, T. V. (2007) Causation and effectuation: measurement development and validation. *Frontiers of Entrepreneurship Research*, 27(13), pp 1-13.

Chandler, G. N., DeTienne, D., McKelvie, A. and Mumford, A. (2011) Causation and effectuation processes: A validation study. *Journal of Business Venturing*, 26(3), pp 375-390.

Dew, N., Read, S., Sarasvathy, S. D. and Wiltbank, R. (2009) Effectual versus predictive logics in entrepreneurial decision-making: differences between experts and novices. *Journal of Business* Venturing, 24(4), pp 287-309.

Dias, S. E. F., Iizuka, E. S. and Boas, E. P. V. (2019) Effectuation theoretical debate: systematic review and research agenda. *Innovation & Management Review*, 17(1), pp 41-57.

Fisher, G. (2012) Effectuation, causation, and bricolage: A behavioral comparison of emerging theories in entrepreneurship research. *Entrepreneurship Theory and Practice*, 36(5), pp 1019-1051.

Freel, M. (2000) Strategy and structure in innovative manufacturing SMEs: The case of an English region. *Small Business Economics*, 15(1), pp 27-45.

Frese, T., Geiger, I. and Dost, F. (2020) An empirical investigation of determinants of effectual and causal decision logics in online and high-tech start-up firms. *Small Business Economics*, 54(3), pp 641-664.

Ghezzi, A. (2019) Digital startups and the adoption and implementation of Lean Startup Approaches: Effectuation, Bricolage and Opportunity Creation in practice. *Technological Forecasting and Social Change*, 146, pp 945-960.

Ghorbel, F. and Boujelbène, Y. (2013) A comprehensive literature review of effectuation theory from 1999 to 2011. *International Journal of Entrepreneurial Venturing*, 5, pp 168-194.

Grégoire, D. A. and Cherchem, N. (2020) A structured literature review and suggestions for future effectuation research. *Small Business Economics*, 54(3), pp 621-639.

Grönroos, C. and Voima, P. (2013) Critical service logic: Making sense of value creation and co-creation. *Journal of the Academy of Marketing Science*, 41(2), pp 133-150.

Hauser, A., Eggers, F. and Güldenberg, S. (2020) Strategic decision-making in SMEs: effectuation, causation, and the absence of strategy. *Small Business Economics*, 54(3), pp 775-790.

Kerr, J. and Coviello, N. (2019) Formation and constitution of effectual networks: A systematic review and synthesis. *International journal of management reviews*, 21(3), pp 370-397.

Laskovaia, A., Shirokova, G. and Morris, M. H. (2017) National culture, effectuation, and new venture performance: Global evidence from student entrepreneurs. *Small Business Economics*, 49, pp 687-709.

McMullen, J. S. and Shepherd, D. A. (2006) Entrepreneurial action and the role of uncertainty in the theory of the entrepreneur. *Academy of Management Review*, 31(1), pp 132-152.

Perry, J. T., Chandler, G. N. and Markova, G. (2012) Entrepreneurial effectuation: a review and suggestions for future research. *Entrepreneurship Theory and Practice*, 36(4), pp 837-861.

Pöschl, A. (2022) Entrepreneurial decision-making logics during time-critical pivoting: empirical evidence from high-tech ventures. *International Journal of Entrepreneurial Venturing*, 14(1), pp 16-52.

Prajogo, D. and McDermott, C. (2014) Antecedents of service innovation in SMEs: Comparing the effects of external and internal factors. *Journal of Small Business Management*, 52(3), pp 521-540.

Read, S., Song, M. and Smit, W. (2009) A meta-analytic review of effectuation and venture performance. *Journal of Business Venturing*, 24(6), pp 573-587.

Reymen, I. M. M. J., Andries, P., Berends, H., Mauer, R., Stephan, U. and van Burg, E. (2015) Understanding dynamics of strategic decision making in venture creation: A process study of effectuation and causation. *Strategic Entrepreneurship Journal*, 9, pp 351-379.

Sarasvathy, S. D. (2001) Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review*, 26(2), pp 243-263.

Shirokova, G., Morris, M. H., Laskovaia, A. and Micelotta, E. (2021) Effectuation and causation, firm performance, and the impact of institutions: A multi-country moderation analysis. *Journal of Business Research*, 129, pp 169-182.

Sjödin, D. (2019) Knowledge processing and ecosystem co-creation for process innovation: Managing joint knowledge processing in process innovation projects. *International Entrepreneurship and Management Journal*, 15(1), pp 135-162.

Van Mumford, J. and Zettinig, P. (2022) Co-creation in effectuation processes: A stakeholder perspective on commitment reasoning. *Journal of Business Venturing*, 37(4), pp 106209.

Werhahn, D., Mauer, R., Flatten, T. C. and Brettel, M. (2015) Validating effectual orientation as strategic direction in the corporate context. *European Management Journal*, 33(5), pp 305-313.

Start-up Incubators for Refugees: How to Develop and Deploy Entrepreneurial Skills to Generate Impact

Andreas Hinz and Claus Daub
Institute of Management, School of Business, FHNW University of Applied Sciences and Arts Northwestern Switzerland, Windisch, Switzerland
andreas.hinz@fhnw.ch
clausheinrich.daub@fhnw.ch

Abstract: Refugee entrepreneurs play an increasingly important role in the ecosystem. However, they may find themselves unable to use their potential because they lack relevant skills, encounter language barriers, have weak local networks and deal with personal problems. Start-up incubators for refugees address these challenges by offering programmes that empower them to develop and deploy entrepreneurial skills for business creation. This work-in-progress paper presents initial insights on skill-related programme elements which will be extended into a detailed analysis of resulting types of economic impact.

Keywords: start-up incubators for refugees, entrepreneurial skills, mental support, local networks, economic impact

1. Introduction

Dedicated start-up incubator programmes seek to empower refugees to take on entrepreneurial endeavours and create social and economic impact (Harima, 2022; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021; Shneikat and Alrawadieh, 2019). For instance, they offer entrepreneurship and language training to develop skills such as business modelling, prototyping and communication (Bajaba et al., 2021; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021). Moreover, they provide coaching and mentoring to support refugees in addressing personal problems and in building local networks to gain access to resources (Chliova, Farny and Salmivaara, 2018; Harima, 2022; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021).

This work-in-progress paper is guided by the following research question: How can start-up incubators for refugees assist the development and deployment of entrepreneurial skills to generate impact?

The paper is structured as follows: First, the methodology is outlined. Second, a preliminary overview on the reviewed literature is given. Third, concluding remarks are made including directions for further research.

2. Methodology

The preliminary literature review presented here focuses on how start-up incubators can support refugees to develop and deploy their entrepreneurial skills. In a next step, the literature will be reviewed extensively to obtain a better understanding of relevant skill-related programme elements, resulting types of economic impact as well as potential cause-effect-relationships.

Based on these findings, a conceptual model will be developed that illustrates programme elements of start-up incubator programmes, types of economic impact as well as the links between the two. This conceptual model seeks to assist further empirical research on cause-effect-relationships.

3. Literature review

Start-up incubators for refugees support the development and deployment of entrepreneurial skills and create economic impact (Harima, 2022; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021; Shneikat and Alrawadieh, 2019). They address typical challenges refugees encounter when creating a business, often related to a lack of relevant skills, language barriers, weak personal networks and mental problems (Harima, 2022; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021; Dustmann et al., 2017; Chliova, Farny and Salmivaara, 2018). This work-in-progress paper focuses on three elements of start-up incubator programmes that can address these challenges: Facilitating entrepreneurial skill development, addressing mental problems and providing access to local networks.

3.1 Facilitating entrepreneurial skill development

Standardised entrepreneurship and language training equips refugees with skills such as business modelling and planning, prototyping, pitching, creative thinking, communication and cultural awareness (Bajaba et al., 2021; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021). Qualifications and skills of refugees may not be recognised in host countries or be regarded inferior which often leaves their potential unused (Bucken-Knapp, Fakih and Spehar, 2019; Spadarotto et al., 2014; Degler, Liebig and Senner, 2017). This represents a major disadvantage in building relationships with investors, potential customers and business partners. In addition, refugee entrepreneurs often face challenges with finances as well as legislative and administrative processes (Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021). Moreover, they tend to have insufficient knowledge of market mechanics, important institutions and other key stakeholders providing support for business creation (Meister and Mauer, 2018; Kloosterman, 2010; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021). Further, refugees often face significant disadvantages in accessing the market due to language barriers (Bucken-Knapp, Fakih and Spehar, 2019; Degler, Liebig and Senner, 2017). Without appropriate language skills, refugees cannot effectively negotiate with customers and investors (Nijhoff, 2021). Interactions with stakeholders can become even more challenging when inadequate knowledge of cultural norms becomes apparent (Meister and Mauer, 2018; Nijhoff, 2021).

Start-up incubators for refugees can address these challenges by providing relevant entrepreneurial training and sharing knowledge of the local ecosystem (Meister and Mauer, 2018). The benefit of entrepreneurial skills is particularly large for refugees. They get the alternative to pursue an entrepreneurial career instead of depending on the labour market where they are disadvantaged versus locals (Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021; Shneikat and Alrawadieh, 2019). Chliova, Farny and Salmivaara (2018) recommend that start-up incubators also offer fast-track programmes for refugees with previous entrepreneurial experience and skills. In addition, start-up incubators are positioned well for intensive language training in the entrepreneurial context where refugees can immediately apply it to interact with stakeholders (Chliova, Farny and Salmivaara, 2018; Kloosterman, 2010).

3.2 Addressing mental problems

Individualised support on mental problems encountered by refugees is important because they can undermine their ability to expand and use their skills and build their local network (Chliova, Farny and Salmivaara, 2018; Harima, 2022; Harima, Freudenberg and Halberstadt, 2019; Nijhoff, 2021). These support forms have a mediating role in that they increase the chances that refugees not only acquire skills but also become empowered and self-confident enough to “go out there” and deploy these skills. Refugees may encounter mental problems like anxiety and depression that affect the confidence needed to start a business (Chliova, Farny and Salmivaara, 2018; Lyon, Sepulveda and Syrett, 2007; Needham and Quintiliani, 2007; Wauters and Lambrecht, 2006; Nijhoff, 2021). Refugees often have had traumatic experiences in their home-countries and during their escape which leaves mental strains. These can affect their ability to trust, believe in themselves and their skills and interact freely with others (Degler, Liebig and Senner, 2017; Dustmann et al., 2017; Nijhoff, 2021; Karlsdóttir et al., 2017). These strains may also damage their ability to acquire and apply skills and make new contacts as far as networking and business development are concerned. Refugees may also experience prejudice and discrimination which can undermine mental well-being and confidence even more (Chliova, Farny and Salmivaara, 2018; Najib, 2014). Overall, these mental problems represent a major barrier for refugees to use their skills, make new contacts and become integrated in the ecosystem (Chliova, Farny and Salmivaara, 2018; Scholten et al., 2017).

To help refugees overcome mental problems, start-up incubators should offer programmes that go beyond skill development and focus on the mental stability necessary for skill deployment (Harima, Freudenberg and Halberstadt, 2019). This requires personalised approaches by coaches and mentors that account for individual needs, characteristics and mental conditions as well as previous education and business experience (Chliova, Farny and Salmivaara, 2018; Degler, Liebig and Senner, 2017). In these personal interactions, coaches and mentors can create an encouraging and positive atmosphere and build trust (Meister and Mauer, 2018). According to Harima, Freudenberg and Halberstadt (2019), coaches and mentors should help refugees address anxieties related to interactions with institutions and individuals that are essential for business creation. Moreover, they should provide continuous motivation and encouragement to persevere and give general guidance and soft support in personal life with mental well-being in focus.

3.3 Providing access to local networks

While networking can be considered an entrepreneurial skill, it is also a mediating factor for entrepreneurial skill deployment in business creation because it provides access to knowledge, funding and other resources (Meister and Mauer, 2018). Because refugees tend to have small local networks with limited access to potential investors, customers and other partners, their skills stay partially hidden instead of being applied for business creation (Harima, 2022; Lyon, Sepulveda and Syrett, 2007). Being unable to access these stakeholders for funding, marketing and business development as well as general advice on market-related and administrative issues is a major obstacle (Meister and Mauer; 2018; Harima, 2022; Alrawadieh, Eyup and Gurel, 2019; Shneikat and Alrawadieh, 2019; Rashid, 2018; Easton-Calabria and Omata, 2016; Alrawadieh, Eyup and Gurel, 2019). In addition, refugees tend to have homogeneous networks, mainly with compatriots who are poorly integrated themselves, which accentuates their disadvantages in the local ecosystem (Ruedin et al., 2020; Söhn et al., 2017).

To address these challenges, start-up incubators provide guidance and facilitate access to the local ecosystem (Meister and Mauer, 2018; Harima, Freudenberg and Halberstadt, 2019). This includes individual support by culturally affine mentors and coaches who understand specific barriers to business creation and can connect refugees with appropriate institutions and experts (Nijhoff, 2021; Meister and Mauer, 2018). While contacts can provide support and access to resources to assist venture creation, the process of building a local network can have larger implications (Harima, Freudenberg and Halberstadt, 2019). As refugees make more relevant connections to other stakeholders and entrepreneurs, they become better integrated in the start-up community and can actively collaborate and contribute to the creation of new business opportunities (Meister and Mauer, 2018).

4. Conclusion

This work-in-progress paper addresses exemplary programme elements of start-up incubator programmes that help refugees build and apply entrepreneurial skills to overcome challenges in venture creation. This represents the basis for further research.

In a next step, the literature will be reviewed extensively to better understand incubator programme elements as well as their relevance and to gain insights into the potential impact they create for refugees and the ecosystem. For instance, it can be assumed that incubator programmes increase the likelihood that refugees build and deploy their skills faster, which accelerates start-up creation. If refugees are successful, they start paying tax and social security contributions themselves and if they create jobs, the effect is multiplied. Moreover, if incubators succeed in building more relevant skills, refugees will likely have steeper learning curves, which increases their chances of success further. In consequence, they may become role models for compatriots in their network and encourage them to follow suit.

Deeper insights into these and other cause-effect-relationships will inform the development of a holistic conceptual model which in turn aims to guide subsequent empirical research.

References

Alrawadieh, Z., Eyup, K. and Gurel, C. (2019). Understanding the Challenges of Refugee Entrepreneurship in Tourism and Hospitality. *The Service Industries Journal*, 39(9-10), 717-740.

Bajaba, A., Le, S., Bajaba, S. and Hoang, B. (2021). Immigrant founder chief executive officers, firm innovation, and performance: The role of cultural distance and top management team and board social capital. *The International Journal of Entrepreneurship and Innovation*, 23(1), 17-27.

Bucken-Knapp, G., Fakih, Z. and Spehar, A. (2019). Talking about integration: The voices of Syrian refugees taking part in introduction programmes for integration into Swedish society. *International Migration*, *57*(2), 221-234.

Chliova, M., Farny, S. and Salmivaara, V. (2018). Supporting refugees in entrepreneurship. prepared for the OECD Centre for Entrepreneurship, SMEs, Regions and Cities.

Degler, E., Liebig, T. and Senner, A.S. (2017). Integrating Refugees into the Labour Market-Where Does Germany Stand?. *ifo DICE Report*, *15*(3), 6-10.

Dustmann, C., Fasani, F., Frattini, T., Minale, L. and Schönberg, U. (2017). On the economics and politics of refugee migration. *Economic policy*, *32*(91), 497-550.

Easton-Calabria, E.E. and Omata, N. (2016). Micro-Finance in Refugee Contexts: Current Scholarship and Research Gaps. Refugee Studies Centre - Working Paper Series.

Harima, A. and Freudenberg, J. (2020). Co-creation of social entrepreneurial opportunities with refugees. *Journal of Social Entrepreneurship*, *11*(1), 40-64.

Harima, A., Freudenberg, J. and Halberstadt, J. (2019). Functional domains of business incubators for refugee entrepreneurs. *Journal of Enterprising Communities: People and Places in the Global Economy*, 14(5), 687-711.

Karlsdóttir, A., Sigurjónsdóttir, H.R., Ström Hildestrand, Å. and Cuadrado, A. (2017). Policies and measures for speeding up labour market integration of refugees in the Nordic region: A knowledge overview.

Kloosterman, R.C. (2010). Matching opportunities with resources: a framework for analysing (migrant)entrepreneurship from a mixed embeddedness perspective. *Entrepreneurship and Regional Development*, 22(1), 25-45.

Lyon, F., Sepulveda, L. and Syrett, S. (2007). Enterprising refugees: contributions and challenges in deprived urban areas. *Local Economy*, 22(4), 362-375.

Meister, A.D. and Mauer, R. (2018). Understanding refugee entrepreneurship incubation–an embeddedness perspective. *International Journal of Entrepreneurial Behavior & Research*, 25(5), 1065-1092.

Najib, H. (2014). Accounting for the business start-up experiences of Afghan refugees in Christchurch, New Zealand. Master's Thesis, University of Canterbury.

Needham, S. and Quintiliani, K. (2007). Cambodians in Long Beach, California: The making of a community. *Journal of Immigrant & Refugee Studies*, 5(1), 29-53.

Nijhoff, K. (2021). Refugees starting a business: experiences of barriers and needs in the Netherlands. *Journal of Small Business and Enterprise Development*, 28(7), 1057-1074.

Rashid, L. (2018). 'Call Me a Business Owner, Not a Refugee!' Challenges of and Perspectives on Newcomer Entrepreneurship. 7. World Refugee Council Research Paper.

Ruedin, D., Efionayi-Mäder, D., Üllen, S., Bilger, V. and Hofmann, M. (2020). Wirkungszusammenhänge Migration, Integration und Rückkehr: eine Literaturanalyse im Auftrag des SEM in Erfüllung des Postulats 16.3790 «Migration. Langfristige Folgen der Integration». Université de Neuchâtel.

Scholten, P., Baggerman, F., Dellouche, L., Kampen, V., Wolff, J. and Ypma, R. (2017). Policy innovation in refugee integration? A comparative analysis of innovative policy strategies toward refugee integration in Europe, Erasmus University Rotterdam.

Shneikat, B. and Alrawadieh, Z. (2019). Unraveling Refugee Entrepreneurship and Its Role in Integration: Empirical Evidence from the Hospitality Industry. *The Service Industries Journal*, 39(9-10), 741-761.

Söhn, J., Birke, P., Bluhm, F., Marquardsen, K., Prekodravac, M., Vogel, B. and Prahms, A. (2017). Erfolgsfaktoren für die Integration von Flüchtlingen.

Spadarotto, C., Bieberschulte, M., Walker, K., Morlok, M. and Oswald, A. (2014). Erwerbsbeteiligung von anerkannten Flüchtlingen und vorläufig Aufgenommenen auf dem Schweizer Arbeitsmarkt. KEK-CDC Consultants and B, S, S. on behalf of the Federal Office of Migration.

Wauters, B. and Lambrecht, J. (2006). Refugee entrepreneurship in Belgium: Potential and practice. *The International Entrepreneurship and Management Journal*, 2(4), 509-525.

Linking Effectuation Logic With Business Model Innovation in the Context of Swiss Start-Ups

Laila Kabous, Andreas Hinz and Stefan Philippi
Institute of Management, School of Business, University of Applied Sciences and Arts Northwestern Switzerland, Windisch, Switzerland
Laila.kabous@fhnw.ch
Andreas.hinz@fhnw.ch
Stefan.philippi@fhnw.ch

Abstract: Effectuation and business model innovation (BMI) are research topics that are frequently discussed in the literature. While effectuation describes the effectual behaviour for founding a start-up with an emphasis on using currently available means, BMI is considered a way of creating a business model with long-term competitive advantages. Both approaches are valuable for start-ups pursuing growth in an uncertain environment. This work-in-progress paper presents insights from the reviewed extant literature. Further research will investigate effectuation and its enabling impact in designing innovative business models in the context of Swiss start-ups.

Keywords: effectuation, business model innovation, relationships between entrepreneurial approaches, start-up behaviour

1. Introduction

In recent decades, effectuation and BMI have been frequently discussed research topics in the literature. While effectuation logic describes the effectual behaviour for founding a start-up with an emphasis on using currently available means, BMI is considered as a way of creating a business model with long-term competitive advantages. Consensus exists in the theory and practice with respect to the different dimensions of effectual behaviours (e.g., partnerships and alliances, experimentation) and dimensions of BMI (e.g., value proposition, value chain). Effectuation may lead to BMI and helps start-ups navigate uncertain environments by creating business models with long-term competitive advantages. The main goal of this research-in-progress is to examine the extent to which effectuation logic is an enabling aspect of BMI and to investigate the causal relationship between these two entrepreneurial approaches. Further research will investigate effectuation and its enabling impact in designing innovative business models in the context of Swiss start-ups.

This paper is structured as follows: first, the methodology is outlined for this research going forward. Second, the reviewed literature is presented which is to be extended further. Third, the conclusion identifies avenues for further research.

2. Methodology

This work-in-progress paper will first lay the foundation by reviewing the literature on effectuation and BMI. A thorough literature review will be conducted next with special emphasis on the impact of effectuation in designing innovative business models. The research will then examine a sample of 24 innovative Swiss start-ups for their application of effectuation logic. The sample will be reviewed for evidence of BMI and causal relationships between the two approaches.

3. Literature review

In this section, we introduce the ideas of our background theory, effectuation logic and BMI.

Effectuation logic

Literature on entrepreneurial behaviour presents effectuation and causation (Sarvasvathy, 2001, 2009) as opposing logics that entrepreneurs follow to make decisions as they react to changes in the business environment. Effectuation can be understood as a form of logic reasoning which can be applied by entrepreneurs in uncertain environments and describes the effective procedure for founding a start-up with special emphasis on using currently available means. Sarasvathy (2001) defines effectuation as “processes that take a set of means as given and focus on selecting between possible effects that can be created with that set of means”. In contrast, the causation logic is defined as “processes that take a particular effect as given and focus on selecting between means to create that effect” (Sarasvathy, 2001: 245). The effectuation logic assumes

that entrepreneurs themselves create and/or co-create business opportunities, recognise and exploit them (Dew et al, 2008; Read, Song and Smit, 2009; Sarasvathy and Venkataraman, 2011). Five principles and a dynamic cycle define the effectuation logic:

Means: Entrepreneurs start with the available means, which can be grouped in three categories: "who I am" (personality), "what I know" (expertise) and "whom I know" (social network). Relevant means include competencies, assets, technological capabilities, internal R&D investments, capital and intellectual property (Read, Song and Smit, 2009).

Affordable loss: Entrepreneurs focus on the downside risk. They define what they can afford to lose at each step focusing on cost control rather than expected incomes. This basically relates to experimentation in that it represents a criterion upon which entrepreneurs make decisions (Chandler et al, 2011; Chandler, DeTienne and Mumford, 2007; Sarasvathy, 2001). Pivoting rapidly and early in the process helps entrepreneurs to control costs and therefore manage downside risks (Read, Song and Smit, 2009).

Partnerships and alliances: Entrepreneurs build partnerships and alliances with self-selecting stakeholders (e.g. customers, suppliers, other companies from the entrepreneur's network) enabling them to minimize uncertainty and co-create complementary assets (Chandler et al, 2011; Chandler, DeTienne and Mumford, 2007) – thus accessing means and going beyond competitive thinking (Perry, Chandler and Markova, 2012; Read, Song and Smit, 2009). Through the involvement of stakeholders, entrepreneurs can, to a certain degree, exercise control over the future, making the need to predict it less relevant (Chandler et al, 2011; Sarasvathy, 2001).

Leverage contingencies: Entrepreneurs exploit prior knowledge and contingencies instead of developing "what-if" scenarios and how to deal with the worst-case scenario. Because no specific goal is set, the result of this process might be completely different from the original idea that led to the formation of the venture in the first instance (Read, Song and Smit, 2009).

experimentation: Entrepreneurs experiment with different approaches prior to defining the business concept (Sarasvathy, 2001; Chandler, DeTienne and Mumford, 2007). As no historical data exists to make informed decisions, entrepreneurs instead experiment with a series of trial-and-error changes pivoting between different approaches. Experiments with mediocre outcomes are halted, enabling the entrepreneurs to focus on the next experiment without wasting resources and time (Chandler et al, 2011).

Business Model Innovation

Before discussing BMI, it is important to introduce what should be innovated. The business model has attracted significant attention from both practitioners and academics and provided a platform for multiple research streams. A business model can be described as the logic of how a company operates and creates value for its stakeholders (Casadesus-Masanell and Ricart, 2010; Amit and Zott, 2012; Zott, Amit and Massa, 2011). Creating value can be achieved through four dimensions, including value proposition, customer, value chain, and revenue mechanism (Csik, 2014; Gassmann et al., 2020). To create and sustain competitive advantages, the role of BMI has been widely discussed in the literature, especially in the context of uncertain environments. According to Foss and Saebi (2017), BMI represents "designed, novel, nontrivial changes to the key elements of a firm's business model and/or architecture linking these elements". Consequently, BMI occurs if an innovative characteristic can be attributed to one or more of the dimensions of a business model (Spieth and Schneider, 2016; Csik, 2014). BMI might be more challenging than product or process innovation, but could result in higher returns (Chesbrough, 2007; Lindgardt et al, 2009; Chesbrough, 2010). This, in turn, can provide start-ups with a way to break through where competition is intense.

4. Effectuation and its enabling potential in designing innovative business models

The objective of this research is to elaborate on effectuation logic and its enabling potential on BMI or its impact on the design of innovative business models. An in-depth analysis of the potential link between these two entrepreneurial approaches in the context of Swiss start-ups will be undertaken.

The framework (Figure 1) will serve as basis to investigate the abovementioned objective and potential link between the two entrepreneurial approaches in the context of Swiss start-ups.

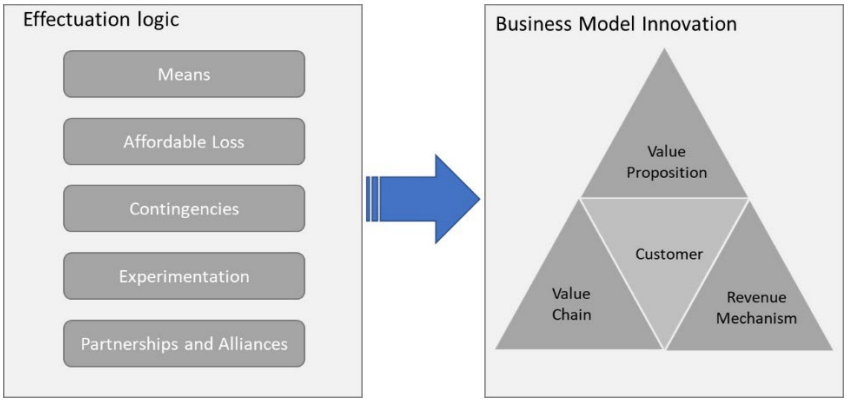


Figure 1: Framework linking effectuation logic and business model innovation (authors' own representation – right-hand diagram adapted from Csik, 2014)

Designing innovative business models requires innovation on at least two dimensions on which a business model is built. First, innovating the dimension of value proposition aims to meet currently unsatisfied needs of clearly defined customers/customer groups by offering products and services that meet those needs. Second, innovating the value chain consists of creating new value through the company's partner network, its available resources as well as its supplier and distribution network. And third, innovating the revenue mechanism refers to the way a company generates value and creates new ways of capturing value through new revenue and profit-generating streams (Spieth and Schneider, 2016). Futter, Schmidt and Heidenreich (2018) differentiate between internal and external dimensions in creating value. Internal value creation comprises activities performed within the organization, while external value creation encompasses activities in collaboration with external partners, enabling entrepreneurs to overcome resource scarcity, reduce uncertainty and pursue further opportunities. Consequently, value creation (in particular the external value) can be affected by applied entrepreneurial behavioural logic (e.g. effectuation). Previous academic research put strong emphasis on the "causation-effectuation-BMI" interface and focused on the effects of both logics on BMI (Futter, Schmidt and Heidenreich, 2018; Reymen et al, 2017; Sitoh, Pan and Yu, 2014; Andries, Debackere and Van Looy, 2013). These studies agree that both effectuation and causation impact BMI positively.

5. Conclusion and future research

Building on previous research and the framework outlined above (Figure 1), we will examine a sample of 24 innovative Swiss start-ups. First, the chosen sample will be analysed on its application of effectuation logic based on a set of pre-defined criteria for the abovementioned effectuation dimensions. Second, the sample will be reviewed for evidence of BMI based on the abovementioned four business model dimensions and their innovative potential. Third, causal relationships between the two approaches will be examined to gain insights into the potential influence of effectuation logic on the development of innovative business models. The outcome of this research will help increase our understanding of the often-abstract principles of effectuation logic and its impact on BMI. Consequently, we expect that the research outcome will help start-ups bridge the design-implementation gap of the innovative business model by applying effectuation logic.

References

Amit, R. and Zott, C. (2012) "Creating Value through Business Model Innovation", *MIT Sloan Management Review*, Spring, Vol 53, No. 3, pp 41–49.

Andries, P., Debackere, K. and Van Looy, B. (2013) "Simultaneous experimentation as a learning strategy: Business model development under uncertainty", *Strategic Entrepreneurship Journal*, Vol 7, pp 288–310.

Casadesus-Masanell, R. and Ricart, J.E. (2010) "From strategy to business models and onto tactics", *Long Range Planning,* Vol 43, No. 2-3, pp 195–215.

Chandler, G.N., DeTienne, D.R., McKelvie, A. and Mumford, T.V. (2011) "Causation and effectuation processes: A validation study", *Journal of Business Venturing*, Vol 26, No. 3, pp 375-390.

Chandler, G.N, DeTienne, D.R. and Mumford, T. V. (2007) "Causation and effectuation: measurement development and validation", *Frontiers of Entrepreneurship Research*, Vol 27, No. 13, Article 3.

Chesbrough, H. (2007) "Business model innovation: it's not just about technology anymore", *Strategy and Leadership*, Vol 35, No. 6, pp 12-17.

Chesbrough, H. (2010) "Business model innovation: opportunities and barriers" *Long Range Planning*, Vol 43, pp 354-363.

Csik, M. (2014) Muster und das Generieren von Ideen für Geschäftsmodellinnovationen. Difo-Druck, Bamberg.

Dew, N., Read, S., Sarasvathy, S. D. and Wiltbank, R. (2008) "Outlines of a behavioral theory of the entrepreneurial firm", *Journal of Economic Behavior & Organization*, Vol 66, pp 37–59.

Foss, N.J. and Saebi, T. (2017) "Fifteen years of research on business model innovation: How far have we come, and where should we go?", *Journal of Management,* Vol 43, No. 1, pp 200–227.

Freisinger, E., Heidenreich, S., Landau, C. and Spieth, P. (2021) "Business Model Innovation Through the Lens of Time: An Empirical Study of Performance Implications Across Venture Life Cycles." *Schmalenbach journal of business research*, Vol 73, pp 339-380.

Futterer, F., Schmidt, J. and Heidenreich, S. (2018) "Effectuation or causation as the key to corporate venture success? Investigating effects of entrepreneurial behaviors on business model innovation and venture performance", *Long Range Planning,* Vol 51, No. 1, pp 64–81.

Gassmann, O., Frankenberger K. Csik, M. and Choudury, M. (2020) The business model navigator: 55 models that will revolutionise your business. Pearson, London.

Lindgardt, Z., Reeves, M., Stalk, G. and Deimler, M.S. (2009) Business Model Innovation. When the Game Gets Tough, Change the Game. The Boston Consulting Group, Boston.

Read, S., Song, M. and Smit, W. (2009) "A meta-analytic review of effectuation and venture performance", *Journal of Business Venturing*, Vol 24, No. 6, pp 573–587.

Perry, J.T., Chandler, G.N. and Markova, G. (2012) "Entrepreneurial Effectuation: A Review and Suggestions for Future Research" *Entrepreneurship Theory and Practice*, Vol 36, No. 4, pp 837-861.

Reymen, I., Berends, H., Oudehand, R. and Stultiëns, R. (2017) "Decision making for business model development: a process study of effectuation and causation in new technology-based ventures", *R&D Management,* Vol 47, No. 4, pp 595–606.

Sarasvathy, SD. (2001) "Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency", *Academic Management Review*, Vol 26, No. 2, pp 243–263.

Sarasvathy, SD. (2009) Effectuation: Elements of Entrepreneurial Expertise, New Horizons in Entrepreneurship, Edward Elgar publishing, Cheltenham.

Sarasvathy, S. D. and Venkataraman, S. (2011) "Entrepreneurship as Method: Open Questions for an Entrepreneurial Future", *Entrepreneurship Theory and Practice*, Vol 35, No. 1, pp 113–135.

Sitoh, M.K., Pan, S.L. and Yu, C.Y. (2014) "Business models and tactics in new product creation: The interplay of effectuation and causation processes", *IEEE Transactions on Engineering Management,* Vol 61, No. 2, pp 213–224.

Spieth, P., Schneckenberg, D. and Ricart, J.E. (2014) "Business model innovation – state of the art and future challenges for the field" *R&D Management*, Vol 44, No. 3, pp 237-247

Spieth, P. and Schneider, S. (2016) "Business model innovativeness: designing a formative measure for business model innovation", *Journal of Business Economics*, Vol 86, pp 671–696.

Zott, R., Amit, L. and Massa, L. (2011) "The business model: recent developments and future research", *Journal of Management*, Vol 37, pp 1019-1042.

Impact of Collaborative Problem Solving on Youth Social Entrepreneurial Intention

Ronan McArt[1], Veronica McCauley[2] and Paul Flynn[2]
[1]St. Angela's College Sligo, Ireland
[2]National University of Ireland Galway, Ireland
rmcart@stangelas.nuigalway.ie

Abstract: Social Entrepreneurship has been recognised as a means of improving the welfare and quality of life for marginalised and neglected communities around the world. Social entrepreneurs apply entrepreneurial approaches to identify problems; create solutions and marshal the necessary resources to form social ventures. To meet an increased demand for socially driven entrepreneurs we need to increase the supply of citizens armed with the competencies and desires to address future social issues. Society's capacity to solve both social and economic problems can be augmented through the implementation of carefully designed, multidisciplinary educational programmes in second level education. This paper presents the findings of the theoretically informed Design Thinking process, that sought to explore how adolescent learners develop shared meaning through collaborative, social interactions centered around solving localised societal challenges. This pedagogical approach, informed by a social constructionist paradigm, required students to collaborate in teams for the creation of an artefact that addressed the sustainable transport needs of their community. The study employed a mixed methods data collection strategy that included both the student and the teacher voice. Data sources included interviews, questionnaires, lesson evaluations and classroom resources. Results from the Social Entrepreneurship Pilot Programme conducted with a teacher and 20 students in small rural post-primary school revealed that social learning is an effective approach to increasing Social Entrepreneurial Intention, 47% of students would consider starting a social venture with their group. Collaborative approaches to problem solving proved an effective means of enhancing student efficacy, empathy, and engagement. 82% of students reported confidence in solving social problems in groups but students reported a decline Social Entrepreneurial Self-Efficacy – indicating collaborative learning works better to increase Perceived Collective-Efficacy. It is anticipated that the research will be of interest to those involved in the delivery of Social Entrepreneurship education and applied research within this field.

Keywords : education, entrepreneurship education, entrepreneurial intention, social entrepreneurship, social constructionism

1. Introduction

Entrepreneurship education is one of the fastest growing curriculum areas globally (Ratten and Usmanij, 2021). Interest in social entrepreneurship has increased in line with heightened emphasis on sustainability, turning Entrepreneurship Education (EE) towards sustainable and social entrepreneurship (Zafar et al., 2022; Mir Shahid and Alarifi, 2021). Social entrepreneurs are motivated by social mission and the creation of social value rather than economic value (Dees, 2001) addressing problems concerning the most vulnerable in society. Social entrepreneurs are change agents, utilising innovation to create social equilibrium (Phillips et al., 2015), and generating income to develop and maintain viable enterprises (Alvarez de Mon et al., 2021). Social entrepreneurship has enormous social and economic potential, Forfas (2013) reported that social entrepreneurship could create 100, 000 jobs in Ireland if EU targets of 9% GDP "Europe 2020" were reached.

Social entrepreneurship is a socially embedded activity and social entrepreneurship education should be directed towards increased community engagement where the entrepreneur(s) will likely have greater understanding of the problem they aim to solve (UN, 2020; Mir Shahid and Alarifi, 2021). As youth (15-24YO) are more positive in outlook, more open to risk than adults with increased capacity to think abstractly and empathise, early introduction to social entrepreneurship has the potential to engage young citizens in targeted social and sustainable goals (Bublitz et al., 2021; UN, 2020;). Collaborative activities offer a unique set of benefits to youth social entrepreneurs; peer-to-peer learning, moral support, exchange of ideas and affirmation (UN, 2020). Effective collaboration enhances Entrepreneurial Self-Efficacy (ESE) (domain specific form of self-belief), an antecedent of Social Entrepreneurial Intention (SEI). Intentionality is an oft measured concept, as it is a robust predictor of future behaviours (Azjen, 1991), in the context of this study, to behave entrepreneurially in the future. Social problems are multifaceted and may be daunting for the individual learner, therefore an educational intervention seeking to address social issues and enhance SEI requires an appropriate educational approach. Collaborative learning as a process is most effective in complex contexts (Zambrano et al., 2019; Reynolds, 2016). Youth social entrepreneurship academic research is novel (Kruse, 2019), extant literature on social entrepreneurship education is unstructured, and lacks clear frameworks (Mir Shahid and Alarifi, 2021).

Providing secondary school teachers and students with realistic, flexible curricula and pedagogical tools offers the potential to inspire social change and reach economic targets (British Council, 2017; Waghid, 2019). This paper investigates the impact of a designed, structured framework of Social Entrepreneurial learning on student's perceptions of SEI.

2. Social Entrepreneurship Programme (SEP) pilot design

The SEP pilot was conducted in a vocational school in rural Ireland. The designed programme was delivered over 6 lessons in 3 weeks in September 2021 to twenty Transition Year students (aged 15-16, 9M:11F). Transition Year is an optional year between examinable cycles that present students with an opportunity to develop vocational skills. The students had no prior exposure to social entrepreneurship. The self-selected groups were either all males or all females. At the start of the programme students were given the challenge to make their school/community more sustainable by reducing car journeys to their school as their region had the highest national figures. The 6-lessons were developed within a Design Thinking Framework to help the students' groups solve the problem selected. Design Thinking was deemed an appropriate framework as it is suitable for use by young, inexperienced designers such as secondary school students and naturally facilitates collaborative problem-solving (Aflatoony et al., 2018). This pilot study is the first cycle of a systematic, iterative, and collaborative testing of a social entrepreneurship intervention, assuming the first step in a Design-Based Research (DBR) project.

Table 1: SEP pilot lesson structure

Lesson Number	Lesson Title
	Introduction and Collaboration
	Empathy
	Problem Definition
	Ideation
	Prototyping, Design and Evaluation
	The Pitch (Presentation)

3. Procedure

A mixed methods research procedure was applied in this study. The pre- and post- intervention online surveys constituted the quantitative research element and were predominantly made up of Likert Scale items from previously validated studies. Social Entrepreneurial Intention, Social Entrepreneurial Self-Efficacy (SESE) and Social Innovativeness were assessed using scales from Liñán and Chen, (2006), Zhao et al. (2005) and do Paco et al. (2011) respectively, and an adapted teamwork scale for collaboration from Lower et al. (2017). Qualitative research was designed to capture data that quantitative research could not, to illuminate how, where and when students collaborated to solve user problems. Qualitative data was generated through two teacher interviews, an open-ended student questionnaire, lesson evaluations from students and teacher, and analysis of returned classroom activity sheets.

4. Results

Table 2 highlights the summated mean scores of scale items in the pre- and post- intervention online questionnaire. Mean Collaboration increased after the programme (0.193, Table 2). The mean scales evidenced small increases in SE innovativeness (0.1342) and SE Intention (0.0439), and a decrease in SE Self-Efficacy (-0.1158).

Table 2: Summated mean data

	Mean		
Construct	**Pre-Int**	**Post-Int**	**Mean Diff**
SE Innovativeness	**4.4026**	**4.5368**	**0.1342**
SE Self-Efficacy	**5.0877**	**4.9719**	**-0.1158**
SE Intention	**4.2982**	**4.3421**	**0.0439**
Collaboration	**3.8583**	**4.0513**	**0.193**

The open-ended qualitative exit survey revealed 65% of students reported having increased interest in Social Entrepreneurship post intervention. 80% of students reported increased positive views of the environment and their local community. 82% of students indicated confidence in their group's ability to solve future social problems, 37% of students reported that they would consider starting a solo venture and 47%, that they would start a social venture with their group after the intervention. The cooperating teacher revealed *"I definitely think there would…more likely...be an increased interest in it (Social Entrepreneurial careers)*" post intervention.

Students worked collaboratively, applying Design Thinking principals to solve their community problem. 70% of students reported changed views on their community and 76% of students reported becoming more aware of their teammates opinions and feelings because of taking part in the programme. There was no evidence of social loafing. The images below (each student had a unique identifying colour to track individual engagement) and evidence from the cooperating teacher indicated that students experienced increased engagement and collaboration with the more complex and creative challenges. Figures 1, 2 and 3 demonstrate the individuals' efforts to engage and collaborate to solve problems and provides illustrations of the groups collaborative output.

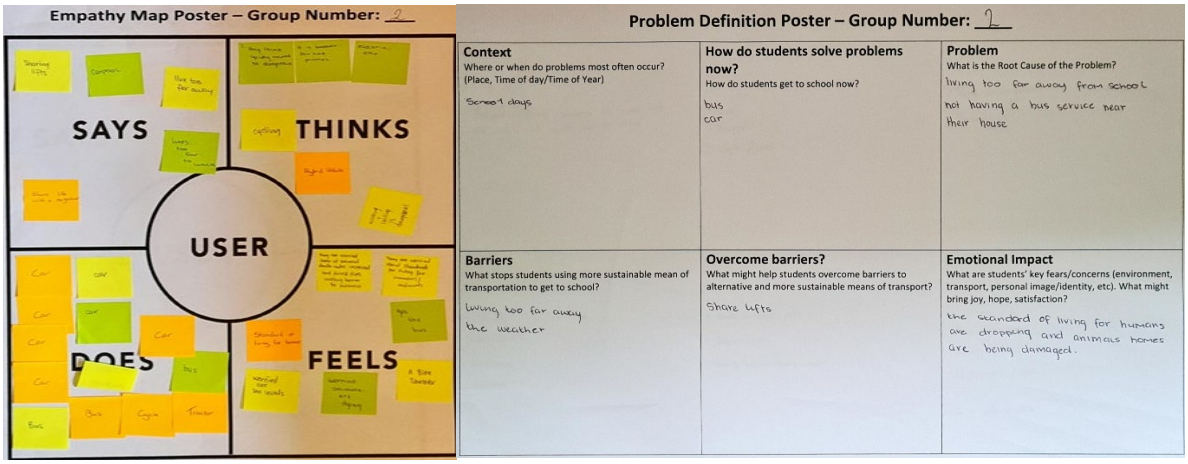


Figure 1: Empathy map and problem definition poster

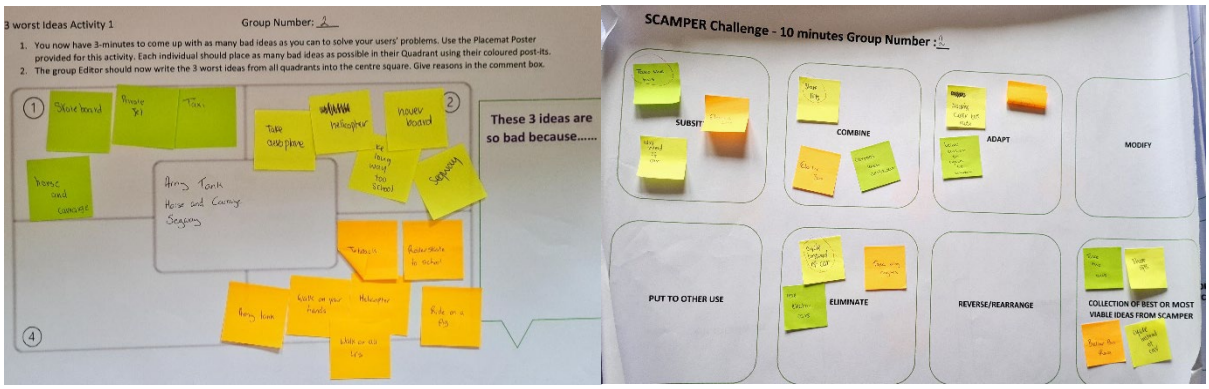


Figure 2: Three worst ideas and SCAMPER challenge

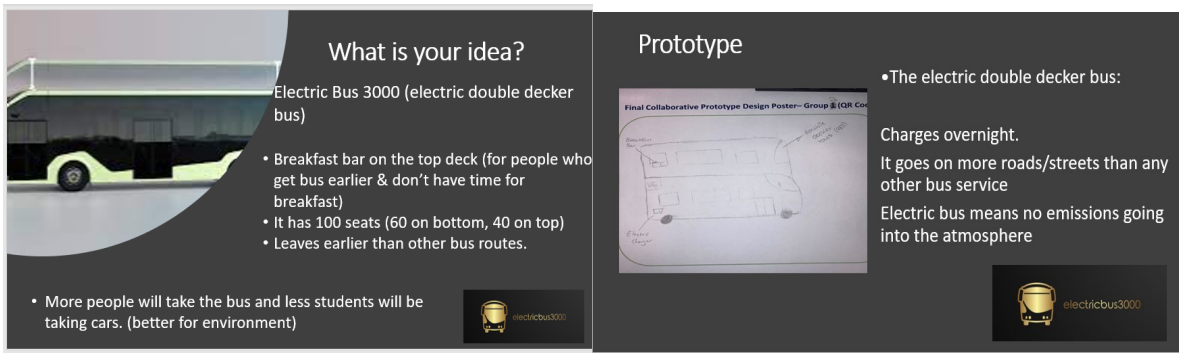


Figure 3: Design prototype

5. Discussion

This designed Collaborative Problem Solving (CPS) programme demonstrates potential to increase students ' perceptions of their groups ability to innovate and solve social entrepreneurial problems. Students rated their collaboration higher post-intervention in the mean scale (0.193 mean increase, Table 2). The small increase may not be surprising in this instance as the cooperating teacher noted a personal preference for group work with students, therefore students may have been quite used to collaborative exercises and perceived smaller personal change. SESE is a measure of an individual's confidence in their ability to perform social entrepreneurial tasks. SESE declined in the pilot. Therefore, CPS works well to increase the group's perception of their capabilities but not the individual's perception of their capabilities. SEI increased for the individual and the group, however, the ability to solve complex entrepreneurial problems collaboratively leads to higher group SEI than individual SEI. When challenges are not interesting or complex – group and individual engagement waned slightly. Complex, novel challenges are required for persistent engagement and collaboration.

6. Next steps

The pilot was conducted in one school. The next phase of research will require testing in more schools and a larger sample to enable further quantitative analysis. Groups will be selected by the teacher to examine how collaboration works when students may not be close friends. An examination of mixed gender groups would also provide interesting insights.

References

Aflatoony, L., Wakkary, R., & Neustaedter, C. (2018) "Becoming a Design Thinker: Assessing the Learning Process of Students in a Secondary Level Design Thinking Course". *International Journal of Art and Design Education*, 37(3), 438–453. https://doi.org/10.1111/jade.12139

Alvarez de Mon, I., Merladet, J. and Núñez-Canal, M. (2021) "Social Entrepreneurs as Role Models for Innovative Professional Career Developments", Sustainability, 13, 13044. https://doi.org/10.3390/su132313044

Ajzen, I. (1991). "The Theory of Planned Behaviour", Organizational Behaviour and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

British Council (2017) "Social Entrepreneurship in Education: Empowering the Next Generation to Meet Society's Needs". Available at: https://www.britishcouncil.org/sites/default/files/british_council_social_entrepreneurship_in_education_web_final.pdf (Accessed January 2022).

Bublitz, M. G., Chaplin, L. N., Peracchio, L. A., Cermin, A. D., Dida, M., Escalas, J. E., Eilert, M., Gloukhovtsev, A., and Miller, E. G. (2021) "Rise Up: Understanding Youth Social Entrepreneurs and Their Ecosystems", *American Marketing Association*, *40*(2), 206–225. https://doi.org/10.1177/0743915620937702

Dees, J. G. (2001), "The Meaning of Social Entrepreneurship," Available at: https://centers.fuqua.duke.edu/case/wp-content/uploads/sites/7/2015/03/Article_Dees_MeaningofSocialEntrepreneurship_2001.pdf (Accessed 22/02/2022)

do Paço, A. M. F., Ferreira, J. M., Raposo, M., Rodrigues, R. G., & Dinis, A. (2011) "Behaviours and entrepreneurial intention: Empirical findings about secondary students". *Journal of International Entrepreneurship*, 9(1), 20–38. https://doi.org/10.1007/s10843-010-0071-9

Forfas (2013) "Social Enterprise in Ireland: Sectoral Opportunities and Policy Issues". Available at: https://www.gov.ie/en/publication/3dcad-social-enterprise-in-ireland-sectoral-opportunities-and-policy-issues/# (Accessed January 2022).

Kruse, Tina (2019) *Making Change: Youth Social Entrepreneurship as an Approach to Positive Youth and Community Development*, Oxford, UK: Oxford University Press.

Liñán, F., & Chen, Y.-W. (2006) "Testing the Entrepreneurial Intention Model on a Two-Country Sample Inclusive Entrepreneurship Country Assessment-Spain View project Entrepreneurship View project". http://selene.uab.es/dep-economia-empresa/

Lower, L. M., Newman, T. J., & Anderson-Butcher, D. (2017) "Validity and Reliability of the Teamwork Scale for Youth". *Research on Social Work Practice*, 27(6), 716–725. https://doi.org/10.1177/1049731515589614

Mir Shahid, S., & Alarifi, G. (2021) "Social entrepreneurship education: A conceptual framework and review", *The International Journal of Management Education*, *19*(3), 100533. https://doi.org/10.1016/J.IJME.2021.100533

Phillips, W., Lee, H., Ghobadian, A., O'Regan, N., and James, P. (2015) "Social Innovation and Social Entrepreneurship: A Systematic Review", *Group & Organization Management*, *40*(3), 428–461. https://doi.org/10.1177/1059601114560063

Ratten, V., & Usmanij, P. (2021) "Entrepreneurship education: Time for a change in research direction?", *The International Journal of Management Education*, *19*(1), 100367. https://doi.org/10.1016/J.IJME.2020.100367

Reynolds, R. B. (2016) "Relationships among tasks, collaborative inquiry processes, inquiry resolutions, and knowledge outcomes in adolescents during guided discovery-based game design in school", *Journal of Information Science*, *42*(1), 35–58. https://doi.org/10.1177/0165551515614537

United Nations: Department of Economic and Social Affairs (2020) *World Youth Report: Youth Social Entrepreneurship and the 2030 Agenda*, United Nations, New York

Waghid, Z. (2019) "Examining the Business Education Curricula in South Africa: Towards Integrating Social Entrepreneurship", *Education + Training*, Vol. 61 No. 7/8 pp. 940-962. https://doi.org/10.1108/ET-05-2018-0115

Zafar, Z., Wenyuan, L., Bait Ali Sulaiman, M. A., Siddiqui, K. A., and Qalati, S. A. (2022) "Social Entrepreneurship Orientation and Enterprise Fortune: An Intermediary Role of Social Performance", *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.755080

Zambrano, J., Kirschner, F., Sweller, J., and Kirschner, P. A. (2019) "Effects of group experience and information distribution on collaborative learning", *Instructional Science*, *47*(5), 531–550. https://doi.org/10.1007/s11251-019-09495-0

Zhao, H., Hills, G. E., & Seibert, S. E. (2005) "The mediating role of self-efficacy in the development of entrepreneurial intentions". *Journal of Applied Psychology*, 90(6), 1265–1272. https://doi.org/10.1037/0021-9010.90.6.1265

EntreComp and GreenComp for Entrepreneurship. What is the 'Real' Relationship?

Christopher Moon[1], Andreas Walmsley[2] and Nikolaos Apostolopoulos[3]
[1]Middlesex University, UK
[2]Marjon University Plymouth, UK
[3]University of Paphos, Cyprus
c.moon@mdx.ac.uk
awalmsley@marjon.ac.uk
nikos.apostolopoulos@gmail.com

Abstract: This paper seeks to explore the relationship between two educational frameworks: EntreComp, the European entrepreneurship competency framework (Bacigalupo et al., 2016) and GreenComp, the European sustainability competency framework (Bianchi et al., 2022). At first sight the relationship is just a matter of competency addressing entrepreneurship and sustainability respectively. Thus, a simple comparison between the two lists of competences would reveal two similar but different competency lists, perhaps aimed at different audiences? The reality though, we posit, is that there is an underlying conceptual emphasis on responsibility which is yet to be fully explored. This paper provides the above comparison but then explores this conceptual underpinning in the light of what we term Responsible Entrepreneurship Education.

Keywords: EntreComp, GreenComp, sustainability, responsible entrepreneurship education

1. Introduction

Many entrepreneurship educators are still not aware nor actively using the European Community competency frameworks for both entrepreneurship education (EntreComp) and for sustainability education (GreenComp). With the imperative of climate change, but also recurring questions about the role of business in society, there is a need for proper teaching in Responsible Entrepreneurship Education and this paper outlines how the competency frameworks have thus far been used in practice; and then discusses them in light of the concept of Responsible Entrepreneurship Education (REE). Justification for the emphasis on responsibility in education is provided by PRME (2022) which has developed Principles for Responsible Management Education. PRME's mission is to transform management education and develop the responsible decision-makers of tomorrow to advance sustainable development (PRME, 2022). According to Antonio Guterres, United Nations Secretary-General "The PRME initiative was launched to nurture responsible leaders of the future. Never has this task been more important. Bold leadership and innovative thinking are needed to achieve the Sustainable Development Goals." (PRME, 2022). PRME is now cited as the largest organised relationship between the United Nations and management-related higher education institutions. The theory of PRME is that managers need to be educated in six principles (see Table 4 below). However, all codes or sets of principles need to be reviewed and or updated to keep up to date with important developments. According to Avelar et al., (2022), using bibiometric research to review 135 papers on PRME, there is need for the knowledge sharing promoted and facilitated by PRME to help prepare decision makers for different situations and scenarios, and different perspectives. This supports our premise in this paper that PRME needs to be used and adapted as much for Entrepreneurship Education as Management Education in general. Arguments supporting the emphasis on Entrepreneurship Education in Universities are also presented in Jones et al., (2020). In this paper we review the two main European competency frameworks for Entrepreneurship and Sustainability, EntreComp and GreenComp, and posit that PRME can be updated or adapted for more direct reference to entrepreneurs rather than managers in general.

2. EntreComp in practice

EntreComp was published in 2016 as a comprehensive, flexible and multipurpose reference framework designed to support and inspire actions to improve entrepreneurial capacity (McCallum et al., 2020). Figure 1 provides an image of the framework which is divided into three competence areas: 'ideas and opportunities', 'resources', and 'into action'. Each of these three competence areas includes fifteen competences; and an eight-level model is provided for progression against 442 learning outcomes. As such, the framework provides a resource that can be used to design entrepreneurship programmes, evaluate learning outcomes, and for students to reflect on their competency from a developmental perspective. The framework is not designed as a pass/fail model or competent/not competent but to provide inspiration and support for educators and learners in a practical way.

Of particular significance to our analysis is that 'ethical and sustainable thinking' is considered a core competence, and the report put forward by Bacigalupo et al. (2016) suggests EntreComp can be applied across various value creating activities, including green enterprise or eco and social entrepreneurship.

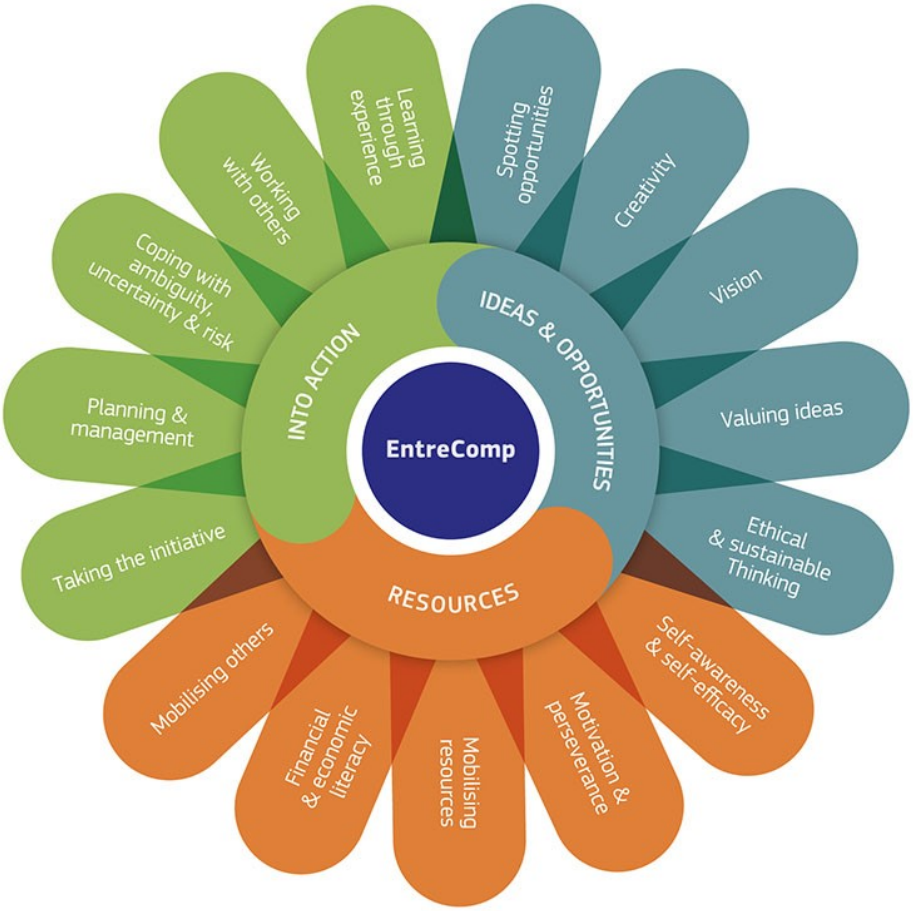


Figure 1: The EntreComp framework image. (Bacigalupo et al., 2016).

The EntreComp playbook from the European Union, Joint Research Centre, provides excellent examples of EntreComp in practice (McCallum et al., 2020). Ten case studies are included (see Table 1).

Table 1: EntreComp case studies. Adapted from McCallum (2020).

Case study title	Focus of case study	Key learning outcomes
NFLinEYE	Non-Formal Learning in the Erasmus for Young Entrepreneurs Programme.	Measures lifelong learning impact of the EYE programme.
Espacio RES	Start-ups in social enterprise, technology, agriculture, clean energy and the creative fields.	Develop, plan and organise an incubator programme for start-ups.
EU3Leader	Third-sector leaders.	Professional skills framework to foster entrepreneurial competence.
Guadalinfo	Digital competence and citizen empowerment.	Support for developing social innovation and business ideas, employability and social inclusion.
Mygrants	App providing information and formative assessment to refugees.	Scout our hidden talents among trainees and match them with job opportunities.
SFEDI	Occupational standards in the UK.	Project development, new course design and review of existing qualifications.

Case study title	Focus of case study	Key learning outcomes
Social Innovators KG	15 unemployed individuals in Graz, Austria.	Develop holistic entrepreneurial skills as part of incubator programme for social enterprises.
Startup Support South Africa	Major bank.	Workforce redeployment training to support employees at risk of redundancy to help develop their P/T enterprises into F/T income.
The Women's Oragnisation	Enterprise creation and growth incubation services for women.	Review and develop services, and organisational development tool for team training and strategic direction.
Youth@Work	Youth Employability and Entrepreneurship of Erasmus+ national agencies.	Tailored capacity-building training to agency staff, creation and training of a pool of trainers.

The above 10 cases have been deployed in the public sector (n=2), private sector (n=3) and third sector (n=5). This indicates that the framework is generic and can be applied and adapted across different sectors and for different purposes, just as suggested by the originators of EntreComp, (Bacigalupo et al. 2016). In fact, the above 10 cases reveal use of the EntreComp framework for a wide range of stakeholders including youth, the unemployed, the employed, for trainers, for educators, for professionals, etc. And the outcomes range from personal and professional development to strategic development, reflection, and capacity development. A particular cross-cutting theme is 'employability' and all 10 cases are mapped against employability indicators (see Table 2.).

Table 2: Employability skills mapped against 10 EntreComp cases. Adapted from McCallum (2020)

Employability skill	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Labour market skills analysis			X		x		X		X	
Outreach to the under/unemployed				X			X		X	
Assessment of skills	X	X	X		X	X	X	X		x
Personal development plan	X		X	X	X	X	X	X	X	
Design of training/development	X		X	X	X	X	X	X	X	X
Delivery of training/development	X	X	X		X	X	X	X	X	x
Careers advice					X					
Client tracking and monitoring						X				
Liaising with employers for job placement/experience					X					
Workforce development	X				X	X		X	X	
Start-up pathway	X	X		X	X	X	X	X	X	
Certificate of competence	x	X				X	x	x		X

The above table indicates which employability indicators had been specifically mapped against use of EntreComp by 2018 in these 10 cases. Indeed, the modal uses of EntreComp are in the design and delivery of training, personal development plans and start-up pathways. McCallum et al., (2020) further review the most common uses of EntreComp in these 10 cases to indicate that EntreComp has been used to promote entrepreneurship, analyse competences, assess skills, and recognise certification.

3. GreenComp in practice

Bianchi et al., (2022) describe GreenComp as a set of sustainability competences to feed into education programmes to help learners develop knowledge, skills and attitudes that promote ways to think, plan and act with empathy, responsibility, and care for our planet and for public health. GreenComp comprises four interrelated competence areas: 'embodying sustainability values', 'embracing complexity in sustainability', 'envisioning sustainable futures' and 'acting for sustainability' (see Table 3).

Table 3: GreenComp image. (Adapted from Bianchi et al., 2022)

Area	Competence	Descriptor	Examples cited
Embodying sustainability values.	Valuing sustainability.	To reflect on personal values…	Impact of fast fashion or short haul flights.
	Supporting fairness.	To support equity and justice for current and future generations…	Stop Ecocide Foundation.
	Promoting nature.	To acknowledge that humans are part of nature…	The Nature Conservancy/ The Nature Lab.
Embracing complexity in sustainability.	Systems thinking.	To approach a sustainability problem from all sides…	Green technologies.
	Critical thinking.	To assess information and arguments…	Interrelation between fast fashion, poor labour conditions, solid waste accumulation, pollution.
	Problem framing.	To formulate current and potential challenges…	Technical solutions as opposed to renewal of nature.
Envisioning sustainable futures.	Futures literacy.	To envision alternative sustainable futures…	Teach the Future.
	Adaptability.	To manage transitions and challenges…	Adapt for our Future.
	Exploratory thinking.	To adopt a relational way of thinking…	Eco-schools programme.
Acting for sustainability.	Political agency.	To navigate the political system…	Fridays for Future movement; Extinction Rebellion.
	Collective Action.	To act for change…	European Education for Climate Coalition.
	Individual initiative.	To identify own potential for sustainability…	Knowledge to Action.

The GreenComp model is represented by bees, flowers, nectar and beehives (Bianchi et al., 2022) wherein bees represent 'acting for sustainability' competences, flowers represent 'envisioning sustainable futures' competences, beehives represent 'embodying sustainability values' competences, and nectar/pollen represents 'embracing complexity in sustainability' competences. Examples supporting the competences are also shown in Table 3 column 4. There does not appear to be a playbook for GreenComp as yet. However, the examples cited by Bianchi et al., (2022) serve to show that the competences identified in GreenComp are evident in practice.

4. Discussion

According to McCallum et al., (2020), success factors for EntreComp include: it provides a common language, is holistic, easy-to-understand, trustworthy, user-friendly and flexible. The authors of this paper would add that with ethics and sustainability, cited as a core competence for entrepreneurs, this supports not just the holistic approach but also supports the emphasis on trust. Seikkula-Leino et al., (2021) caution though that use of EntreComp could be hindered by a lack of a shared vision and development of practice. Their study of n=348 respondents posits that EntreComp is a tool that is best used by the learning community as co-creators through practice-oriented reforms. This emphasis on practice is critical, and Seikkula-Leino et al., (2021) imply that this 'real' learning is when individual awareness of learners is supported by a learning community [this could be described as a community of practice, Author insert]. This is similar to the more recent approach of GreenComp, developed by Bianchi et al., (2022), which specifically cites 'adopting a relational way of thinking' as a descriptor of sustainability competence.

It is too early to evaluate the use of GreenComp per se in developing sustainability competences as the framework was only published in 2022. However, a recent 'whitepaper' on sustainability in startups (Yokoyama and Melde, 2020) provides evidence that sustainability is critical to startups. Their survey of 282 startups found 86% had thought about the role and relevance of sustainability for their business model with 83% seeing tangible positive effects. Further, most startups are motivated internally on sustainability and incentivised externally (51%). However, the influence of human resources within the startups was weaker at 40%. The authors conclude that whilst sustainability in corporations is largely professionalised, with clear standards and guidelines, there is

still a long way to go in startups, and indeed, with a desire on the part of many entrepreneurs to embed sustainability into their startups, now is the time for Enterprise Education (EE) to offer guidance on how this can be achieved. Further, the authors argue that Venture Capitalists also need to take responsibility to educate and influence startups; and if this is the case, then this assumption would also benefit from further study.

5. Conclusions

Both EntreComp and GreenComp provide useful competency-based tools to support the development of entrepreneurship and sustainability skills respectively. Crucially, there are clear overlaps between the two with EntreComp including ethics and sustainability as a core competence for all entrepreneurs and for its authors to explicitly state that value creating activities may include green entrepreneurship (Bacigalupo et al. 2016). This paper has further shown that responsibility is a key link shared between the two approaches with their emphasis on trust and fairness. In the corporate world, principles underpinning 'responsible management education' have been adopted by many leading organisations across the world (PRME, 2022) but there has been less attention to the need for what we term responsible entrepreneurship education (REE). The evidence from the impact of EntreComp which includes ethics and sustainability as a core competence, and evidence from the impact of GreenComp (by default based on data from startups on the significance of sustainability but weak HR influence), indicates that principles of responsible entrepreneurship education (REE) need to be developed. The authors have thus used the PRME principles to develop additional REE principles. We thus anticipate that these will support the use of both EntreComp and GreenComp and in particular strengthen the positive influence of HR practices in startups (see Table 4). This should also mean that communities of practice can be developed to support REE (e.g. co-creation of educational courses and materials between eco and social entrepreneurs and entrepreneurship educators). In addition, further research can be conducted on the take up of GreenComp, and its impact, which will contribute to the global dialogue on the importance of entrepreneurship and sustainability in general.

Table 4: PRME and the development of REE (Author table, adapted from PRME)

PRME principles	Descriptor	REE principles	Descriptor
Purpose	We will develop the capabilities of students to be future generators of sustainable value for business and society at large and to work for an inclusive and sustainable global economy.	Responsibility	We should ensure that ethics and sustainability are core competences that need to be developed in all entrepreneurs. We will achieve this by developing communities of practice based on methods and research to develop practice.
Values	We will incorporate into our academic activities, curricula, and organisational practices the values of global social responsibility as portrayed in international initiatives such as the United Nations Global Compact.	Entrepreneurship	We recognise that all entrepreneurs are not the same and the diversity of entrepreneurial mindsets includes eco and social entrepreneurs in addition to traditional entrepreneurs. We will treat everyone equally but also recognise this diversity in our teaching approaches by catering for such individual differences in mindset. Rather than ignoring values, a consideration of our own values and how these shape our behaviour as part of the entrepreneurial process needs to be considered.

PRME principles	Descriptor	REE principles	Descriptor
Method	We will create educational frameworks, materials, processes and environments that enable effective learning experiences for responsible leadership.	Education	We will adopt the UN PRME but adapt for REE e.g. by applying the principles to entrepreneurs, startups and SMEs not just managers and corporations. We will also use tools such as EntreComp and GreenComp in a responsible manner to educate entrepreneurs on the importance of ethics and sustainability and the development of their practice.
Research	We will engage in conceptual and empirical research that advances our understanding about the role, dynamics, and impact of corporations in the creation of sustainable social, environmental and economic value.		
Partnership	We will interact with managers of business corporations to extend our knowledge of their challenges in meeting social and environmental responsibilities and to explore jointly effective approaches to meeting these challenges.		
Dialogue	We will facilitate and support dialog and debate among educators, students, business, government, consumers, media, civil society organisations and other interested groups and stakeholders on critical issues related to global social responsibility and sustainability.		

References

Avelar, A. B. A., Farina, M. C., da Silva Pereira, R., (2022) Principles for responsible management education - PRME: Collaboration among researchers, The International Journal of Management Education, Volume 20, Issue 2, 2022, 100642, ISSN 1472-8117, https://doi.org/10.1016/j.ijme.2022.100642.

Bacigalupo, M., Kampylis, P., Punie, Y., Van den Brande, G. (2016). EntreComp: The Entrepreneurship Competence Framework. Luxembourg: Publication Office of the European Union; EUR 27939 EN; doi:10.2791/593884.

Bianchi, G., Pisiotis, U., Cabrera Giraldez, M. (2022), GreenComp – The European sustainability competence framework. Bacigalupo, M., Punie, Y. (editors), EUR 30955 EN, Publications Office of the European Union, Luxembourg, 2022; ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040.

Jones, P., Apostolopoulos, N., Kakouris, A., Moon, CJ., Ratten, V., Walmsley., (2021). Universities and Entrepreneurship. Meeting the Educational and Social Challenges, Contemporary Issues in Entrepreneurship Research, Emerald Publishing, ISBN: 978-1-83982-075-5.

McCallum, E., McMullan, L., Weicht, R, and Kluzer, S., (2020), EntreComp at Work, Luxembourg: Publications Office of the European Union, 2020. Retrieved from: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120486/jrc120486_entrecompatwork.pdf

PRME., (2022). United Nations Principles for Responsible Management Education. Retrieved from: https://www.unprme.org/what-we-do.

Seikkula-Leino, J.; Salomaa, M.; Jónsdóttir, S.R.; McCallum, E.; Israel, H. (2021), EU Policies Driving Entrepreneurial Competences—Reflections from the Case of EntreComp. Sustainability 2021, 13, 8178. https://doi.org/10.3390/su13158178.

Yokoyama, M and Melde, T., (2020), Whitepaper - Sustainability in Startups. Published by Techfounders. Retrieved from: https://www.techfounders.com/wp-content/uploads/20200420_Whitepaper_Sustainability-in-Startups_final.pdf.

Exploring Legitimacy in Entrepreneurship Education: Towards a Theoretical Framework

Andreas Walmsley and Birgitte Wraae
Plymouth Marjon University, Plymouth UK and UCL University College, Odense, Denmark
awalmsley@marjon.ac.uk
biwr@ucl.dk

Abstract: Adopting Suchman's (1995) conceptualisation of legitimacy within organisations, this study seeks to understand firstly, how entrepreneurship education itself has been legitimised, secondly, how entrepreneurship educators are legitimised, and lastly, how pedagogical approaches in EE are legitimised. The theoretical framework for the paper distinguishes between institutional legitimacy and strategic legitimacy. We seek to both understand how societal institutions (e.g. policy makers, industry) frame entrepreneurship and entrepreneurship education, and how HE institutions in turn respond strategically to this framing. These legitimisation strategies can be framed as being 'pragmatic', 'moral' and 'cognitive' (Suchman, 1995). The study will draw on data drawn from the UK in the first instance.

Keywords: entrepreneurship education, enterprise, legitimacy, educator, institutional environment, pedagogy.

1. Introduction

The starting point of this 'short paper' that presents work in progress is the notion that, despite its expansion, the case for entrepreneurship education's (EE) legitimacy has not been settled. Kuratko (2005) identified legitimacy challenges for EE over a decade ago. Katz (2003) with reference to research in entrepreneurship argued that with its expansion and maturity there was a danger of researchers becoming complacent with its success. In the same vein it is suggested that EE's success (in terms of its expansion) should not be taken to mean that fundamental questions about its nature and purpose be ignored. Thus, what we aim to do here is present a theoretical framework for the application of Legitimacy Theory to entrepreneurship education.

The paper seeks to explore three aspects of legitimacy in EE: firstly, how EE itself has been legitimised, secondly, how entrepreneurship educators are legitimised, and lastly, how pedagogical approaches are legitimised. It then develops a conceptual framework for an empirical investigation of legitimacy to entrepreneurship education, whereby the paper draws heavily on Suchman's (1995) seminal work. A theoretical framework is offered alongside an outline methodology.

To summarise, the study's aim is to offer a conceptual framework for the investigation of the legitimacy of the provision of EE.

2. Entrepreneurship education and legitimacy

The concept of legitimacy has long been of interest to social scientists. Weber's (1924[1978]) early writing on legitimacy laid the foundation for the much of the research that was to come (Johnson, 2004). For example, Dornbusch and Scott (1975) picked up on Weber's (1924[1978]) work, recognising the collective nature of the legitimation process. What is legitimate and normatively appropriate will vary across time and place and so legitimacy is invariably context-dependent (Díez-Martín *et al.*, 2021).

In addition to its role in sociology in particular, legitimacy has featured prominently in the management/organisational literature (Zelditch, 2001), including in entrepreneurship (e.g. Aldrich & Fiol, 1994, Delmar & Shane, 2004, Stinchcombe, 1965). Thus, entrepreneurs must act according to societal norms in order to gain legitimacy (Bruton & Ahlstrom, 2003, Yousafzai *et al.*, 2015) without which the organisation would not survive (Arshed *et al.*, 2014). Legitimacy may be regarded as a central asset of a new venture (Rao et al., 2008) as well as the individual entrepreneur (Bernard & Barbosa, 2016).

The application of legitimacy concept (and Legitimacy Theory) to entrepreneurship education is still in its infancy. That said, the provision of entrepreneurship education is not akin to a new venture entering an institutional void (Aldrich & Fiol, 1994); entrepreneurship education in many forms is now well established. However, despite rapid growth in provision, what EE is and what it should achieve, as well as the means by which it should achieve this continues to engender debate.

The question of whether entrepreneurship can be effectively taught offers the most fundamental challenge to its legitimacy. Although the issue appears to be largely resolved in that EE does on the whole have positive outcomes on a range of attitudinal and behavioural measures (Martin *et al.*, 2013, Nabi *et al.*, 2017), when it comes to the detail of for whom, under which circumstances and over what time period the issue is less clear (Packham *et al.*, 2010, Petridou & Sarri, 2011, Rideout & Gray, 2013). Moreover, outside academia the perception that one has to be born an entrepreneur, it is not something that one can learn in other words, persists.

A growing interest in the concept of the entrepreneurship education ecosystem (Brush, 2014, Brush, 2021, Williams Middleton *et al.*, 2020, Wraae & Walmsley, 2020) recognises that EE does not occur in a vacuum; despite its expansion which in a broad sense suggests a certain level of legitimacy having been achieved for EE, numerous stakeholders understandably purvey their own views as to the nature of EE and its purpose. Different discourses might then exist, and in applying the concept of legitimacy to the provision of EE this study seeks to identify these different discourses and how they relate to the three components of the study (the provision of EE, the entrepreneurship educator, and the pedagogical approach to EE).

3. Conceptual framework of the application of legitimacy to entrepreneurship education

What this study aims to do is to understand how higher education institutions seek to legitimise the provision of entrepreneurship education. Just as organisations may seek legitimacy via their actions, they may seek legitimacy for the actions they undertake. The first step in the study is therefore to explore institutional legitimacy because this will identify the socio-cultural norms, and more formal regulations, within which the universities operate. Once this has been achieved the task is then to identify how universities respond to the institutional legitimacy in something Suchman (1995) terms 'strategic legitimacy'. Thus, the conceptual framework contains two core elements: institutional legitimacy and strategic legitimacy (see Table 1).

With regard to how universities respond strategically to institutional legitimacy we decided to focus on three key aspects: EE itself (making the case for EE), the EE educator (who is a legitimate EE educator and how is legitimacy granted?), EE practices (how should EE be taught?). Here we seek to segment legitimisation strategies into 'pragmatic', 'moral' and 'cognitive' as per Suchman (1995).

The study will draw on secondary data (see Table 1). Discourse analysis will be applied to documents that form part of the institutional legitimacy framework, and to universities' strategic legitimacy efforts. Discourses here are understood as a way of representing the world; they both structure and are structured by social reality (Wodak, 2001) and can be represented, for example, in texts, conferences, talks and associations (Keller, 2011). Texts may then be understood as social events (Fairclough, 2003), they are complex cultural and psychological products, designed in a way to make things happen (Potter & Wetherell, 1987). Even seemingly neutral descriptions are attached to more evaluative prose that serves a purpose (Potter & Wetherell, 1987).

Because of our two-part theoretical framework, the starting point for the selection of texts are those at an institutional level that provide institutional legitimacy. These could include government policy documents on higher education, statements from the business community/industry in the national press or reports, and to cover the third group of stakeholders student representatives (e.g. Student Unions, parents' associations). Texts relating to strategic legitimacy (the second aspect of the theoretical framework) would use HE-internal documents such as programme specifications, programme descriptions, newsletters and press releases.

The study design will be based around two national case studies: Denmark and the United Kingdom. The inclusion of two distinct institutional environments will permit a more in-depth and therefore also robust analysis of the issue at hand, rather than just focussing on one location. Furthermore, both countries, while distinct, have a relatively long history of providing entrepreneurship education at a tertiary educational level thereby providing sufficient material (data) to undertake a meaningful analysis. In the first instance the focus will be on the UK; subsequently, for comparative purposes, we will focus on Denmark.

Table 1: Types of legitimacy and associated data sources

Type of Legitimacy	Stakeholders	Anticipated Data Sources
Institutional Legitimacy	Policy Makers/Government	Government white papers, policy reports
	Industry/Business Community	Reports compiled by employer associations, industry representative bodies, industry lobbying groups
	Students/Prospective Students/Their Parents	Web fora, Students Union, Careers guidance bodies, Surveys of student opinion/satisfaction
Strategic Legitimacy	Universities	University websites, programme documentation, university strategies

4. Conclusion

The attempt in this short paper was to introduce work in progress on the concept of legitimacy as it applies to the provision of entrepreneurship education. The study seeks to understand the institutional framework for EE and how universities respond to this in their provision of EE. As the provision of EE continues to grow rapidly, the paper adds to those that have sought to engage more critically with this provision, drawing also on a more contextualised understanding of EE. We contend that the concept of legitimacy has much to offer in understanding dominant, and less dominant, discourses in the provision of EE, thereby providing a rich ground for further study with implications at both the level of policy making, and in the entrepreneurial classroom.

We expect some limitations with regard to the material available for analysis. Although universities offer clear documentation on the courses they provide, and while policy makers similarly provide ample documentation, gaining sufficient, suitable material from students/prospective students, and to a lesser degree employers, could present a challenge. Likewise, applying our conceptual framework drawing on Suchman's (1996) types of legitimacy to the documentation is not necessarily going to be straightforward. However, the extent of the challenge will not reveal itself until we engage with the material. These challenges align with the exploratory and boundary-pushing nature of the study.

References

Aldrich, H. E. & Fiol, C. M. (1994) Fools rush in? The institutional context of industry creation. *Academy of Management Review,* 19(4)**,** 645-670.

Arshed, N., Carter, S. & Mason, C. (2014) The ineffectiveness of entrepreneurship policy: Is policy formulation to blame? *Small Business Economics,* 43(3)**,** 639-659.

Bernard, M.-J. & Barbosa, S. D. (2016) Resilience and entrepreneurship: A dynamic and biographical approach to the entrepreneurial act. *M@n@gement,* 19(2)**,** 89-123.

Brush, C. (2014) Exploring the concept of an entrepreneurship education ecosystem, in: S. Hoskinson & D. Kuratko (Eds) *Innovative pathways for university entrepreneurship in the 21st century.* (vol. 24), Emerald Group Publishing), 25-39.

Brush, C. (2021) Entrepreneurship education ecosystems: The case of babson college, in: H. Neck & Y. Liu (Eds) *Innovation in global entrepreneurship education. Teaching entrepreneurship in practice.* 2-17.

Bruton, G. D. & Ahlstrom, D. (2003) An institutional view of china's venture capital industry: Explaining the differences between china and the west. *Journal of Business Venturing,* 18(2)**,** 233-259.

Delmar, F. & Shane, S. (2004) Legitimating first: Organizing activities and the survival of new ventures. *Journal of Business Venturing,* 19(3)**,** 386(325).

Díez-Martín, F., Blanco-González, A. & Díez-De-Castro, E. (2021) Measuring a scientifically multifaceted concept. The jungle of organizational legitimacy. *European Research on Management and Business Economics,* 27(1)**,** 100131.

Dornbusch, S. M. & Scott, W. R. (1975) *Evaluation and the exercise of authority* (San Franciscso, Jossey-Bass).

Fairclough, N. (2003) *Analysing discourse. Textual analysis for social research,* (London, Routledge).

Johnson, C. (2004) Introduction: Legtimacy processes in organizations, in: C. Johnson (Ed.) *Legitimacy processes in organizations.* (vol. 22), Emerald Group Publishing Limited), 1-24.

Katz, J. (2003) The chronology and intellectual trajectory of american entrepreneurship education: 1876–1999. *Journal of Business Venturing,* 18(2)**,** 283-300.

Keller, R. (2011) The sociology of knowledge approach to discourse (skad). *Human Studies,* 34(1)**,** 43.

Kuratko, D. (2005) The emergence of entrepreneurship education: Development, trends, and challenges. *Entrepreneurship Theory and Practice,* 29(5)**,** 577-598.

Martin, B., Mcnally, J. & Kay, M. (2013) Examining the formation of human capital in entrepreneurship: A meta-analysis of entrepreneurship education outcomes. *Journal of Business Venturing,* 28(2)**,** 211-224.

Nabi, G., Liñan, F., Fayolle, A., Krueger, N. & Walmsley, A. (2017) The impact of entrepreneurship education in higher education: A systematic review and research agenda. . *Academy of Management Learning and Education,* 16(2)**,** 277-299.

Packham, G., Jones, P., Miller, C., Pickernell, D. & Thomas, D. (2010) Attitudes towards entrepreneurship education: A comparative analysis. *Education & Training,* 52(8/9)**,** 568-586.

Petridou, E. & Sarri, K. (2011) Developing "potential entrepreneurs" in higher education institutes. *Journal of Enterprising Culture,* 19(1)**,** 79-99.

Potter, J. & Wetherell, M. (1987) *Discourse and social psychology: Beyond attitudes and behaviour.,* (London, Sage Publications).

Rideout, E. & Gray, D. (2013) Does entrepreneurship education really work? A review and methodological critique of the empirical literature on the effects of university-based entrepreneurship education. . *Journal of Small Business Management,* 51(3)**,** 329-351.

Stinchcombe, A. L. (1965) Social structure and organizations. , in: J. G. March (Ed.) *Handbook of organizations.* Chicago, IL, Rand McNally), 142-193.

Suchman, M. C. (1995) Managing legitimacy: Strategic and institutional approaches. *Academy of Management Journal,* 20(3)**,** 571-610.

Weber, M. (1924[1978]) *Economy and society (vols 1 and 2),* (Berkeley, University of California).

Williams Middleton, K., Padilla-Meléndez, A., Lockett, N., Quesada-Pallarès, C. & Jack, S. (2020) The university as an entrepreneurial learning space. *International Journal of Entrepreneurial Behavior & Research,* 26(5)**,** 887-909.

Wodak, R. (2001) What cda is about: A summary of its history, important concepts and its developments. , in: R. Wodak & M. Meyer (Eds) *Methods of critical discourse analysis* London, Sage), 1-13.

Wraae, B. & Walmsley, A. (2020) Behind the scenes:Spotlight on the entrepreneurship educator. *Education & Training,* 62(3)**,** 255-270.

Yousafzai, S. Y., Saeed, S. & Muffatto, M. (2015) Institutional theory and contextual embeddedness of women's entrepreneurial leadership: Evidence from 92 countries. *Journal of Small Business Management,* 53(3)**,** 587-604.

Zelditch, M. J. (2001) Theories of legitimacy, in: J. Jost & B. Major (Eds) *The psychology of legitimacy: Emerging perspectives on ideology, justice, and intergroup relations* Cambridge, Cambridge University Press), 33-53.

An Empirical Study of Entrepreneurial Intention and Youth Entrepreneurship Policy in Hong Kong

Jiahao Zhuang, Rui Xiong and Hongyi Sun
Department of Advanced Design and Systems Engineering, City University of Hong Kong, Hong Kong, China
mehsun@cityu.edu.hk

Abstract: Young entrepreneurship is the future of the economy in terms of increasing employment and creating economic value. This paper will report the milestone results of a pilot survey study on entrepreneurial intention and preparation of young people in Hong Kong with a view to explore potential recommendations to develop youth entrepreneurial policy for the Hong Kong Government. The target of this survey is those young people from 18 to 40 years old. 244 copies of valid questionnaires were collected via e-mail, face-to-face seminars and online platforms. The study was designed based on the Theory of Planned Behavior (TPB) and covered entrepreneurial personality traits, family background, entrepreneurial education, entrepreneurial preparation, and the perception of the entrepreneurial environment in Hong Kong. Implications for education institutions and the government will be discussed finally.

Keywords: youth entrepreneurship, policy, education, government support

1. Introduction

Entrepreneurship is considered an important tool to drive the economy and provide jobs. In Hong Kong, youth groups face the dual oppression of life pressure and reduced employment opportunities (Peng, 2019). Under this situation, starting a business can be an alternative career choice for young people. Personality traits and environmental factors have been widely and separately discussed in the entrepreneurship field. Regarding environmental factors, three dimensions of the institutional theory were firstly tested by Busenitz et al. (2000), and most later scholars widely adopted this theory to test the effects on students' samples (Wannamakok & Chang, 2020). However, there are gaps left in the literature on how young people (not just students) respond to the entrepreneurial environment in their region and study of both personality traits and environmental factors.

This study investigated Hong Kong youth's personality traits, entrepreneurial intention, preparation and how they perceive Hong Kong's entrepreneurial institutional environment. We proposed the following research questions:

- Are there any differences in entrepreneurial intention and preparation of Hong Kong youths from different entrepreneurial backgrounds?
- What are the levels of entrepreneurship-related personality traits among Hong Kong youths?
- What are the levels of attitude, perceived behavioral controls, subjective norms, entrepreneurial intention, and entrepreneurial preparation of Hong Kong youths?
- How do Hong Kong youth perceive the local entrepreneurial institutional environment?

2. Methodology

All the questions were measured by a five-Point Likert Scale ranging from "strongly disagree" to "strongly agree". 244 copies of valid questionnaires were collected via e-mail, face-to-face seminars and online platforms. We used the SPSS Statistics to test the difference of demographic variables and entrepreneurial background factors on entrepreneurial intention. Furthermore, we use the percentage (the total percentage of "strongly agree" and "agree") to describe the levels of Hong Kong youth's personality traits, the TPB model's variables and the perception of the local institutional environment.

3. Demographic variables

To make the sample representative, the sample characteristics have covered different age groups, educational levels and household monthly income backgrounds. Among the 244 samples, 65.2% are female and 34.8% are male. We found that most respondents are between 18 and 24 years old, accounting for 73.4% and the respondents of 25-30 and 31-40 years old only account for 18.0% and 8.6% respectively. Also, the majority of families' income levels are in the low and middle ranges, accounting for 41.0% and 56.5% respectively. In terms

of the highest educational level, it covers all educational levels, with the percentage of high school or lower (5.7%), vocational degree (8.6%), undergraduate degree (70%) and master's degree or higher (15.6%).

4. Demographic variables and entrepreneurial intention

Based on the results of the T-test and one-way ANOVA, some findings are shown below:

First, there are only significant differences in entrepreneurial preparation by gender (sig. = .037). Male has higher entrepreneurial preparation than female.

Second, there are significant differences in entrepreneurial intention (sig. = .013) and preparation (sig. = .049) by different age groups. People aged 31-40 years old have higher entrepreneurial intention and preparation than those aged 18-24.

Third, there are no significant differences in entrepreneurial intention (sig. = 0.149) and preparation (sig. = 0.715) by household income.

Fourth, there are only significant differences in entrepreneurial intention (sig. = .005) by educational levels. People who gained a master's degree or higher have higher entrepreneurial intention than those with a lower educational level.

5. Entrepreneurial background factors and entrepreneurial intention

Entrepreneurial background factors include prior entrepreneurial experience, role model, family entrepreneurial background and entrepreneurial education. Based on the results of the T-test, some findings are shown below:

First, due to the critical role of prior entrepreneurial experience (Bignotti & Le Roux, 2020), we found that there are significant differences in entrepreneurial intention (sig. = .000) and preparation (sig. = .000) by different prior entrepreneurial experience.

Second, individual entrepreneurial intention and behavior can be influenced by observing the conduct of others and they can be the "role models" (Bosma *et al*., 2012). Accordingly, we found that there are significant differences in entrepreneurial intention (sig. = .000) and preparation (sig. = .028) by getting to know people (friends, relatives, teachers and colleagues) who started a business.

Third, we also found that there are significant differences in entrepreneurial intention (sig.= .002) and preparation (Sig.= .000) by whether receiving the entrepreneurship education and training.

Fourth, although family business backgrounds facilitate becoming an entrepreneur (Tarling *et al*., 2016), there are no significant differences in entrepreneurial intention (sig. = .096) and preparation (sig. = .132) by different family entrepreneurship backgrounds.

6. Personality traits and theory planned behavioral model

In terms of personality traits, only 19.4 % agree that a business offering high returns with high risks is preferable to a secure job with a steady salary. Also, only 29.3 % believe they can deal with unexpected situations. Moreover, only 36.1% of them agree that they are creative people and only 37.9% agree that they enjoy establishing social networking. It implies that young people in Hong Kong generally have a low risk-taking propensity, tolerance for ambiguity, creativity and social networking. Finally, 61.1% of them agree that the success of my life is heavily reliant on my ability. 62.4% agree that they desire and pursue success, which means that Hong Kong young people have a relatively high internal locus of control and need for achievement.

Based on Ajzen's (1991) theory of planned behavior (TPB) model, we explored attitude, subjective norms, perceived behavioral control, entrepreneurial intention and preparation. Some findings are shown below:

Concerning attitude toward entrepreneurship, the average percentage of "agree" and "strongly agree" of all items is 46.4%. Specifically, only a small portion of people agree that being an entrepreneur has more benefits (46.3%) and are interested in pursuing a career as an entrepreneur (35.2%). They would prefer to be an entrepreneur(36.4%). A relatively higher percentage of people would start a business (66.0%) if given the

opportunity and resources and agree that becoming an entrepreneur would provide them with a lot of satisfaction (54.5%).

Moreover, the finding of subjective norms shows that they have a medium subjective norm (54.1%). Specifically, If they start a business, they are more likely to receive support from their friends (66.4%) than from colleagues or classmates (53.7%) and from their parents (42.2%).

However, with respect to perceived behavioral control, the average percentage of "agree" and "strongly agree" of all items is only 20.4%. It shows that only a small portion of young people believe they can control the business creation process (32.8%) and have a high probability of success (13.9%). Few people know how to keep the business functional (13.9%), understand the practical detailed (24.2%) and develop business projects (17.2%).

Similarly, the average percentage of all items of entrepreneurial intention of young people is low (22.5%). Only a small number of young people agree that they are determined to create a firm in the future (20.9%), have very seriously thought of starting a firm (25.0%) and have the firm intention to start a firm someday (21.7%).

Lastly, the average percentage of all items of entrepreneurial preparation of young people is extremely low (8.6%). Less than 10% of young people engaged in entrepreneurial activities, such as preparing a business plan (6.6%), doing market research (8.2%), setting up a start-up team (7.8%), gathering the funding information from the government (8.2%) and gathering of information regarding administrative formalities for company creation (8.6%).

7. Descriptive analysis of regional factor variables - Hong Kong

The institutional theory suggests that regulatory, normative and cognitive environments influence the level of region entrepreneurship (Busenitz *et al*., 2000) and entrepreneurial intention (Oftedal *et al*., 2018). Based on the 244 samples, there are some findings:

First, in terms of the regulatory environment, few people agree with sufficient grants and subsidies (16%), qualified consultants and service support (12.7%), clear bureaucratic procedures(15.2%), and favorable laws and regulations (15.6%). Although Hong Kong provides a lot of entrepreneurial support and incentives, Hong Kong youth have a low sense of identity with Hong Kong's entrepreneurial regulatory environment.

Second, as for the normative environment, most young people agree that young entrepreneurs who started their own businesses are admired (67.4%) and respected (70%), and having a creative idea are admired. (70.5%).

Third, the cognitive environment covers the perception of local young people's cognition of the entrepreneurship-related knowledge and skills. Few young people agree that Hong Kong youth can deal with entrepreneurial risks (14.7%), have entrepreneurial skills (15.6%), know the departments and social organizations that the government supports entrepreneurship (13.8%), know information about entrepreneurship (17.9%) and know the entrepreneurial procedure (15.6%). This demonstrates that the overall level of entrepreneurial recognition among Hong Kong youths is low.

8. Discussions and conclusions

This study revealed that there are significant differences in entrepreneurial intention and preparation among Hong Kong youths of different age groups, educational levels, prior entrepreneurship experiences, role models, and entrepreneurship education. However, such differences were not found among people from diverse family household incomes and family entrepreneurship backgrounds. Moreover, we revealed that Hong Kong youths generally have a low risk-taking propensity, tolerance for ambiguity, creativity and social networking. Regarding the TPB model, young people have a low attitude towards starting a business and extremely low perceived behavioral control, entrepreneurial intention and preparation. The results of subjective norms show that friends are more supportive than parents. The results inspire the following implications for education and entrepreneurial policy.

Based on the perception of the entrepreneurial environment in Hong Kong, we proposed some suggestions for Hong Kong entrepreneurship. First, the universities need to consider providing relevant education that can influence their personality traits such as risk taking propensity, tolerance for ambiguity, creativity and social

networking. Second, although ranking 3rd in "ease of doing business" shows that the entrepreneurial environment in Hong Kong is very favorable (World Bank, 2020), most young people still poorly understand the entire entrepreneurial environment and have insufficient knowledge. Therefore, the government should broaden its channels of entrepreneurship policy advocacy. Third, in our initial survey, only 15.6 % of young people have received entrepreneurial education or training. To some extent, poor entrepreneurial knowledge and skills limit their entrepreneurial ideas. Government, enterprises and universities should cooperate to launch more entrepreneurship courses to benefit the youths. At the same time, entrepreneurship education should provide more entrepreneurial resources (such as funding, consulting, and exchanges with business leaders) and entrepreneurial opportunities (such as business competitions) since 66.0% agree that people would start a business if given the opportunity and resources.

This study only provided the percentage of the five-Point Likert Scale. Further study can examine the relationships between the personality traits and entrepreneurial intention and preparation as well as the relationships between their perceptions of the institutional environment and entrepreneurial intention and preparation.

Acknowledgements

This paper was supported by the Strategic Public Policy Research Funding Scheme from the Policy Innovation and Co-ordination Office of the Government of the HKSAR (S2020.A1.033.20S) and matching fund by the City University of Hong Kong (9678240).

References

Ajzen, I. (1991) "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol 50, No. 2, pp 179-211.

Bosma, N., Hessels, J., Schutjens, V., Van Praag, M., & Verheul, I. (2012) "Entrepreneurship and role models". *Journal of Economic Psychology*, Vol 33, No. 2, pp 410-424.

Busenitz, L. W., Gomez, C., & Spencer, J. W. (2000) "Country institutional profiles: Unlocking entrepreneurial phenomena", *Academy of Management Journal*, Vol 43, No. 5, pp 994-1003.

Oftedal, E. M., Iakovleva, T. A., & Foss, L. (2018) "University context matter: An institutional perspective on entrepreneurial intentions of students", *Education + Training*, Vol 60, No. 7/8, pp 873-890.

Peng, C. H., (2019) "Relying on the construction of Guangdong-Hong Kong-Macao Greater Bay Area to promote the integration of Hong Kong youth into national development", *Journal of Guangdong Administration Institute,* Vol 31, No. 2, pp 41-50.

Tarling, C., Jones, P., & Murphy, L. (2016) "Influence of early exposure to family business experience on developing entrepreneurs", *Education + Training*, Vol 58, No. 7-8, pp 733-750.

Wannamakok, W., & Chang, Y. Y. (2020) "Institutional environments and social entrepreneurial intentions: a case of Thailand", *Review of Integrative Business and Economics Research*, Vol 9, No. 1, pp 97-111.

World Bank. (2020) "Ease of doing business ranking", [online], https://www.doingbusiness.org/content/dam/doingBusiness/pdf/db2020/Doing-Business-2020_rankings.pdf

Late Submissions

Gender Bias in Idea Generation and the Evaluation of Creative Ideas: An Online Behavioural Experiment

Jo'Anne Langham, Caihui (Veronica) Lin, Anna Jenkins, Ivano Bongiovanni, Karolina Mikolajewska-Zajac and Neil Paulsen,
University of Queensland Business School, Brisbane, Australia
j.langham@business.uq.edu.au
v.lin@business.uq.edu.au
a.jenkins@business.uq.edu.au
i.bongiovanni@business.uq.edu.au
k.mikolajewska@uq.edu.au
n.paulsen@uq.edu.au

Abstract: Generating and selecting profitable ideas to solve complex problems, is essential to entrepreneurship. However, such choices are heavily influenced by personal bias. Entrepreneurship is framed as a "masculine world" (Bird and Brush, 2002). Entrepreneurs rely heavily on creativity, risk-taking and divergent thinking which are deemed to be predominantly masculine traits (Cropley, 2006). The majority of investment decision-makers are also male (Brush et al., 2018). Investors are critical in determining whether an idea will be further developed. The compounding effect is the inequitable distribution of funding and low rates of success for female founders. A significant factor in the divergence of treatment between men and women entrepreneurs is gender bias. However, we believe that innovative ideas are also gendered and that this is what influences selection. We conducted experiments to understand the impact of gender bias in creative group processes when using the divergent-convergent (diamond) approach for ideation. Our aim was to explore whether individuals selected ideas due to the creator's identity or whether ideas perceived as "feminine" or "masculine" influences choice. Furthermore, we examined whether males were more creative and produced more divergent ideas than females. Using an electronic brainstorming system (EBS) we engaged 230 innovation and entrepreneurship university students in vignette-style ideation and evaluation challenges. Results showed no significant differences between genders in creativity, novelty, or usefulness ratings. However, "feminine" ideas were rated higher by females on all (but one) criteria and males rated "masculine" ideas higher on all criteria. Our results demonstrate a sex-based preference for gendered ideas in both sexes. Females were rated higher on divergent ideas and males higher on convergent ideas, which conflicts with the established view of male dominance. The experiment showed that the EBS system mitigated social cues around identity and reduced the impact of gender bias on creative evaluation. This research raises concern about investment in innovation and whether "masculine" preferred solutions are inevitable in a male-dominated funding environment. This research contributes to an understanding of the influence of finance on the success of economic or profit-focused innovations (masculine) as opposed to those that address social outcomes or community good (feminine).

Keywords: social entrepreneurship; gender bias; design-led innovation; decision-making, sex-role attributes

1. Introduction

Most innovation requires funding and support for the further development and experimentation of ideas. Innovative ideas are conceived by entrepreneurs who, through resourcefulness, nous, and business ingenuity, develop and market their solution. The first step in this difficult journey is often identifying and commissioning finance. The global Covid-19 pandemic highlighted a strong gender-based bias in funding for entrepreneurs. In 2020, female entrepreneurs received only 2.3% of available global venture capital funding (Bittner and Lau, 2021) and were 20% more likely to report a business closure due to the pandemic (Kelly and Majbouri, 2021). Funding sources were predominantly male, with only 5.8% by female investors compared to 8.2% of males (Kelly and Majbouri, 2021).

There are several factors that have produced such a startlingly unbalanced playing field. The most significant factor in the gender funding gap is bias against women in terms of selection or evaluation of ideas (Brush and Greene, 2014). Research shows that during times of economic pressure, investors systematically perceive female entrepreneurs as less attractive for investment opportunities in comparison to their male counterparts (Bigelow et al., 2014). Investment decisions are influenced by stereotypes aligned to characteristics associated with the different genders. such as "competence and warmth" (Fiske et al., 2002) or "credibility and competence" (Bigelow et al., 2014). Stereotypes or bias create the perception that investing in women-led enterprises is riskier. Other research showing under-representation of women as entrepreneurs, focuses on poor entrepreneurial education (Wilson et al., 2007), social expectations (García and Welter, 2013), traits and image

(Gupta et al., 2014), communication (Bird and Brush, 2002) and self-efficacy (Mueller and Dato-On, 2008) which either lead to reduced support or lower intention in females to undertake business ventures.

Feminine stereotyped behaviours lower investor evaluation of venture pitches (Balachandra et al., 2019) and entrepreneurial growth expectations (Martiarena, 2022). Feminine characteristics also trigger stereotyped threat response (Steele et al., 2002) which reduces female performance. Conversely, women who display masculine traits are perceived negatively and experience backlash or roadblocks according to role congruity theory (Eagly and Karau, 2002). However, research shows women are as capable as men in all aspects of entrepreneurship, having the skills or human capital to recognise and develop potential opportunities (Detienne and Chandler, 2007).

Stereotypes of entrepreneurial characteristics goes beyond basic gender bias. Fisk et al (Fiske, Cuddy, Glick, & Xu, 2002) illustrated how bias and stereotypes are closely aligned to characteristics displayed rather than gender. Their model showed two influential dimensions of "competence" and "warmth" as primary determinants of stereotypes. These characteristics are similar to many other researchers' descriptions in perceptions research such as Asch (1946) cold-warm, competence related (Hamilton and Fallot, 1974) and personality traits (Lydon et al., 1988). Researchers (Dimitriadis et al., 2018) found that "Agreeableness", "Openness to Experience", "Conscientiousness", and "Extraversion" were positively associated with creativity. Entrepreneurs are believed to be more creative if they model these 'masculine' traits.

The performance of women entrepreneurs are also evaluated on 'masculine' success criteria which does not apply to all types of entrepreneurship (Yousafzai et al., 2022). Social entrepreneurs are often less concerned with profit and wealth than overall social good and the outcome of their venture (Zahra et al., 2009). Social entrepreneurs are motivated by many diverse and interrelated objectives not associated with traditional or commercially driven entrepreneurship. Largely, social entrepreneurs are women and they generate considerable social value and change in parts of the world such as Pakistan, India, Africa and Sri Lanka (Zahra et al., 2009). In these sectors women are also involved heavily in micro-entrepreneurship which is also devalued against the profit-wealth success criteria (Zahra et al., 2009).

1.1 The role of bias in selection of creative ideas

Bias undermines the creative process as well as the successful implementation of any innovation. Bias in the creative process negatively impacts group creativity. In groups, the most common ideas are often shared because these will be the ones most likely accepted by all (Abele and Stasser, 2019). There are many examples of bias exhibited when people work together to solve problems such as groupthink (Grohowski et al., 1990, Kim, 2018), social loafing/free riding (Coursey et al., 2018), the ideator's own bias (Fuchs et al., 2019), insight bias (Lucas and Nordgren, 2022), ownership bias (Zheng and Miller, 2019) and self-censorship (Williams, 2002). Participants in group processes may also be biased towards self-generated concepts or other salient viewpoints and may prefer conventional ideas due to the associated risk with new ideas (Toh and Miller, 2016). Evaluation of creative ideas is also influenced by emotions. People who are in a positive mental frame are more likely to rate all ideas (both creative and non-creative) higher (Mastria et al., 2019).

Creative evaluation is fraught with subjectivity and biases due to people's poor understanding of creativity and a lack of clear evaluation criteria. For instance, Elsbach et al. (2003) found experts in Hollywood used behavioural and physical cues to match pitchers with a variety of prototypes in their head, while Mueller et al. (2018) found that decision-makers rely on social approval cues to assess ideas. In both cases, the cues the assessors draw on have little or no relationship to the quality of the ideas per se.

Research has also shown assessment of creative ideas can be heavily influenced by decision makers personal preferences (Mueller et al., 2018). The usefulness or value of an idea is closely related to social approval and economic mindset: a tendency to prioritise concerns at the heart of economics such as accuracy, rationality and self-interest rather than potential novelty or originality (Molinsky et al., 2012). Social context and approval cues have a significant influence on the evaluation of creative ideas causing highly valuable (and desirable) ideas to be downgraded due to a lack of alignment with a decision maker's views. Decision makers tend to reject financially uncertain ideas or innovations, which are often more creative (Huang and Wu, 1994).

1.2 Why is understanding and negating bias in creativity evaluation important?

Creativity is essential for innovation (Amabile, 1988), is a fundamental dimension of entrepreneurship (Fillis and Rentschler, 2010) and is seen as being as one of the most important skills of the future (Lombardo, 2010). Solving the great and complex problems of the world, requires creativity.

However, creativity is ascribed primarily to men, even when women have produced identical output (Luksyte et al., 2018, Proudfoot et al., 2015b). Gender based stereotypes of creative capability significantly impede the progress of female creators and innovators. The rejection, dismissal or undervaluing of ideas from women, means opportunities lost or significant delays in urgent solutions for complex problems. Prejudice reduces creativity and the progress of innovation (Rasch and Hain, 2017). Furthermore, perceived creativity rather than actual creativity, is increasingly rewarded in the corporate world. Proudfoot et al. (Proudfoot et al., 2015b), show that it is society's layman understanding of creativity, that determines whether an individual or their idea is deemed creative, not by a true measure of creative utility. Given characteristics ascribed principally to men such as "daring", "autonomy" and "self-direction" (Proudfoot et al., 2015b) are apparent signals of creativity, then the corporate world is simply valuing and rewarding men for being male. Providing clarity and unbiased evaluation of creativity is necessary to uncover authentic innovation and to stop a self-reinforcing system feedback loop based on prejudice.

A systematic review of the literature revealed no consistency of the impact of gender on creativity (Nakano et al., 2021). Most of the research into assessing creative capability used self-reporting psychological instruments (such as surveys) and did not assess the actual performance of creative tasks (Nakano et al., 2021). Despite the abundance of research into the subject of creativity, there is no evidence of dominance of capability between men and women (Baer and Kaufman, 2008).

1.3 Our research and hypothesis

Although research clearly demonstrates gender bias in entrepreneurship, little is known about strategies to mitigate bias in assessment of creativity and ingenuity. Research in a variety of fields show few effective approaches. Attempts to reduce gender bias through training, has been shown to have little success (Dobbin et al., 2007). One tactic has been shown to offer counter-stereotypical effect in an employee recruitment scenario, in which assessors evaluate people jointly rather than separately, but its effect has not been examined in a creativity context (Bohnet et al., 2016). Blind reviews to reduce cues have yielded poor results, and in some cases worsened the effect (Tricco et al., 2017). The use of structured free recall (SFR) has been shown to have some positive effects on the evaluation of female leaders, even with individuals that held strong explicit stereotypes (Anderson et al., 2015).

Removing names for identification of gender has potential in reducing bias in evaluation. In an experiment to assess the impact of unconscious gender bias in the review of six academic articles written by both man and women, where the article appeared to be written by a man, they were evaluated as better crafted (Goldberg, 1968). Alternatively, an experiment conducted with students to evaluate female advertising executives in a predominantly male environment, researchers removed the first name of the person being assessed to prevent cues on gender (Roca et al., 2016). The results showed no significant difference in the evaluation of creative outcome between genders. Measures that seek to reduce social cues and remove signalling may provide solutions that improve equity in evaluation, support and funding.

Building on the research on gender biases in creativity evaluation (Luksyte et al., 2018, Proudfoot et al., 2015b) we seek to clarify and measure difference in evaluation of creativity between genders as well determine the role of feminine and masculine traits in creativity. Our study focuses on the following questions:

- Are ideas proposed by females rated less than those proposed by males in terms of creativity?
- Do *novelty* and *usefulness* carry different weights in the evaluation of males' and females' creativity?
- Are females rated less when the problem is perceived to be "masculine"?
- Is there a difference in the evaluation of "feminine" versus "masculine" ideas by the genders?
- Are ideas proposed by males more divergent?

Creativity is believed to be comprised of two dimensions: novelty and usefulness (Amabile, 1988, Amabile, 1982, Amabile, 1983, Sarkar and Chakrabarti, 2011, Harvey and Berry, 2022). Studies examining the two dimensions separately have yielded useful insights (Sue-Chan & Hempel, 2016). However, it is not known whether the two dimensions will weigh the same in the evaluation of males' and females' creativity and whether females' creativity will be downgraded in both aspects and be penalized in one aspect more than another. We used the existing measures of creativity (Sue-Chan & Hempel, 2016) and the conceptualisation of divergent-convergent thinking as discussed by Proudfoot et al. (2015b) to explore the research questions.

2. Research design

2.1 Method

We developed an online experiment where individuals participated in a complete creative process of idea generation, expansion, integration and evaluation. Participants interacted with SparkTank [an electronic brainstorming tool (EBS)] during a facilitated workshop. SparkTank uses the divergent-convergent process from design thinking and enables individuals or groups to participate in ideation in a digital environment.

Participants were invited to register, create a profile and then engage in an idea generation session on the platform. Participants selected an avatar to represent their gender (colour coded). The process involved a facilitator directing ideation simultaneously for the whole group through a "control room" screen which 'pushed' each step of the idea generation process to participants. Each participant was encouraged to submit as many ideas as possible within a set time to address the challenge question. When the time had elapsed, the platform randomly reassigned ideas to other people to extend or improve. The process used the "Yes, and…" method used in theatre improvisation. When the time allocated for this step had elapsed, the facilitator activated the third step in the process. Each participant was shown their original ideas along with the additions or suggestions from other participants. Each participant was given the opportunity to reshape and submit final ideas. When the time for this step elapsed, the facilitator activated the last step in the process. Each person was randomly assigned completed ideas (displaying the contributions from other participants) to be evaluated on our criteria. The platform used the scores from the criteria to provide an overall rating. The rating given to each idea was shown as a percentage. Finally, participants were shown the leaderboard with all ideas scored.

2.2 Procedure

A "feminine" and a "masculine" challenge were conducted online using Zoom video conferencing concurrently with SparkTank. A sample of students (n=230) were invited from the University of Queensland courses (EIBS7300 Creativity and Innovation Design and TIMS1301 Entrepreneurial Mindset & Idea) to participate. To foster commitment, the task was integrated in the university course offering and details were explained to students in class. The experiment was conducted between April and August 2021. The feminine challenge (Figure 1) was on the topic of sustainable fast fashion (Fast Fashion) and the masculine topic, a sustainable football talent pipeline (Football Pipeline). We used the definition of masculine and feminine by Proudfoot et al (2015b, 2015a) and Prentice and Carranza (2002), a *masculinized orientation* being: agentic, independent, distinctive, intelligent, decisive, competitive, self-reliant, willing to take risks, ambitious, daring, adventurous, courageous; and a *feminine orientation* being interconnectedness, harmony, communal, sensitive, cooperative, understanding of others, helpful to others, sympathetic, nurturing, warm in relations with others, and supportive. Each challenge took approximately 30 minutes.

Fashion problem and a solution
How do we create a planet-friendly sustainable approach to fast fashion in the future?
Description of the problem:
The term 'fast fashion' has become more prominent in conversations surrounding fashion, sustainability and environmental consciousness. The term refers to 'cheaply produced and priced garments that copy the latest catwalk styles and get pumped quickly through stores in order to maximise on current trends'. The fast fashion model is a system involving rapid design, production, distribution and marketing, which means that retailers are able to pull smaller quantities of greater product variety and allow consumers to get more fashion and product differentiation at a low price. Fashion production has a massive impact on global emissions (10% global emissions are due to fashion). The production of fashion uses water, pollutes rives and increases landfill through waste.
Fast fashion however, has made it possible for all people to wear clothes that match the latest trends. For many people this provides a means of crossing cultural, class or socio-economic barriers. As clothing has become cheaper, people with low income are able to enjoy the thrill of buying something that they want and not have to sacrifice purchases in comparison to basic living expenses. Fast fashion is successful for many reasons such as: shopping is fun; fast fashion is affordable; many style choices; and its available everywhere.
(Read more here: https://earth.org/fast-fashions-detrimental-effect-on-the-environment/)

Who is impacted: consumers with low to medium income, because they can have things that they could not normally afford.

Assumptions:

1. That fast fashion is environmentally unsustainable
2. That fast fashion is cheap
3. That fast fashion is convenient
4. That environmentally sustainable fashion is more expensive
5. That environmentally sustainable fashion is often not "on trend"

Focus areas:
Social identity and behaviour
What solutions can you provide that provide sustainable approaches to fashion, but still cater to individual need to respond to latest trends, enjoy creating an individual identity, the thrill of looking good and the fun of shopping.

Accessibility and affordability
What solutions can you think of that will make fashion affordable, accessible and available for all people whilst still being sustainable?

Figure 1: Vignette of challenge on "Fast Fashion Sustainability"

The evaluation criteria for assessment were adapted from Sue-Chan and Hempel's (2016) exploration of the factors of creativity (novelty and usefulness). Novelty and usefulness are a multiplied measure and are therefore believed to only produce creativity if both factors exist (greater than zero) (Sarkar and Chakrabarti, 2007).

Table 1: Measures of novelty, usefulness and creativity

Independent variables		
Factor	Description	Scale
Novelty	A fresh approach was taken to solve the problem	(Disagree 1 – agree 5)
Novelty	The solution is out of the box	(Disagree 1 – agree 5)
Novelty	The solution to the problem is unprecedented	(Disagree 1 – agree 5)
Novelty	The solution is different from traditional ways of doing things	(Disagree 1 – agree 5)
Usefulness	Other contributor's ideas are combined in a constructive manner	(Disagree 1 – agree 5)
Usefulness	The solution focused on the needs of the user	(Disagree 1 – agree 5)
Usefulness	The solution develops adequate plans for the implementation of new ideas	(Disagree 1 – agree 5)
Usefulness	The solution identifies opportunities for its implementation	(Disagree 1 – agree 5)
Dependent variables		
NOVELTY	How original and practical is the solution? – Original and practical solutions are both totally unique and especially useful	(1 Not very original and practical – 5 very original and practical)
USEFULNESS	How adaptive and practical? Adaptive and practical solutions use existing information or materials to develop ideas that are useful	(1 Not very adaptive and practical – 5 very adaptive and practical)
CREATIVITY	How creative is this solution? Creativity refers to the extent to which the solution is both original and useful	(1 Not very creative – 5 very creative)

3. Analysis

For the *Fast Fashion* challenge, a total of 284 ideas were generated, the *Football Pipeline* challenge generated 217 ideas. Out of those, 148 in the *Fast Fashion* challenge (52%) and 125 (57%) ideas were retained. Incomplete data, meaning the ideas were not rated by at least 3 other students and/or the gender of their author was missing and could not be reassigned, was discarded. In the Fast Fashion challenge females contributed 44% of the ideas and males 56%. For the *Football Pipeline* challenge females contributed 47% of the ideas and males 53%.

The data was coded and interrogated in several different ways. Firstly, all ideas at every step were open coded (in NVIVO) according to theme over several passes of the data and cross checked amongst the research team to ensure consistency. Concurrently, each integrated final idea was coded by three researchers according to whether it was considered a masculine or feminine idea as well as on the divergent-convergent criteria. The thematic coded data from NVIVO was then merged with the screened data file that included the systematic coding for masculine-feminine ideas and the convergent-divergent codes. All descriptives and frequencies were checked to ensure no further missing data.

4. Results

ANOVAs were conducted to determine difference in ratings on all 11 creativity criteria according to gender. In both the *Fast Fashion* and the *Football Pipeline* challenge there were no significant difference in the ratings in on the usefulness, novelty, and creativity factors, according to gender. There were also no differences in overall individual creativity scores for either males or females.

ANOVAs were also conducted on all ideas according to the masculine-feminine dimensions, revealing several significant differences. Ratings provided by males were compared with ratings provided by females on masculine and feminine coded ideas. Generally, males rated higher than females on all criteria across both challenges. Where ideas were classified as gendered, females rated feminine ideas higher than males and males rated masculine ideas higher than females. The difference in rating patterns was more pronounced in the *Fast Fashion* challenge.

Analysis of the differences in means between male and female ideas according to the divergent-convergent criteria showed inconsistent ratings across the two challenges.

In the *Fast Fashion* (feminine) challenge, females scored highest scores for divergent thinking on overall creativity as well as the two factors: novelty and usefulness with the *Thinking out of the box* criteria for divergence. Males were also significantly higher on the convergent criteria *Building on tradition* across all factors. However, females were rated higher than males on the convergent criteria *Bringing perspectives together* and males were rated higher across all factors in the *Adopting a perspective distinct from others* (divergent) criteria.

In the *Football Pipeline* challenge, males scored highest on two different set of convergent criteria: *Following what others have done* and *Connecting the dots.* Females scored higher on two divergent criteria in the novelty factor *Thinking outside the box* and *Disregarding tradition.* In both challenges, females rated higher on divergent criteria and males rated higher on convergent criteria.

4.1.1 Fast Fashion challenge results

On all but one characteristic, males rated masculine ideas higher than females (Figure 2). Similarly, females rated 6 of the 12 characteristics higher than males on feminine ideas. Where ideas were coded as "neutral" (neither male nor female), four questions had significant difference in ratings between genders. Each of the questions were rated higher by males.

4.1.2 Football Pipeline challenge results

In the Football Pipeline challenge, ratings for masculine ideas showed no difference between genders on seven of the 11 criteria (Figure 3). However, males rated masculine ideas on three criteria and females rated masculine ideas higher on one criterion: *This solution identifies opportunities for its implementation*. Feminine ideas were also mostly rated higher by males (Figure 3).

4.2 Differences in rating according to divergence-convergence

The divergent-convergent ratings showed significant differences between males and females across the two challenges. ANOVAs were conducted across all the individual variables as well as on the total overall rating. The two tables below summarise the highest ratings according to gender on the divergent and convergent criteria. ANOVAs were also conducted on the novelty, usefulness and creativity scores. Divergent ideas were rated higher than convergent ideas on all divergent-convergent pairs except the *Adopting a perspective distinct from others – bringing perspectives together*, where convergent ideas were rated higher.

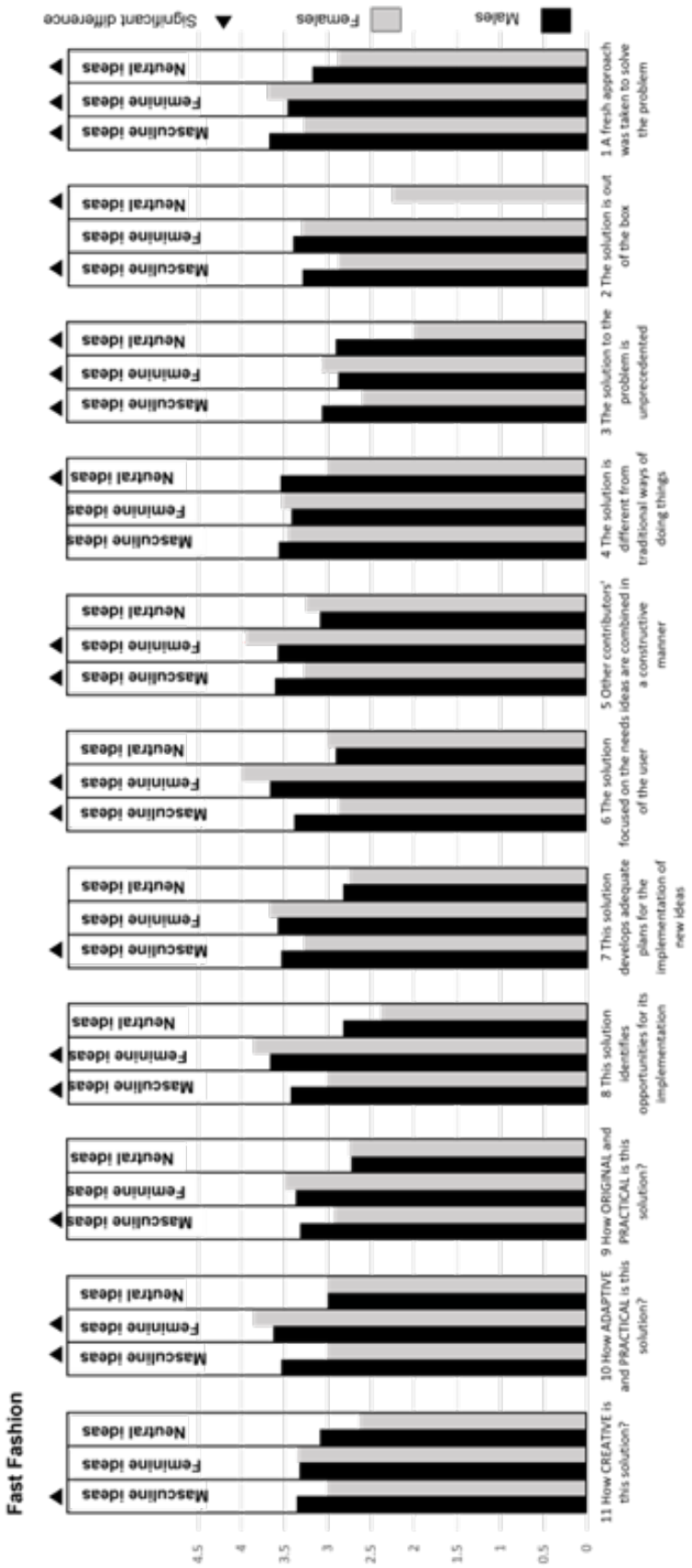


Figure 2: Fast Fashion results across all creativity criteria

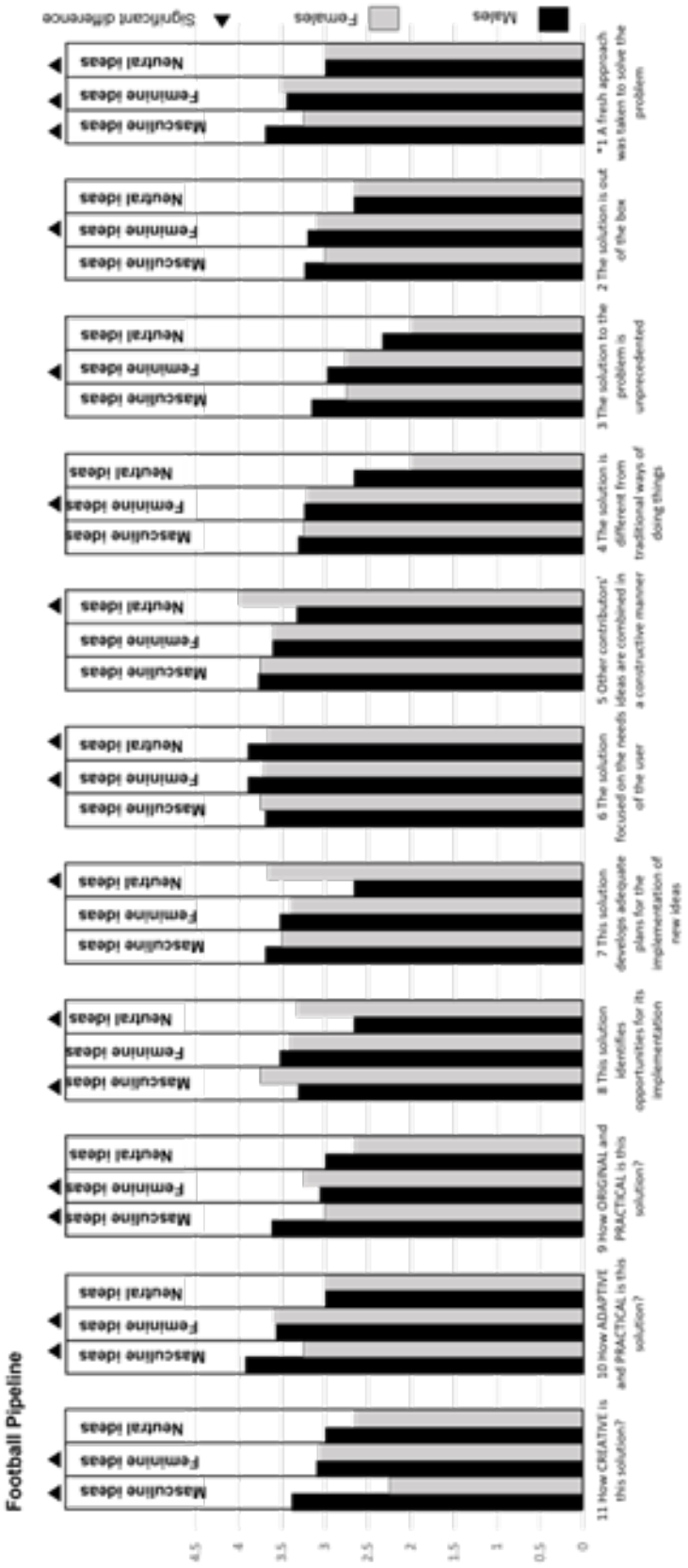


Figure 3: Football Pipeline results across all creativity criteria

Table 2: Highest rated gender on the divergent-convergent criteria Fast Fashion

Divergent-convergent pairs	Usefulness	Novelty	Overall creativity
Thinking outside the box (divergent)	female	female	female
Connecting the dots (convergent)	X	male	male
Disregarding tradition (divergent)	X	X	X
Building on tradition (convergent)	male	male	male
Going against what others have done (divergent)	X	male	X
Following what others have done (convergent)	X	X	X
Adopting a perspective distinct from others (divergent)	male	male	male
Bringing perspectives together (convergent)	female	X	X

X indicates no significant difference between ratings

Table 3: Highest rated gender on the divergent-convergent criteria Football Pipeline

Divergent-convergent pairs	Usefulness	Novelty	Overall creativity
Thinking outside the box (divergent)	X	females	X
Connecting the dots (convergent)	X	male	male
Disregarding tradition (divergent)	X	female	X
Building on tradition (convergent)	X	X	X
Going against what others have done (divergent)	X	X	X
Following what others have done (convergent)	male	male	male
Adopting a perspective distinct from others (divergent)	male	X	X
Bringing perspectives together (convergent)	X	X	male

X indicates no significant difference between ratings

5. Discussion and conclusion

Our results show no apparent gender-bias in generating and evaluating novelty, usefulness or creativity of an idea when using an EBS. Both the feminine and masculine challenges had an equivalent number by proportion, of masculine and feminine solutions. Even though we asked participants to associate a gendered avatar to their identity as a form of social signalling, this did not have any discernible effect on the ratings people gave to other's ideas for creativity scores. The use of a digital tool, where participants were all remotely participating in the ideation process, reduced or mitigated any stereotyped gender associations with ideas. Technology has potential to remove social cues that create stereotypes and influence perceptions of innovative ideas.

Females and males also had similar distributions of scores across all factors. Therefore, neither males nor females were shown as having dominant creative capability. However, the process did reveal a distinct preference for females to rate "feminine" ideas higher, and males to rate "masculine" ideas higher when the challenge was "feminine" despite the gender of the idea creator. The *Football Pipeline* challenge results showed higher ratings by males on both feminine and masculine ideas. The higher ratings on all factors reveal males appeared less discerning than females and had different standards when evaluating creativity.

Results also showed ideas created by females were rated higher on divergence and males higher on convergence criteria in both challenges. This result challenges the firmly held belief that men are more divergent in their thinking and are therefore more creative (Proudfoot et al., 2015b). Men may be *perceived* as being more divergent in their thinking, but the experiment showed that females produced more ideas that were divergent, and thus potentially more creative.

Creative performance, such as ideation is not dominated by either gender. However, stereotypes and unconscious bias impact evaluation of ideas at a fundamental level. Ideas themselves are "feminine" and "masculine" and therefore may be evaluated differently depending on the framing of the challenge. The results in our research, raise a fundamental question about how we value attributes or characteristics associated with masculinity or femininity and how these contribute to our view of "best" solutions. Our research contributes to understanding the impact of bias on the effectiveness and selection of innovations as well as problem solving for the greater good.

References

Abele, S. & Stasser, G. 2019. "Group Creativity and Collective Choice". *In:* PAULUS, P. B. & NIJSTAD, B. A. (eds.) *The Oxford Handbook of Group Creativity and Innovation.* Oxford University Press.

Amabile, T. M. 1982. "Social psychology of creativity: A consensual assessment technique". *Journal of personality and social psychology,* 43**,** 997-1013.
Amabile, T. M. 1983. "The social psychology of creativity: A componential conceptualization". *Journal of personality and social psychology,* 45**,** 357-376.
Amabile, T. M. 1988. "A model of creativity and innovation in organizations". *Research in organizational behavior,* 10**,** 123-167.
Anderson, A. J., Ahmad, A. S., King, E. B., Lindsey, A. P., Feyre, R. P., Ragone, S. & Kim, S. 2015. "The effectiveness of three strategies to reduce the influence of bias in evaluations of female leaders". *Journal of Applied Social Psychology,* 45**,** 522-539.
Asch, S. E. 1946. "Forming impressions of personality". *Journal of abnormal and social psychology,* 41**,** 258-290.
Baer, J. & Kaufman, J. C. 2008. "Gender Differences in Creativity". *The Journal of Creative Behavior,* 42**,** 75-105.
Balachandra, L., Briggs, T., Eddleston, K. & Brush, C. 2019. "Don't Pitch Like a Girl!: How Gender Stereotypes Influence Investor Decisions". *Entrepreneurship theory and practice,* 43**,** 116-137.
Bigelow, L., Lundmark, L., Mclean Parks, J. & Wuebker, R. 2014. "Skirting the Issues". *Journal of Management,* 40**,** 1732-1759.
Bird, B. & Brush, C. 2002. "A Gendered Perspective on Organizational Creation". *Entrepreneurship Theory and Practice,* 26**,** 41-65.
Bittner, A. & Lau, B. 2021. "Women-Led Startups Received Just 2.3% of VC Funding in 2020". *Harvard Business Review.* Boston: Harvard Business Publishing.
Bohnet, I., Van Geen, A. & Bazerman, M. 2016. "When Performance Trumps Gender Bias: Joint vs. Separate Evaluation". *Management science,* 62**,** 1225-1234.
Brush, C., Greene, P., Balachandra, L. & Davis, A. 2018. "The gender gap in venture capital- progress, problems, and perspectives". *Venture capital (London),* 20**,** 115-136.
Brush, C. & Greene, P. G. B., L.
Davis, A. 2014. "Women Entrepreneurs 2014: Bridging the Gap in Venture Capital".
Coursey, L. E., Paulus, P. B., Williams, B. C. & Kenworthy, J. B. 2018. "Chapter 14 - The Role of Individual Differences in Group and Team Creativity". *In:* REITER-PALMON, R., KENNEL, V. L. & KAUFMAN, J. C. (eds.) *Individual Creativity in the Workplace.* Academic Press.
Cropley, A. 2006. "In Praise of Convergent Thinking". *Creativity Research Journal,* 18**,** 391-404.
Detienne, D. R. & Chandler, G. N. 2007. "The Role of Gender in Opportunity Identification". *Entrepreneurship Theory and Practice,* 31**,** 365-386.
Dimitriadis, E., Anastasiades, T., Karagiannidou, D. & Lagaki, M. 2018. "Creativity and Entrepreneurship: The role of Gender and Personality". *International Journal of Business and Economic Sciences Applied Research,* 11**,** 7-12.
Dobbin, F., Kalev, A. & Kelly, E. 2007. "Diversity management in corporate America". *Contexts,* 6**,** 21-27.
Eagly, A. H. & Karau, S. J. 2002. "Role congruity theory of prejudice toward female leaders". *Psychological review,* 109**,** 573-598.
Elsbach, K. D. & Kramer, R. M. 2003. "Assessing Creativity in Hollywood Pitch Meetings: Evidence for a Dual-Process Model of Creativity Judgments". *Academy of Management journal,* 46**,** 283-301.
Fillis, I. & Rentschler, R. 2010. "The role of creativity in entrepreneurship". *Journal of Enterprising Culture,* 18**,** 49-81.
Fiske, S. T., Cuddy, A. J. C., Glick, P. & Xu, J. 2002. "A Model of (Often Mixed) Stereotype Content: Competence and Warmth Respectively Follow From Perceived Status and Competition". *Journal of personality and social psychology,* 82**,** 878-902.
Fuchs, C., Sting, F., Schlickel, M. & Alexy, O. 2019. "The Ideator's Bias: How Identity-induced Self-efficacy Drives Overestimation in Employee-driven Process Innovation". *Academy of Management Journal*.
García, M.-C. D. & Welter, F. 2013. "Gender identities and practices: Interpreting women entrepreneurs' narratives". *International Small Business Journal: Researching Entrepreneurship,* 31**,** 384-404.
Goldberg, P. 1968. "Are women prejudiced against women?". *Society,* 5**,** 28-30.
Grohowski, R., Mcgoff, C., Vogel, D., Martz, B. & Nunamaker, J. 1990. "Implementing Electronic Meeting Systems at IBM: Lessons Learned and Success Factors". *MIS Quarterly,* 14**,** 369-383.
Gupta, V. K., Goktan, A. B. & Gunay, G. 2014. "Gender differences in evaluation of new business opportunity: A stereotype threat perspective". *Journal of Business Venturing,* 29**,** 273-288.
Hamilton, D. L. & Fallot, R. D. 1974. "Information salience as a weighting factor in impression formation". *Journal of personality and social psychology,* 30**,** 444-448.
Harvey, D. S. & Berry, D. J. 2022. "Toward a meta-theory of creativity forms: How novelty and usefulness shape creativity". *Academy of Management Review,* 0**,** null.
Huang, P. H. & Wu, H. M. 1994. "More order without more law - A theory of social norms and organizational cultures". *Journal of Law Economics & Organization,* 10**,** 390-406.
Kelly, D. J. S., Jeffrey & Majbouri, M. B., Candida G. 2021. "GEM 2020/21 Women's Entrepreneurship: Thriving Through Crisis". *In:* BABSON COLLEGE, L. B. S. (ed.) *Global Entrepreneurship Monitor.* Babson Park, MA: Babson College.
Kim, M. J. 2018. "Group Positive Affect Diversity and Group Creativity: Mediating Role of Groupthink and Moderating Role of Affective Fit Perception". *Indian Journal of Public Health Research & Development,* 9.
Lombardo, B. J. R., D. J. 2010. "Cultivating organizational creativity in an age of complexity: A companion study to the IBM 2010 Global Chief Human Resource Officer Study".

Lucas, B. J. & Nordgren, L. F. 2022. "Lay people's beliefs about creativity: evidence for an insight bias". *Trends in Cognitive Sciences,* 26**,** 6-7.

Luksyte, A., Unsworth, K. L. & Avery, D. R. 2018. "Innovative work behavior and sex-based stereotypes: Examining sex differences in perceptions and evaluations of innovative work behavior". *Journal of Organizational Behavior,* 39**,** 292-305.

Lydon, J. E., Jamieson, D. W. & Zanna, M. P. 1988. "Interpersonal similarity and the social and intellectual dimensions of first impressions". *Social cognition,* 6**,** 269-286.

Martiarena, A. 2022. "How gender stereotypes shape venture growth expectations". *Small Business Economics,* 58**,** 1015-1034.

Mastria, S., Agnoli, S. & Corazza, G. E. 2019. "How does emotion influence the creativity evaluation of exogenous alternative ideas?". *PLOS ONE,* 14**,** e0219298.

Molinsky, A. L., Grant, A. M. & Margolis, J. D. 2012. "The bedside manner of homo economicus: How and why priming an economic schema reduces compassion". *Organizational behavior and human decision processes,* 119**,** 27-37.

Mueller, J., Melwani, S., Loewenstein, J. & Deal, J. J. 2018. "Reframing the decision-makers' dilemma: Towards a social context model of creative idea recognition". *Academy of Management Journal,* 61**,** 94-110.

Mueller, S. L. & Dato-On, M. C. 2008. "Gender-role orientation as a determinant of entrepreneurial self-efficacy". *Journal of developmental entrepreneurship,* 13**,** 3-20.

Nakano, T. D. C., Oliveira, K. D. S. & Zaia, P. 2021. "Gender Differences in Creativity: A Systematic Literature Review". *Psicologia: Teoria e Pesquisa,* 37.

Prentice, D. A. & Carranza, E. 2002. "What Women and Men Should Be, Shouldn't be, are Allowed to be, and don't Have to Be: The Contents of Prescriptive Gender Stereotypes". *Psychology of Women Quarterly,* 26**,** 269-281.

Proudfoot, D., Kay, A. C. & Koval, C. Z. 2015a. "Creativity is Gendered: The Perceived Association Between Masculinity and Creative Ability". *Academy of Management Proceedings,* 2015**,** 13095-13095.

Proudfoot, D., Kay, A. C. & Koval, C. Z. 2015b. "A Gender Bias in the Attribution of Creativity: Archival and Experimental Evidence for the Perceived Association Between Masculinity and Creative Thinking". *Psychological Science,* 26**,** 1751-1761.

Rasch, A. R. & Hain, D. S. 2017. "Rethinking Interorganizational Collaboration: The Impact of Prejudice on Group Creativity in Ideation".

Roca, D., Tena, D., Lázaro, P. & González, A. 2016. "Is there gender bias when creative directors judge advertising? Name cue effect in ad evaluation". *International Journal of Advertising,* 35**,** 1008-1023.

Sarkar, P. & Chakrabarti, A. "Development of a method for assessing design creativity". DS 42: Proceedings of ICED 2007, the 16th International Conference on Engineering Design, Paris, France, 28.-31.07. 2007, 2007. 349-350 (exec. Summ.), full paper no. DS42_P_79.

Sarkar, P. & Chakrabarti, A. 2011. "Assessing design creativity". *Design Studies,* 32**,** 348-383.

Steele, C. M., Steele, C. M., Spencer, S. J. & Aronson, J. 2002. "Advances in Experimental Social Psychology Volume 34 Contending with group image: The psychology of stereotype and social identity threat". *Advances in Experimental Social Psychology***,** 379-440.

Sue-Chan, C. & Hempel, P. S. 2016. "The Creativity-Performance Relationship: How Rewarding Creativity Moderates the Expression of Creativity". *Human resource management,* 55**,** 637-653.

Toh, C. A. & Miller, S. R. 2016. "Creativity in design teams: the influence of personality traits and risk attitudes on creative concept selection". *Research in Engineering Design,* 27**,** 73-89.

Tricco, A. C., Thomas, S. M., Antony, J., Rios, P., Robson, R., Pattani, R., Ghassemi, M., Sullivan, S., Selvaratnam, I., Tannenbaum, C. & Straus, S. E. 2017. "Strategies to Prevent or Reduce Gender Bias in Peer Review of Research Grants: A Rapid Scoping Review". *PLOS ONE,* 12**,** e0169718.

Williams, S. D. 2002. "Self-esteem and the self-censorship of creative ideas". *Personnel Review,* 31**,** 495-503.

Wilson, F., Kickul, J. & Marlino, D. 2007. "Gender, Entrepreneurial Self–Efficacy, and Entrepreneurial Career Intentions: Implications for Entrepreneurship Education". *Entrepreneurship Theory and Practice,* 31**,** 387-406.

Yousafzai, S. Y., Henry, C., Boddington, M., Sheikh, S. & Fayolle, A. 2022. "*Research handbook of women's entrepreneurship and value creation",* Cheltenham, UK, Edward Elgar Publishing.

Zahra, S. A., Gedajlovic, E., Neubaum, D. O. & Shulman, J. M. 2009. "A typology of social entrepreneurs: Motives, search processes and ethical challenges". *Journal of business venturing,* 24**,** 519-532.

Zheng, X. & Miller, S. R. 2019. "Is Ownership Bias Bad? The Influence of Idea Goodness and Creativity on Design Professionals Concept Selection Practices". *Journal of mechanical design (1990),* 141.