Proceedings of the
23rd European Conference on Knowledge Management

A Conference hosted by
University of Naples Parthenope and
University of Naples Federico II, Italy
1-2 September 2022



VOLUME TWO

Edited by

Prof. Roberto Cerchione **Prof. Piera Centobelli**

A conference managed by ACI, UK

Proceedings of the

23rd European Conference on Knowledge Management ECKM 2022

Hosted By

University of Naples Parthenope and
University of Naples Federico II, Italy

1–2 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/

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 **VOLUME ONE:** 978-1-914587-45-0
E-Book ISBN **VOLUME TWO**: 978-1-914587-47-4
E-Book ISSN: 2048-8971
Book version ISBN: **VOLUME ONE** 978-1-914587-44-3
Book version ISBN **VOLUME TWO**: 978-1-914587-46-7
Book Version ISSN: 2048-8963

Published by Academic Conferences International Limited, Reading, UK
www.academic-conferences.org

Contents

Paper Title	Author(s)	Page No
Preface		xiii
Committee		xiv
Biographies		xvii
Research papers		
VOLUME ONE		
Techniques and technologies for managing COVID-19 related Knowledge: A Systematic Review	Wala Abdalla, Suresh Renukappa, Subashini Suresh and Khaled Algahtani	1
Knowledge Transfer in Doctoral Education During the Pandemic Time: An Exploratory Study of the PhD Students' Experiences	Rocco Agrifoglio, Paola Briganti, Maria Ferrara, Maria Luisa Iavarone, Rocco Reina, Luisa Varriale and Anna Maria Melina	10
Remote work and Knowledge Exchange Strategies in the Opinions of Generation Z	Anna Albrychiewicz-Słocińska	19
Managing Knowledge About Future of Work: A Model for Higher Education Institutions	Matheus Argôlo, Mauricio Miranda, Rodrigo Pagliusi, Yuri Oliveira de Lima, Herbert dos Santos, Carlos Eduardo Barbosa, Alan Lyra and Jano de Souza	28
A Model for an Effective Learning Process in Higher Education: An Example from Three use Cases	Aurilla Aurelie Bechina Arntzen, Tone Vold and Pedro J. Lara-Bercial	37
Managing Knowledge Towards firm Performance: The Moderation role of the Business Environment	Emmanuel Ebo Arthur and Jan Stejskal	44
Resistance to Digital Transformation: The role of middle Management Personal Networks	Konstantin Bagtationi, Thomas Wolfgang Thurner and Olga Gordienko	52
Measuring the Impact of a Shared Vision on the Perceived Meaningfulness	Lisa-Maria Baumgartner, Alexander Kaiser and Clemens Kerschbaum	60
Achieving Public Value in Universities Through Knowledge Management: The Need of Rationalization Regarding Investee Companies	Marco Berardi, Andrea Ziruolo,Fabrizia Fontana and Simone Cifolelli	68
Knowledge Discovery in Case Studies: The Case Insight Method for Case-Based Problem Solving	Marco Bettoni	79
Knowledge pills in Education and Training: A Literature Review	Ettore Bolisani, Enrico Scarso, Malgorzata Zieba, Susanne Durst, Alexandra Zbuchea, Anna M. Lis and Tomas Cherkos Kassaneh	89
Digitization and Business Intelligence at the Heart of a Business Strategy Within African Industries Funds	Jean-Pierre Booto Ekionea	97
Knowledge Dynamics and Phronesis in Performing Family Business	Constantin Bratianu and Adrian Motoc	107
Action Research as a Tool for Project Knowledge Management in the Projectified Public Organization	Kamila Brodzińska	115

Paper Title	Author(s)	Page No
Lifelong learning through knowledge-sharing & digital collaboration	Kay Brouwers, Wouter van Lelyveld, Emőke Takács and Toon Abcouwer	122
Does the level of Intellectual Capital Affect Meeting the Information Needs of Social Media Users in the Field of Sustainability? The case of the World's Largest Energy Industry Companies	Łukasz Bryl, Justyna Fijałkowska and Dominika Hadro	132
Role of Managers in Stimulating Innovativeness of Employees in Enterprises	Felicjan Bylok	143
Organizational Conditions associated with the sharing of Tacit and Explicit Knowledge in the financial sector in Colombia	Delio Ignacio Castaneda and Camilo Andrés Ramírez	152
The Impact of Ethical Leadership on Knowledge Management Processes: An Empirical Study on Healthcare Professionals in Turkey during the Pandemic Period	Ömer Çelik and Mustafa Sağsan	159
Innovation for Banking in the Covid-19 Era: The Role of Transformational Leadership and Knowledge Sharing	Sherine Al-Ahmad Chaar and Nasser Fathi Easa	171
The Intellectual Potential of Employees in Hospital Crisis Management During a Pandemic	Jolanta Chluska	180
Impact of ICT Strategy on Intellectual Capital, Quality of Service, and Financial Autonomy in Polish Hospitals	Andrzej Chluski	189
Developing User Personas as a way of Managing Knowledge About Ecolabnet Project Participants	Grzegorz Chmielarz	200
Improving the Offer for SMEs Through Managing Internal Competency Gaps in Ecolabnet Project: The Case of Czestochowa University of Technology (CUT)	Grzegorz Chmielarz and Robert Kuceba	210
Counterproductive Aspects of Remote Work in the Context of Exchange of Knowledge	Leszek Cichobłaziński	218
The Relationship Between Remote Work, Knowledge Sharing and Knowledge Hiding	Daniela Firmino Cidade, Mário Bissani and Mírian Oliveira	226
Knowledge Management for Smart Tourism: an exploratory survey in Abruzzo region	Simone Cifolelli, Andrea Ziruolo and Marco Berardi	236
Tacit Knowledge Transfer in Family Firms During Generational Succession	Concetta Lucia Cristofaro, Sabrina Bonomi, Rocco Reina and Marzia Ventura	245
Knowledge Management Practices in a Religious Organisation in South Africa	Chantall Cyster and Oghenere Salubi	252
The Organisation of Knowledge and Information Exchange in Remote Working Conditions in the Opinion of Generation Z	Aleksandra Czarnecka	260
Corporate Social Responsibility and Intellectual Capital in Sports and Leisure: The case of a Golf Club	Francesca Dal Mas, William Jupp, Maurizio Massaro, Carlo Bagnoli and Giuseppe Roberto Marseglia	269

Paper Title	Author(s)	Page No
Shared Decision-making in Trauma and Emergency Surgery Settings: A Literature Review	Francesca Dal Mas, Maurizio Massaro, Sarah Woltz, Federico Ruta, Fausto Catena, Paola Fugazzola, Luca Ansaloni and Lorenzo Cobianchi	278
FDI Spillover Channel and its Effect on Innovation	Raymond Darfo-Oduro and Jan Stejskal	289
Reconsidering Higher Education Organizations via ecosystem Thinking: Some Initial Thoughts	Zito de Boer, Daniel Dominguez van Tilburg, Jan Kamburg, Kyra Kronenberg, Max Kuppens, Emőke Takács and Toon Abcouwer	297
Towards Knowledge Governance in Public Administration	Fronika de Wit, Alice Lourenço, Hugo Moreira and Filipa Vala	307
Open Design: Exploring the Use of Open Knowledge in Service Design	Anıl Dinç Demirbilek and Onur Mengi	315
Do Entrepreneurial Ecosystems Matter in Knowledge Sharing Through Startups?	Roberta Dutra de Andrade, Paulo Gonçalves Pinheiro and Luísa Cagica Carvalho	323
Sources of Knowledge About Cryptocurrencies: Polish Students Perspective	Monika Eisenbardt and Tomasz Eisenbardt	335
Learning and Energy-efficient Renovation of Residential Buildings: The user Perspective	Anandasivakumar Ekambaram, Evgenia Gorantonaki and Bjørn S. von der Leyen	345
Developing a Training and Educational Programme for Learning Energy-efficient Building Renovation	Anandasivakumar Ekambaram and Nils Olsson	353
Awareness, Adoption, and implementation of Building Information Modelling in Small and Medium Enterprises in the Moroccan AEC Industry	Hayat El Asri and Laila Benhlima	362
Knowledge Management and Practices of Real Estate Valuation in Turkey	Celal Erdogdu and Inese Spica	371
Relational Capital and Technology Brands Over Time	G. Scott Erickson and Helen N. Rothberg	380
From Knowledge Management to Career Management and Related Concepts: Conceptual Model	Rafael Ferreira, Paula Peres and Ana Cláudia Rodrigues	388
Threats to Future Knowledge: The Impact of the Pandemic on Organisational Recordkeeping	Fiorella Foscarini, Ragna Kemp Haraldsdottir, Seren Wendelken, Charles Jeurgens, Yu Jing Tey, Gillian Oliver and Viviane Hessami	397
How Innovation Is Created: A Conceptual Framework From a Knowledge-based View	Qiang Fu	406
Sharing Information on Employment Conditions in Social Media by Representatives of Different Generations, and the Image of the Organization	Joanna Gajda	415
Exploring Social media Knowledge as a Means for fighting Corruption in CEE Countries	Mohammed Ibrahim Gariba , Solomon Gyamfi and Vita Jukneviciene	424
Local ICT Firms' Perspective on Planning Cooperation with city Government for Innovations	Konrad Głębocki	434

Paper Title	Author(s)	Page No
COVID-19 and Safety: A Theoretical Study with Applications	Cátia Godinho, John S. Edwards and Eduardo Tomé	440
Knowledge Sharing and Managing Intellectual Capital in the Times of COVID-19: Evidence from the Polish Restaurant Industry	Jagoda Goll and Krzysztof Zięba	450
I Share, we Share? A Mixed-Method Analysis of Helping behaviors, HRM Practices and Knowledge Sharing Behavior	Tiago Gonçalves, Carla Curado and Natalia Martsenyuk	459
The Perceived Effect of Intellectual Capital on the Performance of a Higher Education Institution: A Case Study	Adriana Gradim, Elaine Neris, José Vale and Florinda Matos	469
Smart Development Principles of Knowledge Ecosystem in an Industrial Cluster	Kristina Grumadaitė, Giedrius Jucevičius and Sonata Staniulienė	478
Knowledge Management Models Supporting Causal Analysis in Project Design Creation	Tadeusz A. Grzeszczyk	487
The New Normal Worklife: Lessons from the Pandemic	Hanne Haave, Ole Jørgen Ranglund and Tone Vold	495
From NGOs with Knowledge: An Empirical Study on the Impact of Trust-Antecedents on Knowledge Transfer	Sheikh Shamim Hasnain	502
Lessons Learned Process case study: An Unintended Enabler of Upstream and Downstream Knowledge Management Capabilities at the European Space Agency	Andrew Herd and Francesca Piretti	510
How to Exchange Tacit Knowledge in Multicultural Discussion?	Yayoi Hirose	519
Business Analytics and Firm Performance: A Literature Review	Henri Hussinki	527
Knowledge Mobilization in Agile Information Systems Projects: A Literature Analysis	Eli Hustad, Makoto Nakayama, Norma Sutcliffe and Merri Beckfield	533
A Bibliometric Analysis Deconstructing Research on how Digitalisation Affects Knowledge Workers	Henry Isegran, Mats Kuvene and Karl Joachim Breunig	542
Patterns for Personal Business Model Canvas Applications - BE(A)ST, an Approach for Aware Career Development	Jacek Jakieła, Joanna Świętoniowska and Joanna Wójcik	552
Stimulating Eco-innovation Development in Small and Medium-sized Enterprises: Ecolabnet Eco-innovation Network	Waldemar Jędrzejczyk	560
The Knowledge work of the Future and the Future of Knowledge work	Birgit Helene Jevnaker and Johan Olaisen	568
Knowledge Ecosystem Approach to Addressing The Wicked Problems	Giedrius Jucevičius	576
Co-producing Knowledge: Challenges of the Transdisciplinary Research in Pandemic Times	Maria Angelica Jung Marques, Eduardo Giugliani and Jane Lucia Silva Santos	583

Paper Title	Author(s)	Page No
Forms of Adaptation of Newcomers in Wikipedia as Online Sharing Knowledge Project	Anna Karczewska	592
The use of Virtual Learning Environment for Students' Effective Engagement in the Higher Education Institutions Through Knowledge Management and Blended Learning	Nasrullah Khan Khilji	601
Challenging the IC Theory: Suggestions for Some Ways Forward	Aino Kianto and Sladjana Cabrilo	611
Intellectual Capital Statement (ICS): A Case Study from a Hungarian non-profit Joint Venture	Florian Kidschun, Fabian Hecklau and Nick Gábor	619
Managing Knowledge Through the Internet of Everything on an Example of Smart Estate	Leszek Kieltyka	628
Knowledge Sharing Challenges in Hybrid Knowledge Work: Lessons from Denmark	Kathrin Kirchner, Christine Ipsen and Anders Reenberg Andersen	638
Why Knowledge Management for Sustainability needs a Sustainability Mindset	Beate Klingenberg and Helen N. Rothberg	646
Knowledge Management and Corporate Social Responsibility Interactions in Theory and Practice	Patrycja Krawczyk	654
Remote Negotiations during the COVID-19 Pandemic and Its Impact on Interorganisational Relations of Small and Medium-Sized Enterprises	Joanna Krzywda	662
Relationship Between Self-Efficacy, Trust, and Knowledge Sharing Among IT Industry Employees Working Remotely	Ewelina Krzyżowska	669
Internal Development Strategies of Partners of Eco-Innovative Services Network: Consortium's Source of Knowledge	Robert Kuceba and Grzegorz Chmielarz	677
Social Capital, Human Capital, Tacit Knowledge, and Innovations: A Polish-US Cross-Country Study	Wioleta Kucharska and G. Scott Erickson	687
Knowledge Sharing Co-operative Structures: The Case of WikiProjects	Katarzyna Kukowska	696
The role of Mentorship in Universities: The Knowledge Management Framework	Kristina Kuznetsova-Bogdanovitsh and Annukka Jyrämä	705
VOLUME TWO		
Knowledge Management Competencies in Health and Social Care	Harri Laihonen and Kaija Saranto	715
Knowledge Sharing in Private Social Solidarity Institutions during Pandemics	Carmem Leal, Carla Susana Marques, Pedro Gaspar and Ana Fermento	723
The Process of Sharing Knowledge In The Implementation of a Marketing Project: A Proposal for a Data Selection Model	Małgorzata Łęgowik-Małolepsza	731
Multidimensionality of Knowledge in Strategic Innovation Processes of Enterprises in the Light of Research Results	Sylwia Łęgowik-Świącik	740

Paper Title	Author(s)	Page No
Actions for Knowledge Integration capability in Building an Innovative Enterprise: Organizational Perspective	Anna Lemańska-Majdzik	750
The Relationships Between National Intellectual Capital and Foreign Direct Investment	Te-Yi Lin and Yeh-Yun Carol Lin	757
Knowledge Management Challenges in Start-up Companies in China's Great Bay Area	Gang Liu, Sabetzadeh Farzad, Lengxin Lora Liu and Yixiao Zhao	764
A Knowledge Management Model for Internal Auditing	Duc Nghia Mai and Hoang To Loan Nguyen	768
Factors Influencing Transfer of Learning in the ICT Sector. A Conceptual Framework	Margaret Mangion	777
Workplace Learning. A Proposed Typology to Facilitate Transfer from Situated Learning	Margaret Mangion	788
Digital Human Resources Management HUB: Exploring their Importance as a Learning Space	Dora Martins	796
University and Industry Collaboration in the Era of Smart Specialisation: Empirical Research on Sustainable Knowledge Transfer	Carla Mascarenhas, Anderson Galvão, Telma Mendes, Carla Marques and João Ferreira	804
Relating Organizational Knowledge with ISO 9001: 2015: An Empirical Approach	Florinda Matos, Valter Vairinhos, Ana Anes, Maria Francisca Matos and José Vale	814
Unaware Unethical Behavior and 'Learning from Error' through the Knowledge Sharing	Concetta Metallo, Rocco Agrifoglio, Concetta Cristofaro, Maria Ferrara, Paolino Fierro, Reina Reina, Mauro Romanelli and Roberta Oppedisano	822
Organising and Coordination in Support of Knowledge Work: Examples from Practice	Ludmila Mládková	829
Factors Facilitating Knowledge Sharing and Transfer in the South African Transport Sector	Donovan Nadison and Enis Elezi	837
Overcoming the Challenges of Digitalisation in Hungarian Manufacturing Companies	Nóra Obermayer, Viktória Nagy, Viktória Erika Tóth and Dénes Kiss	845
Entrepreneurial Orientation in Embedding Knowledge-Based Resources in the Organization	Małgorzata Okręglicka	852
The Dynamics of Power and Micropolitics on Project Management	Johan Olaisen and Birgit Helene Jevnaker	861
Towards the Essence of Knowledge Research: A Comparative Study of ECKM Papers 2017-21	Johan Olaisen and Birgit Helene Jevnaker	869
Facilitating Cyber Security Threat Modelling: A Social Capital Perspective	Johanna Orjatsalo	878
GeoSPARQL-Jena: Implementation and Benchmarking of a GeoSPARQL Graphstore	Taha Osman and Gregory Albiston	885
Data Analytics in Organic Farming: Impact on Environmental Sustainability	Cristhian Paz, Josune Sáenz and Ana Ortiz-de-Guinea	895
Knowledge Management in Chile: An Analysis of 10 years of Initiatives in the Public and Private Sector	Gregorio Pérez-Arrau	904

Paper Title	Author(s)	Page No
Management of Consumer Payment Determined by Gender During the COVID-19 Pandemic	Luiza Piersiala	912
Model for Innovation Management and Continuous Improvement at EFIGAS	Mónica Posada, Manuel Tamayo, Carlos Carmona, Beatriz Osorio, Carlos Marulanda and Mauricio Arbeláez	919
Knowledge Gains and Losses to Organizational Resilience, from Intellectual Capital	Lídia Neumann Potrich, Jaime Miranda Junior, Paulo Maurício Selig, Denilson Sell and José Leomar Todesco	928
Crowdsourcing as an Open Innovation Strategy in Knowledge-Based Smart City Management	Aleksandra Radziszewska	937
I miss my Office in my home Office: Challenges with work from home	Ole Jørgen Ranglund, Hanne Haave and Tone Vold	946
The Impact of Covid-19 on Online Final Exam Scores Among Computer Science Students	Malgorzata Rataj and Joanna Wojcik	955
The Analytic Hierarchy Process for new Product Screening Decisions: A Knowledge Management Perspective	Marcin Relich	965
Knowledge Exchange as a Factor Shaping Employee Relations in Remote Work	Elżbieta Robak	975
The Wise Leader: Where did the Roads pave by Nonaka and Takeuchi lead to?	Raysa Rocha, Florian Kragulj and Paulo Pinheiro	983
Impact on the Transfer of a Management Model in the SMEs of Valle de Aburra, Colombia	Gastón Rodríguez, Jorge Betancur and Fredy Garcés	993
Advancing Urban Regeneration Projects for Sustainable Development and Intellectual Capital	Mauro Romanelli, Maria Ferrara, Concetta Metallo, Rocco Reina, Luisa Varriale, Marzia Ventura, Walter Vesperi and Filomena Buonocore	1002
Smart Cities and Intellectual Capital for Urban Innovation and Future	Mauro Romanelli	1010
Social Innovation as a Paradigm of Change in Organisational Management	Anna Rybak	1017
Knowledge Management and Dynamic Capabilities: A Digital Embracing of Interrelated Processes	Mohammad Omar Sabri	1026
T-shaped Capabilities of the next Generation: Prospecting for an Improved Model	Juha Saukkonen and Pia Kreus	1032
The role of Intellectual Property Rights in Enhancing Regional Development	Yee Yee Sein and Viktor Prokop	1042
Analysis of the Potential for Resilience of Integrated Oil & Gas Operations in Brazil	Denilson Sell, Heron Trierveiler, José Todesco, Aran Morales, Paulo Selig, Eduardo Giugliani and Jane Lúcia dos Santos	1050

Paper Title	Author(s)	Page No
Semiotic Inception, Attitude Altering, and Behavioral Expression: Understanding the Foundation of Organizational Knowledge Construction	Chulatep Senivongse and Alex Bennet	1060
Knowledge Sharing Enablers and Barriers: Insights From a Socio-Environmental Project	Natália Silvério, Edilene dos Anjos Cavalcanti, Mariângela Poleza and Gregório Varvakis	1071
Knowledge-Based Management Challenges in the Asset Life Cycle	Viivi Siuko, Jussi Myllärniemi and Pasi Hellsten	1079
Evolution of the Coordination of Activities Aimed at Building Knowledge in the Wikipedia Community	Sebastian Skolik	1088
Cultural Semiotics in Strategy Conversation: Taking a Position on Strategy Through Knowledge Transfer	Graeme CM Smith	1097
The Impact of Leadership on Digital Learning in Health	Marit Meyer Solheim and Tale Skjølsvik	1106
Knowledge Transfer Through Digital Education Technologies in Higher Education	Maria Jose Sousa, Luciana Aparecida Barbieri da Rosa, Carolina Martins Rodrigues, Waleska Yone Yamakawa Zavatti Campos and Joanna Martinho Costa	1115
Knowledge Management of Business Ethics in Lithuanian Companies	Sonata Staniulienė, Giedrius Jucevičius and Kristina Grumadaitė	1123
Future Maritime Transport Systems and Integrated Planning	Trine Marie Stene, Kay Fjørtoft and Even Ambros Holte	1131
The Dynamics of Knowledge when Changing Product Distribution Channels during the Covid-19 Pandemic: A Case Study	Marcin Stępień	1140
Knowledge Management for Managing Crisis in Tourism: Theoretical insights	Ewa Stolarek-Muszyńska and Malgorzata Zieba	1149
Digitalization of Knowledge Development in the Media Industry	Fred Strønen, Karl Joachim Breunig, Ross Ellefsen and Tor Arne Vikingstad	1158
Intellectual Capital and Performance: A Case Study of Construction Companies	André Sucena, Florinda Matos and António Nunes	1165
Collaborative Practical Wisdom: Challenges and Opportunities in a Dynamic World	Marta – Christina Suciu, Alexandru Stativă, Ana – Maria Bocăneală, Mircea Ovidiu Mitucă and Decebal Dumitrescu	1175
Sustainable Competitive Advantage through Embedding Intellectual Capital in the Business Plan and Strategy	Slavica Trajkovska, Angelina Taneva-Veshoska, Srecko Trajkovski and Vlatko Ivanov	1186
A Systematic Literature Review of Agriculture Knowledge Management in KM and non-KM Journals	Rebecca P. Tumwebaze, John N. Walsh and John Lannon	1193
Digital Innovation Hubs: Two-mode and Network-Based View on Technology and Services Provided	Anna Ujwary-Gil, and Bianka Godlewska-Dzioboń	1202

Paper Title	Author(s)	Page No
The Positive Impact of Relation Capital in Family firm: The Latent Generation	Marzia Ventura, Anna Maria Melina and Walter Vesperi	1212
Challenges and Trends of Knowledge Management in SME Enterprises in the Context of CSR	Dariusz Wielgórka	1220
Implementing a European KM Approach in a Brazilian Innovation Institute on a Remote Basis	Markus Will, Ronald Orth, Felix Budde, Fernanda Neumann and Victoria Santos	1230
Exploring Factors Triggering Individual Knowledge Hiding at the e-Commerce Operation Workplace	Jin Xue, Matthew Tingchi Liu and Hoi Ngan Loi	1241
Can bots Support Employees in Lessening Digital Fatigue during e-work: Research Results	Magdalena Zalewska-Turzyńska	1251
New Perspectives for Knowledge Management in Inter-Organizational Networks and Relations in Agribusiness	Cinthya M. S. Zanuzzi, Eduardo Giugliani, Denilson Sell and Paulo M. Selig	1260
A new Critical risk on the Block: Cyber Risks as an Example of Technical Knowledge Risks in Organizations	Malgorzata Zieba, Susanne Durst and Martyna Gonsiorowska	1269
Knowledge Management, Including the Cybernetic Theory of Human Character	Izabela Ziebacz	1277
Innovation Management and Usage of Knowledge Transfer in Tourism Enterprises	Zbigniew Zontek and Ewa Lipianin-Zontek	1286
Phd Research Papers		1295
Explaining Knowledge Intensive Firms' Performance Through Internal Factors: Evidence from an IT Consulting firm	Asmaa Abid-Baudin	1296
Organisational Factors Affecting Knowledge Retention in a Public Organisation	Joshua Ishaku Azaki and Ulrike Rivett	1304
Role of Knowledge Management in Small and Medium Enterprise Performance	Krishna Dixit and Satya Ranjan Acharya	1312
Knowledge Management for Integrated Health and Social Care: The Case of Keusote in Finland	Tuomas Hujala and Harri Laihonen	1321
Collaborative Knowledge Building and Social Capital in Gender-Based Violence, Northern Iraq	Goran Yousif Ismael	1329
Exploring Knowledge Exchange and Social Capital Within agri-food Business Support Programmes	Suzanne Kelly	1339
Major Drivers to Innovation in Higher Education Institutions of Developing Countries	Alfred Hove Mazorodze and Peter Mkhize	1347
Using Domain Redefinition to explain Born Global Firms' Behaviour	Margaret Robb, Andrea Reid, Sandra Moffett and Trevor Cadden	1356
Knowledge Management Models and the Innovativeness of high-tech Companies: The case study	Wiktoria Trzepizur	1359
Organisational Knowledge Sustainability	Vivien Vágner and Andrea Bencsik	1368

Paper Title	Author(s)	Page No
Exploring Knowledge-Hiding Methods and Reasons in a Small Chinese Family Business	Bo Wen, Scott Foster and Khalid Abbas	1375
Customer Knowledge Management: A Systematic Literature Review and Agenda for Future Research	Victoria Yousra Ourzik	1384
Masters Research Papers		1395
Factors Affecting m-learning Continuance: From the Perspectives of flow Theory and Stimulus-Organism-Response Theory	Chen-Cheng Chang	1396
How to Implement Knowledge Management in Financial Institutions? A Flowchart for Practice (FIGCIF)	Darci De Borba	1403
Non-Academics Papers		1411
An Applied Knowledge Framework to Enable Knowledge Reuse in Consulting firms	Evgeniya Ivanova	1412
Digitizing the Austrian Universities' ICR for an Effective Higher Education Governance	Dominik Reisner	1419
Smart Working Paradigms in a Hybrid Working era	Daniela Robu and John B. Lazar	1428
Work In Progress Papers		1438
Conceptualising the Role of the UAE Innovation Strategy in University-Industry knowledge Diffusion Process	Mousa Al-kfairy, Munir Majdalawieh and Saed Alrabaee	1439
The Effects of Knowledge Sharing on IT Risk Management Performance	Neda Azizi, Bahareh Ghodoosi, Claire Davison, Omid Haass and Shahrzad Saremi	1443
Key Types of Crowdsourcing in Science: Systematic Literature Review	Regina Lenart-Gansiniec	1448
Disruption, Disruptors and Disruptiveness of Scholarly Communication: An Actor-Network Theory Approach	Alina Praun, Anna Cunningham and Martina Pieperhoff	1452
How to Facilitate Knowledge Ambidexterity with the Use of Enterprise Social Media	Gerald Stei, Levente Szász and Alexander Rossmann	1457
The Ethics of Classifying the World: From Library Catalogues to AI	Clare Thornley, Marta Bustillo and Christoph Schmidt Supprian	1463
Late Submissions		1466
Preparing Students for a Digital Work-Life Using Student-Centred Methods: A Case Study from Music Production	Hanne Haave, Ole Jørgen Ranglund, Tone Vold and Carl-Henrik Wahl	1467
The Application of PLS-SEM in Knowledge Management Processes in Higher Education Institutions	Emanuela Riccio, Roberto Cerchione and Piera Centobelli	1473
The Effect of Organizational Learning and Knowledge Management on Innovation Performance at Companies in Technology Parks	Besir Kemal Sahin	1484

ECKM Preface

These proceedings represent the work of contributors to the23rd European Conference on Knowledge Management (ECKM 2022), hosted by University of Naples Parthenope and University of Naples Federico II, Italy on 1-2 September 2022. The Conference Co-Chairs are Prof. Piera Centobelli from University of Naples Federico II and Prof. Roberto Cerchione, from University of Naples Parthenope, Italy.

ECKM is now a well-established event on the academic research calendar and now in its 23rd 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 jointly by Prof. Manlio Del Giudice, Linked Campus University in Rome, Italy and Prof Armando Papa, the University of Teramo, Italy. The second day of the conference will open with an address by Dr Omid Haass, RMIT University, Australia, who will talk about *Exploring the application of digital twin as an enabler in knowledge management*.

With an initial submission of 263 abstracts, after the double blind, peer review process there are 149 Academic research papers, 12 PhD research papers, 2 Masters Research papers, 3 Non-Academic papers and 7 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia; Austria; Brazil; Canada; Chile; China; Colombia; Czech Republic; Denmark; Egypt; Estonia; Finland; France; Germany; Hungary; Iceland; India; Ireland; Italy; Japan; Jordan; Latvia; Lithuania; Malta; Morocco; Netherlands; New Zealand; North Macedonia; Northern Cyprus; Norway; Poland; Portugal; Republic of South Africa; Romania; Singapore; Slovenia; South Africa; Spain; Switzerland; Taiwan; Thailand; Turkey; UAE; Uganda; UK; USA; Vietnam;

We hope you enjoy the conference.

Prof Piera Centobelli
University of Naples Federico II

Prof. Roberto Cerchione
University of Naples Parthenope
Italy
September 2022

ECKM CONFERENCE COMMITTEE

Executive Committee

Dr. Stefano Abbate, University of Naples Federico II
Prof. Piera Centobelli (Chair), University of Naples Federico II
Prof. Roberto Cerchione (Chair), University of Naples Parthenope
Prof. Emilio Esposito, University of Naples Federico II
Dr. Eugenio Oropallo, University of Naples Federico II
Prof. Renato Passaro, University of Naples Parthenope
Prof. Ivana Quinto, University of Naples Parthenope
Dr. Emanuela Riccio, University of Naples Parthenope
Prof. Shashi, Indian Institute of Management Sirmaur

Conference Programme Committee

Prof Rute Abreu, Guarda Polytechnc Institute, Portugal; Dr Sawasn Al-husseini, Middle Technical University, Iraq; Dr Ali Alawneh, Philadelphia University, Jordan; Albena Antonova, Sofia University, Bulgaria; Dr Nekane Aramburu, University Of Deusto, San Sebastian, Spain; Dr Pierre-Emmanuel Arduin, Paris-Dauphine University, France; Prof Oscar Arias Londono, Institucion Universitaria de Envigado, Colombia; Dr Ramona Bastida, Universitat, Internacional de Catalunya, Spain; Prof Andrea Bencsik, University of Pannonia, Veszprem, Hungary; Marco Bettoni, Steinbeis Consulting Center Knowledge Management & Collaboration, Basel, Switzerland; Heather Bircham-Connolly, University of Waikato, Hamilton, New Zealand; Prof Karsten Böhm, University of Applied Sciences, Kufstein, Austria; Dr Ettore Bolisani, University of Padua, Vicenza, Italy; Prof Constantin Bratianu, Bucharest University of Economic Studies, Bucharest, Romania; Prof Robert Buchmann, Babes-Bolyai University of Cluj Napoca, Business Information Systems Department, Romania; Anthony Buckley, TU Dublin, Ireland; Prof Acma Bulent, Anadolu University, Turkey; Ass Prof Sladjana Čabrilo, I-Shou University, Kaohsiung, Taiwan; Dr Daniela Carlucci, University of Basilicata, Potenza, Italy; Delio Castaneda, Pontificia Universidad Javeriana, Bogota, Colombia; Prof Juan-Gabriel Cegarra-Navarro, Universidad Politécnica de Cartagena, Spain; Prof Roberto Cerchione, University of Naples Parthenope, Italy; Dr Koteshwar Chirumalla, Malardalen University, Sweden; Dr Pieris Chourides, European University Cyprus, Cyprus; Dr Ritesh Chugh, Central Queensland University, Australia; Expert Technologist Maria Laura Clemente, CRS4, Italy; Assistent Professor PhD Cosmulese Cristina Gabriela, “Stefan cel Mare” University of Suceava, Romania, Romania; Anikó Csepregi, University of Pannonia, Hungary; Associate Professor Roberta Cuel, Università degli Studi di Trento, Italy; Dr Francesca Dal Mas, University of Rome/University of Rome La Sapienza, Italy; Assistant Professor Farshid Danesh, Regional Information Center for Science and Technology , Iran; Prof Monica De Carolis, University of Calabria, Italy; Dr Souad Demigha, Univ Paris 1 Sorbonne And Univ Paris 11 Orsay, France; Dr Mihaela Diaconu, "Gheorghe Asachi" Technical University, Romania; Prof Laura Diaconu Maxim, Faculty of Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania; Dr Yan Qing Duan, University of Bedfordshire, University Square, Luton, , UK; Prof John Edwards, Aston Business School, UK; Dr Ramadan Elaiess, University of Benghazi, Libya; Dr Scott Erickson, Ithaca University, USA; Assoc Prof Nasser Easa , American University in the Emirates , UAE; Prof Max Evans, McGill University, Canada; Dr Vitor Ferreira, Polytechnic Institute of Leiria, Portugal; Prof Elisa Figueiredo, Guarda Polytechnic Institute, Portugal; Dr Silvia Florea, Lucian Blaga University of Sibiu, Romania; Alexeis Garcia-Perez, Coventry University, UK and IAKM, UK; Dr Andrea Garlatti, Udine University, Italy; Dr Daniel Glauber, KMAG, USA; Georg-Friedrich Göhler, Helmut-Schmidt University / University of the Federal Armed Forces, Hamburg, Germany; Dr Loganathan Narayansamy Govender, University of Kwazulu-Natal, South Africa; David Gurteen, Gurteen Associates, UK; Dr Leila Halawi, Embry-Riddle Aeronautical

University, USA; Ragna Kemp Haraldsdottir, University of Iceland, Reykjavík, Iceland; MSc Ann-Therese Hedqvist, Region Kalmar, Sweden; Ilona Heldal, Western Norway University of Applied Sciences, Bergen, Norway; Andrew Herd, European Space Agency, Leiden, Netherlands; Dr Ali Hessami, Vega Systems Ltd., UK; Dr Conor Horan, Technological University Dublin, Ireland; Dr Eli Hustad, University of Agder, Norway; Dr Thomas Jackson, Loughborough University, UK; Prof Brigita Janiunaite, Kaunas University of Tehnology, Lithuania; Birgit Jevnaker, , Norway; Dr Magdalena Jurczyk-Bunkowska, Opole University of Technology, Poland; Dr Selvi Kannan, Victoria University, Melbourne, Australia; Dr Marcela Katuščáková, Faculty of Social and Economic Sciences of the Comenius University in Bratislava, Slovakia; Prof Dr Turksel Kaya Bensghir, TODAIE - Public Administration Institute for Turkey and the Middle East, Turkey; Ute Klotz, Lucerne University of Applied Sciences and Arts, Switzerland; Dr Florian Kragulj, WU Vienna University of Economics and Business, Vienna, Austria; Assc Jeanette Lemmergaard, University of Southern Denmark, Dept. of Marketing & Management, Denmark; Assc Regina Lenart-Gansiniec, Jagiellonian University in Krakow, Polska; Dr Ramona-Diana Leon, Universitat Politecnica de Valencia , Spain; Dr Palmira Lopez-Fresno, Unnversity of East of Finland, Finland; Dr Teodoro Macaraeg, University of Caloocan City, Philippines; Dr Łukasz Mach, Opole University of Technology, Poland; Dr Maria de Lourdes Machado-Taylor, CIPES, Portugal; Miss Naheed Malik, University of Manchester, UK; Dr Avain Mannie, Dept of Finance , SA Revenue Serivce, South Africa; Dr Eva Martínez-Caro, Universidad Politécnica de Cartagena, Spain; Dr Aurora Martínez-Martínez, Universidad Politécnica de Cartagena, Spain; Prof. Antonio Martins, Universidade Aberta, Portugal; Prof Dora Martins, ISCAP, Portugal; Prof Isabel Martins, University of KwaZulu-Natal, South Africa; Prof Ana Martins, University of KwaZulu-Natal, South Africa; Dr Łukasz Marzantowicz, SGH Warsaw School of Economics, Poland; Dr Marta Mas-Machuca, Universitat, Internacional de Catalunya, Spain; Florinda Matos, ISCTE-IUL, Lisbon, Portugal; Prof Jane McKenzie, Henley Business School, UK; Dr Pedro Mello, Isntituto Português de Marketing e Admnistração, Portugal; Dr Robert Mellor, Kingston University, UK; Dr Anabela Mesquita, School of Accounting and Administration of Porto (ISCAP) / Politechnic Institute of Porto (IPP), Portugal; Prof Awais Mian, LUMS, Pakistan; Dr Antonio Leal Millan, Universidad de Seville, Spain; Dr Clemente Minonne, Institute for Innovation and Technology Management, Switzerland; Ludmila Mládková, University of Economics Prague, Czech Republic; Dr Sandra Moffett, University of Ulster, Londonderry, UK; Prof Samuel Monteiro, University of Beira Interior, Portugal; Dr Mahmoud Moradi, University of Guilan, Iran; Prof Oliver Moravcik, Slovak University of Technology, Slovakia; Aboubakr Moteleb, B2E Consulting, UK; Dr Mary Muhenda, Uganda Management Institute, Uganda; Aroop Mukherjee, King Saud University, Saudi Arabia; Dr Cecilia Murcia-Rivera, CEU San Pablo University, Madrid, Spain; Dr Birasnav Muthuraj, New York Institute of Technology, Bahrain; Dr Gaby Neumann, Technical University of Applied Sciences Wildau, Germany; Dr Emanuela Alia Nica, Center for Ethics and Health Policy (CEPS) and University "Petre Andrei" Iasi, Romania; Dr Funmi Obembe, De Montfort University, Leicester, UK; Dr Nora Obermayer, University of Pannonia, Hungary; Dr Małgorzata Okręglicka, Czestochowa University of Technology, Poland; Gary Oliver, University of Sydney, Australia; Prof Leonor Pais, University of Coimbra, Portugal; Dr Kaushik Pandya, Sheffield Business School, City Campus, UK; Dr Dan Paulin, Chalmers University of Technology, Sweden; Jan Pawlowski, University of Jyväskylä, Austria; Dr Marta Pérez-Pérez, University of Cantabria, España; Rodney Petersen, Nat Inst Standards and Technology, USA; Prof Mário Pinto, Polytechnic Institute of Porto, Portugal; Prof Selwyn Piramuthu, University of Florida, Gainesville, USA; Dr Gerald Polesky, IBM, Phoenix, USA; Dr John Politis, Charles Darwin University, Australia; Dr Stavros Ponis, National Technical University Athens, Greece; Prof Asta Pundzienė, Kaunas University of Technology , Lithuania; Prof Thurasamy Ramayah, Universiti Sains Malaysia, Malaysia; Andrea Reid, Department of Business and Enterprise, UUBS, Belfast,, UK; Dr Marcin Relich, University of Zielona Gora, Poland; Gerold Riempp, EBS, Germany; Dr Eduardo Rigoni, Unisinnos University, Brazil; Paula Rodrigues, Lus ada University Porto, Portugal; Dr Eduardo Rodriguez, IQ Analytics, Ottawa, Canada; Dr Josune Sáenz, University of Deusto, San Sebastián, Spain; Prof Lili Saghafi, Canadian International College, Egypt; Mustafa Sagsan, Cyrpus Inter Univ, Cyprus; Prof Abdel-Badeeh M. Salem, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt; Dr Kalsom Salleh, Faculty of Accountancy, University

Technology MARA, Malaysia; Dr Behrang Samadi, Asia Pacific University of Technology and Innovation , Malaysia; Dr María-Isabel Sanchez-Segura, Carlos III University of Madrid, Spain; Ass Prof Dr Sebastian Saniuk, University of Zielona Gora, Poland; Dr Anna Saniuk, University of Zielona Gora, Poland; Enrico Scarso , Università Degli Studi Di Padova, Italy; Prof Jurgita Sekliuckiene, Kaunas University of Technology , Lithuania; Dr Ana María Serrano-Bedia, University of Cantabria, Spain; Dr Armin Shams, Sharif University of Technology, Iran; Peter Sharp, Regent's University London, UK; Dr Souad Slyman, University of Roehampton, UK; Dave Snowden, Cognitive Edge, Singapore; Dr Siva Sockalingam, Glasgow School for Business and Society, UK; Dr Lew Sook Ling , Multimedia University , Malaysia; Dr Maria Jose Sousa, ISCTE-IUL, Portugal; Dr Trine Marie Stene, SINTEF, Norway; Prof Ana Sucena Santos, Politécnico do Porto, Portugal; Prof Dr Marta-Christina Suciu, Bucharest University of Economic Studies, Bucharest, Romania; Dr Mohd Nizam Sudin, Universiti Teknikal Malaysia Melaka, Malaysia; Dr Ann Svensson, University West, Sweden; Dr Christine Nya-Ling Tan, Auckland Institute of Studies, New Zealand; Dr Eduardo Tomé, Universidade Lusófona, Lisboa, Portugal; Prof Maria Tsakalerou, Nazarbayev University, Kazakhstan; Dr Geoff Turner, Park Advisory LLP, UK; Dr Anna Ujwary-Gil, IInstitute of Economics, Polish Academy of Sciences, Warsaw, Poland; Dr Abel Usoro, University of the West of Scotland, UK; Prof José Vale, School of Accounting and Administration of Porto, Portugal; Dr Changiz Valmohammadi, Islamic Azad University-South Tehran Branch, Iran; Walter Vesperi, Università degli Studi di Messina, Italay; Vilma Vuori, Ramboll Finland, Finland; Richard Wilson, Towson Univ, Maryland, USA; Dr Hon Keung Yau, City University of Hong Kong, Hong Kong; Dr Malgorzata Zieba, Gdansk University of Technology, Poland; Dr Inga Zilinskiene, Mykolas Romeris University, Lithuania; Dr Justyna Żywiołek, Czestochowa University of Technology, Poland;

Biographies

Conference and Programme Chairs



Piera Centobelli teaches Business Economics and Organization at the Department of Industrial Engineering of the University of Naples Federico II. From 2013 until 2016 she joined the Fraunhofer Joint Laboratory of Excellence on Advanced Production Technology (J-LEAPT) in partnership with Fh-IWU of Chemnitz. She published more than fifty papers in top journals and conference proceedings. She acts as editorial board member, guest editor and reviewer for several peer-reviewed journals. Her research interests focus on blockchain and Industry 4.0, knowledge and technology management, Industry 4.0, digital transformation, operations management, logistics and supply chain management, corporate social responsibility, circular economy, environmental, economic, financial and social sustainability.



Roberto Cerchione is Chair of IEEE Blockchain Italy, Delegate of Engineering Management Committee and Director of SGu at the University of Naples Parthenope and Professor of Technology, Innovation and Management Faculty at the University of Bergamo and the University of Naples Federico II. He is Professor of 'Advanced Logistics Systems and Sustainable Supply Chain Management' at the Aerotech Academy. He serves as Co-Editor-in-Chief the Journal of Entrepreneurship Education and the Academy of Strategic Management Journal, and acts as managing guest editor, section editor, and editorial board member for many international journals. He has co-authored more than 100 publications including articles published in peer-reviewed journals, book chapters, conference proceedings, research reports.

Keynote Speakers



Prof. Manlio Del Giudice is Full Professor of Management at the University of Rome "Link Campus". He holds a PhD in Management at the University of Milano-Bicocca and he built up his academic and scientific career outside of Italy for more than 12 years, in a wide number of worldwide-renewed universities, prior to coming back to Italy on 2014. In 2018 he had a role as a full professor making him *one of the 20 youngest professors in Italy, in every scientific field*. For 4 years, he has been serving as the Editor in Chief of the top tier *Journal of Knowledge Management* and he holds key editorial positions in several international mainstream scientific journals on management (like Journal of Business Research, Journal of International Management, International Entrepreneurship and Management Journal, IEEE Transactions on Engineering Management, Technological Forecasting and Social Change, etc.).



Armando Papa Ph.D., is currently Associate Professor of Management at the Faculty of Communication Sciences of the University of Teramo. He obtained the Italian national qualification as Full Professor in 2020. Previously, he joined the University of Rome Universitas Mercatorum; he is also a lecturer at the Link Campus University of Rome and the Catholic University of the Sacred Heart in Rome. Previously he was Research Fellow at the University of Turin. He received his PhD from the Department of Economics, Management, Institutions of the Federico II of Naples. Currently, he is involved in research studies on Technology Transfer in Business Networks; previously his

studies focused on the study of Italian capitalism, of the relationships between governance and of the mechanisms for allocating corporate control between the stock exchange, banking groups and family ownership. Managing Editor for the Journal of Knowledge Management and Member of the Editorial Board of Journal of Intellectual Capital and Management Decision. He is also involved in numerous Peer Review Processes for numerous international Management journals. Ordinary member of the I.P.E. of Naples.



Dr Omid Haass is a Lecturer at the RMIT University, School of Property, Construction and Project Management based in Melbourne, Australia. Omid obtained his doctoral degree on Project Management in the department of International Business and Asian Studies (IBAS), Griffith Business School (GBS), Griffith University. His research interests entails Project, Knowledge and Risk management. He also worked at GBS, Griffith School of Engineering and Griffith School of Information and Communication technology as a sessional academics and delivers a variety of courses such as project management, managerial problem solving, introduction to international business, comparative management and business processes to the postgraduate and undergraduate students. He also holds over 16 years work experience (since 2002) as a practitioner and worked in various project based, management consulting and manufacturing companies in Iran. His professional career includes project management office (PMO) director, quality management representative, quality manager, quality lead auditor, chief of knowledge executive (CKO), systems and training manager and project planner.

Mini Track Chairs



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



Joana Martinho Costa (Ph.D) is a researcher at ISTAR and invited assistant professor at ISCTE. She is certified by the Scientific and Pedagogical Council for Continuous Training, Portugal, and has been publishing her works in several journals indexed in Scopus and ISI Web of Knowledge in Educational Technology, Technology-enhanced learning, and Learning Environments. Currently, she participates in ATHENA, an Erasmus+ funded project created to improve university teachers' digital skills.



Regina Lenart-Gansiniec is Associate Professor of the Faculty of Management and Communication, Jagiellonian University in Krakow, Poland. Her research revolves around crowdsourcing and organizational learning. She is a principal investigator and participant in national and international research projects, and the Editor-in-Chief of International Journal of Contemporary Management.



Florinda Matos is a Professor at ISCTE - University Institute of Lisbon. She is the founder and president of the Intellectual Capital Association (ICAA), whose mission is to help transform intellectual capital into added value by contributing to Sustainable Development. She is also a member of the New Club of Paris, an international organisation whose main objective is to create awareness about

the Knowledge Economy. As a Knowledge Management and Intellectual Capital expert, she works with several international organisations to promote the management of the intangibles as accelerators of Innovation, Competitiveness and Sustainability in the Digital



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



Raysa Geaquinto Rocha, Ph.D. student and a research fellow at the University of Beira Interior (UBI), a researcher at the NECE, Research Center in Business Sciences. She is an associate member of the International Association for Knowledge Management (IAKM). Her main research areas are organizational spirituality, organizational practical wisdom, and knowledge management. https://orcid.org/0000-0002-6542-1397



Dr Joanna Rosak-Szyrocka, is a Lecturer at Częstochowa University of Technology in Poland, the Vice President of the Qualitas Foundation and a member of the Polish ISO 9000 Forum Club. Joanna has author/co-authored 221 scientific publications in prestigious journals, chapters in monographs and conference materials as well as co-authoring 20 scientific monographs. She has been a participant of the Erasmus + international exchange, during which she conducted a series of international lectures in England, Slovenia, Slovakia and Italy.



Marta Pérez-Pérez, PhD, is a full-time assistant professor of Operations Management at University of Cantabria (UC). Her research interest lies in knowledge management, strategic management of manufacturing and supply chain flexibilities, innovation management, entrepreneurship and family firms. Her work has been published in leading international journals such as those appeared in International Journal of Production Research, Journal of Small Business Management, Journal of Manufacturing Systems, Technology Analysis & Strategic Management, Journal of Further and Higher Education, Revista Española de Documentación Científica or Global Journal of Flexible Systems Management.



Prof Dr Mustafa Sağsan is currently working at the Business Administration Department in Cyprus International University and is teaching some of the courses related to Knowledge Management and Organization Sciences. He is member of organizing committee of ECKM and ICICKM since 2009



Maria José Sousa (Ph.D.) is a professor at ISCTE-Instituto Universitário de Lisboa, a research fellow at Business Research Unit. She is an expert in digital learning and digital skills, as she has assumed a Post-Doc position from 2016-2018 at Universidade de Coimbra. She has developed major research in the digital education field with articles published in high-level journals and is a guest-editor of more than

5 Special Issues from Springer and Elsevier. Currently she is the Coordinator of ATHENA, an Erasmus+ funded project created to improve university teachers' digital skills.



José Vale is a professor at the Porto Accounting and Business School, Polytechnic of Porto, Portugal, where he teaches several courses related to management accounting. He is PhD in management – specialized in accounting and management control, and MSc in administration and management. Also, he holds an MBA in commercial operations' management. He has several articles published in indexed international journals, having also participated in different international and national conferences. He has been a member of different scientific committees in conferences.



Walter Vesperi is Adjuct professor in Organization Theory and HRM at University of Messina and "Magna-Graecia" University of Catanzaro. His research topics are on knowledge transfer, university entrepreneurship and agri-food sector. His publications appeared in academic journals and presented his research at several international conferences. Also he is member of editorial board of International Journal of Management Practice



Dr. Changiz Valmohammadi is Associate Professor at, Islamic Azad University, South Tehran Branch and visiting professor of Universidad de las Américas Puebla (UDLAP). His areas of interest are knowledge management, quality management, strategic management, operations management and application of IT in business operations. For more than 24 years he has taught undergraduate and graduate courses and offered consulting services to the Iranian public and private organizations. He has published research papers in journals such as Information & Management, International Journal of Production Economics, Resources Policy, Total Quality Management & Business Excellence and Journal of Enterprise Information Management, to name a few. He is on editorial board of Journals such as the International Journal for Quality Research, Industrial and Commercial Training.



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



Justyna Żywiołek is a doctor of engineering at the Faculty of Management of the Częstochowa University of Technology. It deals with the management of information and knowledge, and their security. He is also a personal data protection inspector and an auditor of the ISO 27000 standard. He is also interested in the use of Big Data, Internet of Things for security management systems. He is guest editor of many international magazines. He is the co-author of over 150 publications, including articles published in peer-reviewed journals, book chapters, conference materials, and research reports.

Biographies of Contributing Authors

Toon Abcouwer is a lecturer at the University of Amsterdam. He is the founder of the Adaptive Cycle of Resilience, helping organisations operating in changing environments. Together with Emőke Takács he published over 25 articles in the past five years, leading to the understanding of the necessary shift from the 'Me-We' paradigm to the 'We-All'.

Wala Abdalla, Ph.D. researcher in managing knowledge in the context of smart cities (Faculty of Science and Engineering, University of Wolverhampton, UK). Holds an MSc in Civil Engineering management, BSc in Civil Engineering, and is a Fellow of the UK Higher Education Academy. Research interests: knowledge management, smart cities, business model innovation for smart cities, sustainability strategies, and competitiveness.

Asmaa Abid-Baudin has accumulated 7 years of professional experience within various organizations before enrolling in a Phd Program. She is in her last year of thesis preparation in joint supervision at Université de Bourgogne (France) and Université Hassan 1er (Maroc) Her research interests are around knowledge, consulting firms, organizational design and resource-based view theory.

Anna Albrychiewicz-Słocińska is an assistant professor at Częstochowa University of Technology, Poland. She received her PhD in social sciences from Częstochowa University of Technology in 2008. She has been participating and organizing several international conferences on human resources management. Her main research areas are human resources management, knowledge sharing, knowledge management, ethics and organizational behaviour.

Bruno Alexandre is graduated in Psychology and is currently in last year of master's degree in human resources management and development at ISCAP (Porto Accounting and Business School, Polytechnic of Porto, Portugal). He has 7 years experience on Human Resources Management, namely in HR International policies, expatriation and repatriation employees and he is currently working at Adidas (GBS Porto) has HR Specialist International Mobility.

Mousa Al-kfairy is an Assistant Professor at the College of Technological Innovation in Zayed University, UAE. Prior to joining ZU, he worked in the American University of Madaba and Kingston University London. Dr.Mousa is very interested in industry-academic collaboration. His research interests include Social Commerce, Metaverse, Monte-Carlo simulation in business and economics

Roberta Dutra de Andrade, PhD Student Roberta Andrade is a Professor at the Federal University of Ceará, Beira Interior University, and Catholic University

Center of Quixadá. PhD student at Beira Interior University (UBI) and researcher at the Research Center of Business Science (NECE). His teaching activities are mainly on entrepreneurship and knowledge management.

Matheus Argôlo received his B.Sc. degree in Electronics and Computer Engineering from the Universidade Federal do Rio de Janeiro in 2021. He is currently a M.Sc. student in the Systems Engineering and Computing in the Universidade Federal do Rio de Janeiro. His research areas

include Computer Supported Cooperative Work, Knowledge Management, Work, and Education.

Emmanuel Ebo Arthur is a first year PhD student in the University of Pardubice, Czech Republic. His areas of specialization are Regional and Public Economics. He received his master's degrees in Leadership and Management in Education and Commonwealth Executive MBA (Finance) with the Universities of Newcastle, Australia and Kwame Nkrumah University of Science and Technology, Ghana respectively.

Joshua Azaki is a doctoral student at the Department of Information Systems, University of Cape Town (UCT), South Africa. His research areas cover knowledge management, Information Communication Technologies for Development. He has been involved in information and knowledge sharing projects with the UCT Faculty of Commerce and World Wildlife Fund, South Africa.

Dr Neda Azizi is a lecture at Torrens University, School of Business and Information Systems based in Melbourne, Australia. She has taught at Undergraduate and Postgraduate levels in Business Information systems, Logistics and the Master of Commerce. Her research interests broadly focus on the human, organizational and institutional aspects of systems development, Project, Knowledge and Risk management. Her research is informed by the social informatics literature as a means for conceptualising the social context of information systems development.

Lisa-Maria Baumgartner works at the Institute for Data, Process and Knowledge Management at the Vienna University of Economics and Business and is a Master student in Strategy, Innovation and Management Control. Her research is on meaningful work as well as the impact and elaboration of visions.

Andrea Bencsik is a professor at the University of Pannonia in Hungary and at J. Selye University in Slovakia. She is doing research in the fields of knowledge- change- human resources management and teaching these disciplines at the same time. She is the author of a number of scientific publications and a member of some international scientific committees.

Marco Berardi is a post-doc researcher at “G.d’Annunzio” University, Department of management and business administration, Pescara (Italy). Marco researches on the creation of public value in public administrations, accounting and reporting on local authorities. He is also a business consultant and CPA, and advises on public administration in anticorruption and integrity issues

Marco Bettoni Prof. emer. in Knowledge Technologies, Director of the Steinbeis Consulting Center for Knowledge Management and Collaboration (since 2018). Director of Research at Fernfachhochschule Schweiz (2005-2017). Since 1981 research in Knowledge Theory (Radical Constructivism). From 1977 to 2005 researcher, engineer and lecturer with industrial and academic organisations in machine design, engineering education, IT development, knowledge engineering and knowledge management.

Ettore Bolisani - Associate Professor - Padova University; previously researcher at Manchester University, visiting lecturer - Coventry University, Kaunas Technological University,

Universidad Politecnica de Cartagena, Technische Hochschule Köln; Chair - ECKM 2009, 2018, IAKM Past President; Series co-editor - "Knowledge Management and Organisational Learning" (Springer), Editor-in-chief EJKM, management committee EU Action INDCOR

Booto Ekionea: Professor of management information systems (University of Moncton, Canada). Received his PhD in Management information systems from (University of Quebec, Montreal) in 2008. Also associate professor of management information systems at Institut supérieur de commerce (Kinshasa, DR Congo). Research areas are KM capabilities, strategic aspects of information systems and KM and the digitalization of society.

Constantin Bratianu: Professor of *Strategic Management* and *Knowledge Management*, Bucharest University of Economic Studies, Romania. President of the International Association for Knowledge Management. Founding editor of the international journal *Management Dynamics in the Knowledge Economy*. Also Associate Editor of the *Electronic Journal of Knowledge Management*. Academic interests: knowledge dynamics, knowledge management, knowledge strategies, and strategic management.

Karl Joachim Breunig: Full Professor of Strategic Management (Oslo Business School, Oslo Metropolitan University). Heads the research group on Digital Innovation and Strategic Competence in Organizations. Received his Ph.D. (BI Norwegian Business School), and MSc (London School of Economics). Researches the interception of strategy- and innovation theory e.g. service- and business model innovation and digitalization in knowledge intensive firms.

Kamila Brodzińska is a PhD candidate in Doctoral School of Social Sciences at the Jagiellonian University, in Kraków, Poland. She obtained her Master's in Social Policy with a major in Management of Public and Civic Organisations (2019) and in Finance and Controlling (2019) at the Jagiellonian University. Her main research interest is project knowledge management.

Kay Brouwers, Scribbr, earned a BA in Business Innovation from Avans University of Applied Sciences and an MSc in Information Studies: Information Systems (track). Performed research on digital collaboration for lifelong learning and learner-computer interaction. Kay currently works as a Product Manager at the Edtech company Scribbr.

Łukasz Bryl is an Assistant Professor in the Department of International Economics at the Poznan University of Economics and Business. He holds PhD in economics and specializes in Intellectual Capital and corporate reporting. Lukasz was Visiting Professor at the Jyvaskyla University of Applied Sciences.

Felicjan Bylok is an Full Professor of sociology. He is the head of the Department of Applied Sociology and Human Resource Management at the Faculty of Management of the Czestochowa University of Technology. His scientific interests is as follows: the social capital and trust, Human Recourses Management, the sociology of organization. The educational background of Prof. Bylok is in Sociology and HRM.

Sladjana Cabrilo is a Professor at I-Shou University, Taiwan. Sladjana's research focuses on intellectual capital, knowledge management, innovation and business performance. Her experience includes participation in scientific and industry-related projects, more than 80 academic publications, holding lectures and presentations worldwide, and serving on editorial boards of academic journals and conferences.

Delio I. Castaneda, PhD (Cum Laude) in Organizational Behavior from Universidad Autónoma de Madrid, Spain. Master (with Distinction) in Education with emphasis in Organizations from University of Manchester, England. Now Full Professor at Pontificia Universidad Javeriana, researcher, consultant and invited Professor in the fields of Knowledge Management, Organizational Learning and Strategic Talent Management.

Omer Celik has graduated from Master's degree in MBA from Cyprus International University. His interest of fields are leadership in healthcare, knowledge management, and organizational behaviour. He is currently working at the public sector in Turkey.

Chen-Cheng, Chang is currently a graduate student in the Department of Business Administration of National Chin-Yi University of Technology. Her research interests include knowledge management, organizational behavior, and digital learning.

Jolanta Chluska is a professor of accounting at the Faculty of Management of Częstochowa University of Technology (Częstochowa, Poland). She is the head of the Department of Finance, Banking and Accounting. Its main research areas are financial accounting and management accounting of medical entities and other economic organizations. Since 1999 she is a statutory auditor.

Andrzej Chluski is an assistant professor at the Faculty of Management at Czestochowa University of Technology, Poland. He obtained a PhD degree in management science at Czestochowa University of Technology (2012). He has published over 50 peer-reviewed papers. His current research focuses on management of knowledge, information systems and information and communication technology in healthcare organizations.

Grzegorz Chmielarz, PhD, studied English Drama at University of Lodz, Economics and Law (Polonia University of Czestochowa) and Computer Networks (Czestochowa University of Technology). Works at the Department of Information Management Systems (Czestochowa University of Technology, Faculty of Management). Main research interest is information and personal data security management, recently application of Artificial Intelligence in this area.

Leszek Cichobłaziński: Assistant Professor of Human Resources Management and Negotiation (Management Faculty of the Częstochowa University of Technology, Poland). Main scholarly interests are in human resources management. Research focuses on the anthropology of organization, knowledge management, organizational semiotics, mediation in collective bargaining as well as on organizational conflict management. His educational background is in Sociology.

Daniela Firmino Cidade is a PhD candidate at Business School, Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), Brazil. She obtained her master degree in Organizational Communication from PUCRS in 2019. Her current research interests include Knowledge Management, Knowledge Sharing and Corporate Communication. Her has been a communication executive for over 25 years.

Simone Cifolelli is a PhD student in accounting management and business economics at "G.d'Annunzio" University, Department of management and business administration, Pescara (Italy).

Concetta Lucia Cristofaro: Associate professor in Human Resource Management at e-Campus University (Italy) Currently, she is adjunct Professor of in Organization theory, Conflict Management and Human Resource Management, Public and Private Organization at the Magna Graecia University. Her research is focused of intellectual capital, ITC, digitalization, family business, performance, gender diversity and knowledge management.

Carla Curado is an Associate Professor of Organizational Behavior and Human Resources Management at ISEG – Lisbon School of Economics and Management, Universidade de Lisboa, Portugal. Her research interests include Knowledge Management, Human Resource Management and Organizational Behavior. She is a researcher and a founder director of the ADVANCE research center

Aleksandra Czarnecka is an assistant professor at Czestochowa University of Technology, Poland. In 2006 she obtained a PhD in economic sciences in the field of management. She has been participating and organizing several international conferences on human resources management. Her main research areas are human resources management in organizations, knowledge sharing and knowledge management.

Francesca Dal Mas, MSc, JD, PhD is a Senior Lecturer in Accounting and Healthcare Management at the Department of Management, Ca' Foscari University of Venice, Italy. Priori to joining Ca' Foscari, she was a Senior Lecturer in Strategy and Enterprise at The Lincoln International Business School, University of Lincoln, UK. Her research interests include healthcare management and innovation, knowledge management, and sustainability.

Raymond Darfo-Oduro is a first year Ph.D. student of the University of Pardubice, Czech Republic and studying Public and Regional Economics in the Institute of Economic Sciences in the Faculty of Economics and Administration. My research interest covers areas of knowledge transfer, knowledge spill over and international trade.

Zito de Boer is a recent Master's graduate from the University of Amsterdam. Having followed his studies across a number of continents, he is passionate about equal access to high quality education globally. He is currently working in the fintech sector.

Darci de Borba holds a master's degree in administration from the Pontifical Catholic University of Rio Grande do Sul (PUCRS), a doctoral candidate in administration from the Universidade do Vale do Rio dos Sinos (UNISINOS), a specialist in corporate education management from UNISINOS and a degree in administration from PUCRS.

Fronika de Wit is a knowledge management consultant at the Portuguese Competence Center for Planning, Policy and Foresight in Public Administration. She holds a PhD in climate change and sustainable development policies from Lisbon university. Her main research interests include knowledge governance, sustainability, system innovation and participatory approaches.

Anıl Dinç Demirbilek is a research assistant from Izmir University of Economics Department of Industrial Design. He started his master studies in Izmir University of Economics, Department of Design Studies in 2020. His main research areas are open design and user-centered design.

Krishna Dixit is currently a FPM Scholar (Fellowship Program in Management) of Entrepreneurship Development Institute of India. She is currently visiting faculty in Nirma University. Her broad research areas include Knowledge Management, Innovation Management, and Start-up Ecosystem.

Daniel Dominguez is an Information Sciences graduate of the UvA. I love growing intellectually and physically, while serving my friends, family and the greater good. I hope to use everything I know to help people understand themselves and each other more, to be more positive.

Yanqing Duan is Professor of Information Systems at University of Bedfordshire, UK. Her principal research interest is the development and use of emerging ICTs and their impact on organisational performance, decision making, and knowledge management. She has received many research grants from various funding sources and published over 240 peer reviewed articles.

Nasser Easa: Associate professor of Business Administration (American University in the Emirates and Alexandria University, Egypt.) He also is the program director for Master of Knowledge Management at American University in Emirates. Nasser Easa held his PhD on Knowledge Management & Innovation in Banking at University of Stirling, UK.His research interest includes HRM, leadership, and knowledge management.

Monika Eisenbardt is an assistant professor at the University of Economics in Katowice, Poland. She received her PhD in information systems as well as changes and challenges involving modern consumers. She has published over 40 peer-reviewed papers. Her current research focuses on knowledge-based organizations, especially information systems and technologies for consumers.

Tomasz Eisenbardt is an assistant professor at the University of Warsaw, Poland. He has published several dozen of scientific papers and didactic works. He is interested in computer science and economic informatics, in particular in issues such as VLE and e-learning, data processing, analysis and design of IT systems as well as new trends in the field of IT, economics, and management.

Anandasivakumar (Siva) Ekambaram works as a research scientist at SINTEF, Trondheim, Norway. He obtained his doctoral degree, which focuses on project management and knowledge transfer in organizations, from the Norwegian University of Science and Technology (NTNU). Besides his research work, he is involved in teaching activities at NTNU.

Hayat El Asri is a Ph.D. Candidate at the Mohammadia School of Engineering, Morocco. She holds a M.Sc. in Management Information Systems from Coventry University, UK, and a B.Sc. in Computer Science from Al Akhawayn University in Ifrane, Morocco. Her current research interests include: Knowledge & Data Management, Artificial Intelligence, Predictive Analytics, and Public Procurement.

Celal Erdogdu has a Master's degree in Business Administration. He works in business as a real estate valuer and urban planner. He is Phd student in Business Management at the Department of Economics of ISMA University of Applied Sciences in Riga, Latvia. His main research areas are real estate, housing, valuation and urban economics.

G. Scott Erickson is Charles A. Dana Professor and Chair of Marketing in the School of Business at Ithaca College, Ithaca, NY. He has published widely on big data, intellectual capital, and business analytics.

Rafael Ferreira is a final year student in the Master of Business Information at the School of Accounting and Administration of Porto (ISCAP). He received his graduation diploma in Human Resources from ISCAP in 2020.

Fiorella Foscarini is an associate professor in the Faculty of Information at the University of Toronto, Canada. In her teaching and research, she uses rhetorical genre studies and information culture concepts to explore issues related to the creation, management, and use of records in organizational contexts.

Qiang FU is currently working in Institute of Technical Education, Singapore. He holds a Doctorate degree in Business Administration awarded by University of Canberra, Australia, and his research interest is in innovation management related fields. He presented and/or published papers in USA, Spain, Australia, South Korea, Singapore, China, Japan, and Hong Kong.

Joanna Gajda is a doctor of humanities. Since 1995, he has been working in a research and teaching position at the Częstochowa University of Technology in Poland. Her scientific and research interests relate to human resource management. In 2017, she was awarded the Medal of the National Education Commission for contributions to education and upbringing.

Mohammed Ibrahim Gariba is a second year PhD student in the University of Pardubice, the Czech Republic. His field of study is Economic Policy and Administration and specialises in Regional and Public Economics. His research interest is in fiscal decentralization and sustainability, corruption and economic growth as well as regional disparities and income inequality.

Eduardo Giugliani is full professor at the School of Technology of the Pontifical Catholic University of Rio Grande do Sul – PUCRS, Brazil. Director of IDEIA - Support Center for Scientific and Technological Development, PUCRS. Post-Doctor and Distinguished Fellow by Fondazione Bruno Kessler (FBK), Trento, Italy. Doctor in Engineering and Knowledge Management from the Federal University of Santa Catarina.

Konrad Głębocki is an associate professor at the Management Faculty at the Technical University of Częstochowa. He concentrates his research on smart city management. He lectures in Public Management and the European Union. He was a member of the Częstochowa City Council, deputy in the Polish Parliament and Ambassador of Poland to Italy.

Bianka Godlewska-Dzioboń, PhD, assistant professor (University of Economics Krakow, Department of Public Policies, Faculty of Economy and Public Administration). Expert and trainer in research and implementation projects in the field of promotion of academic entrepreneurship and competence development. Founder of UEK Dialogue Laboratory, an initiative connecting university community, students, research, and teaching staff with the business community /local government.

Tiago Gonçalves, is an Invited Assistant Professor and PhD candidate in Management at ISEG – Lisbon School of Economics and Management, Universidade de Lisboa, Portugal. His research interests include Knowledge Management, Human Resources Management and Organizational Behavior. His research is published in international journals and presented in both national and international conferences.

Martyna Gonsiorowska is a master student of the Faculty of Management & Economics at the Gdansk University of Technology. Her research interest is in knowledge management. Currently, member of a team working on the project entitled "Knowledge risks in modern organizations" financed by National Science Center of Poland.

Adriana Coutinho Gradim is a PhD student at the University of Aveiro. She has a bachelor's in Business Relationships and a master's in Management. She worked in the INNHOSPITAL project. She has a doctoral scholarship to develop her thesis in the field of intellectual capital and knowledge management in a mobility context.

Kristina Grumadaite is a project researcher at the Faculty of Economics and Management, Vytautas Magnus University. Research interests: emergence of self-organising industrial systems, innovation, business and knowledge ecosystems, smart development of social systems.

Tadeusz A. Grzeszczyk is an associate professor in Faculty of Management at Warsaw University of Technology and conducts scientific and didactic activity regarding project management and evaluation (about 150 publications in management and social sciences). His interests and research work also include methodology of management sciences and the use of AI methods in decision support.

Mercedes Gumbau-Albert is PhD in Economics. Specialist fields: Knowledge, thecnological change, regional economics…Visiting Researcher at Florida State University, MartinTrust Center for Entrepreneurhsip (MIT)… Some published articles: Annals of Regional Science; International Journal of Knowledge, Culture and Change Management; Papers in Regional Science; Entrepreneurship and Regional Development; European Journal of Innovation Management.

Assoc. Prof. Hanne Haave is a researcher and lecturer, having lectured quantitative and qualitative data collection methods for several years. Besides being a Project Manager in several large research projects, she has been conducting important gender research. She is currently doing research into student active methods and game based learning.

Ragna Kemp Haraldsdottir is an assistant professor in the division of Information Science, School of Social Sciences, University of Iceland. Her teaching and research focus on information management in organizations, where she emphasises the human, communicative and organizational aspects of IT.

Sheikh Shamin Hasnain works at British University in Egypt as a Senior Lecturer (Associate Professor). Hasnain has taught in numerous universities in the UK, Egypt, and Bangladesh. Besides, several academic papers, he has written a book titled "Knowledge Management in Non-Governmental Organizations: Towards a New Horizon," which tackles current knowledge management issues.

Dr Omid Haass is a Lecturer at the RMIT University, School of Property, Construction and Project Management based in Melbourne, Australia. His research interests entails Information system Development, Project, Knowledge and Risk management. Omid is a member of Project Management Institute (PMI) and PMI Melbourne chapter since 2014 and have been certified as a Project Management Professional (PMP) by PMI since 2015. Omid is also a Certified Scrum Master (CSM) with Scrum Alliance since July 2019.

Andrew Herd is a senior expert in knowledge management and leads the ESA Lessons Learned activities at the Agency. Andrew joined ESA in 2003, having previously worked as Deputy Programme Manager with NASA on an International Space Station payload development project. He holds an Executive Masters in Business Administration and a honours degree in Mechanical Engineering.

Yayoi Hirose is a professor of Business Management at Toyo University, Japan. She received her Doctoral degree in Management from Henley Business School. Her main research areas are multi-cultural knowledge transfer and management, including Anglo-American and Asian countries, and engineering and business experts. She also proposes global digital business strategy to various Japanese companies.

Tuomas Hujala is finishing his first year at the Department of Health and Social Management in University of Eastern Finland. The topic of his dissertation is effectiveness of knowledge management on the management of health and social care.

Henri Hussinki, D. Sc. (Econ. & Bus. Admin.) Assistant Professor, Business Analytics (School of Business and Management, LUT University, Finland). Research focus: utilization of data and knowledge in organizational decision-making, value creation and business model innovation. Research published in journals e.g. Journal of Knowledge Management, Journal of Intellectual Capital, Critical Perspectives on Accounting, Accounting, Auditing and Accountability Journal.

Eli Hustad is a Professor at the Department of Information Systems, University of Agder, Norway. Her main research interests include knowledge management, agile system development, digital transformation, digital inclusion, and socio-technical aspects related to implementation of large-scale information systems. She has presented her work at several international conferences and published in many journals.

Goran Yousif Ismael, NOBLE Institute, Department of Business Administration, Northern Iraq (Erbil). He received Master and PhD degree in Innovation and Knowledge Management Department.

Evgeniya Ivanova is Knowledge Manager at CORE since 2018 and resposible for developemnt and management of COREresearch entity. Her experiences include the conception and development of a new knowledge management system, process optimization in knowledge flows and creating knowledge sharing environment and related harvesting processes to prevent the loss of valuable information and organisational silo.

Jacek Jakieła, Ph.D., Eng. University Professor at Department of Computer Science (Rzeszow University of Technology, Poland) with 23 years of research and teaching experience. He is an author of several scientific papers on Business Computing as well as co-author of international projects regarding the creativity-oriented methods for students professional development.

Waldemar Jędrzejczyk is a associate professor in the discipline of management science. He has been working at the Faculty of Management of the Czestochowa University of Technology since 1998. As a part of his research work, he is interested in management, economics, psychology and computer science. The main research stream concerns the issue of competences.

Birgit Jevnaker is a professor in Innovation and Economic Organization at BI Norwegian Business School. Birgit holds a Ph.D. from BI. Publications within design, art and knowledge management, innovation, entrepreneurship, and leadership.

Giedrius Jucevičius is Full Professor and Head of Research at the Faculty of Economics and Management, Vytautas Magnus University. Research interests: inter-organizational relations, business and innovation ecosystems, comparative management. He was a visiting researcher at EUI (Italy), UNIL (Switzerland), University of Cambridge (UK), is a member of EU expert groups under Horizon Europe.

Maria Angelica Jung Marques, PhD in Knowledge Engineering and Management, Post-Doctoral Student at Pontifical Catholic University of Rio Grande do Sul (PUCRS), HFACTORS Research Center

Annukka Jyrämä, professor (Estonian Academy of Music and Theatre Cultural Management program Tallinn, Estonia, Aalto University School of Business), Docent (Aalto University School of Business) on arts marketing and entrepreneurship and University of Arts Sibelius Academy on arts marketing. Research articles published in several journals e.g. International Journal of Arts Management, Marketing Intelligence and Planning, and Management Learning.

Jan Kamburg is a recent masters graduate from the University of Amsterdam. He has experience living and working in many countries which influences his work. This publication is his first and was envisioned during his studies at the University of Amsterdam.

Anna Karczewska is an assistant professor at Częstochowa University of Technology, Poland. She received her PhD in social sciences from University of Wrocław in 2016. She has been organizing several international conferences on human resources management. Her main research areas are organizational behaviour, human capital management, online communities of practice.

Suzanne Kelly is a PhD researcher at Ulster University and Teagasc. Her PhD is exploring the role of social capital for innovation amongst agri-food business support programmes. Her main research areas are social capital, knowledge exchange and innovation capabilities.

Clemens Kerschbaum works at the Institute for Data, Process and Knowledge Management at Vienna University of Economics and Business. Coming from a Business Law background he pursues a PhD in Business. His research centers around non-rational knowledge and the connection between aesthetics and organizational purpose.

Reem Khamis: Assistant professor, University College of Bahrain, Manama, Bahrain.

Nasrullah Khilji is a Portfolio Leader for Academic Partnerships and Senior Lecturer in Applied Project Management at the University of West London, School of Computing and Engineering.

He has extensive knowledge of KM, MIS, project management, business strategies and systems, technology innovation, leadership, and entrepreneurship in a variety of settings.

Aino Kianto, is a Professor in Knowledge Management at the LUT School of Business and Management, LUT University, Finland. Aino's research focuses on knowledge management, intellectual capital, creativity, innovation and organizational renewal. Her research on these topics has been published widely, and she holds an editorial board position in five academic journals.

Prof. DSc PhD Eng. Leszek Kiełtyka, Czestochowa University of Technology, Faculty of Management. His main scientific interests include: developing algorithms for monitoring and economic evaluation of phenomena occurring in selected procedures of marketing; adaptation model of "Intelligent system for decision support in enterprise"; forecast of telework development at the time of Information Society emergence.

Kathrin Kirchner is an associate professor at Technical University of Denmark. She received her PhD in information systems from University of Jena, Germany. She is co-editor of the Journal of Workplace Health Management. Her main research areas are knowledge sharing, virtual collaboration, distance work and the impact of artificial intelligence in organizations.

Beate Klingenberg (dual degreed in business (MBA) and physical chemistry, (PhD), is lecturer at the FOM Hochschule für Oekonomie & Management, Germany and adjunct lecturer at Marist College, School of Computer Science and Mathematics. She is the co-founder and CTO/CFO of SMIndicator, LLC.

Florian Kragulj (PhD) is a postdoctoral researcher at the Institute for Data, Process and Knowledge Management at the Vienna University of Economics and Business, Austria. His research is on organizational learning and knowledge-based management. He received a PhD in Social Sciences and holds a master's degree in Cognitive Science.

Patrycja Krawczyk graduated from the University of Economics in Wrocław (Poland). Her research interests are focused on management processes taking into account the international perspective. She focuses her attention on learning new areas, especially non-financial reporting. She works at the Częstochowa University of Technology. She is the head of the Corporate Governance postgraduate studies.

Kyra Kronenberg is a researcher in the field of education and IT, and recently graduated from the University of Amsterdam with a specialization in Information Systems. She is passionate about research that focuses on accessible education, the promotion of equal opportunity and is involved in multiple Erasmus+ projects.

Joanna Krzywda is a researcher and academic teacher at the Faculty of Management, Częstochowa University of Technology. She is also a translator and negotiator. She teaches subjects related to logistics and negotiations. Her research interests include city logistics, reverse logistics, but above all commercial negotiations.

Ewelina Krzyżowska is an assistant professor at the Cathedral of Applied Sociology and Human Resources Management at Częstochowa University of Technology, Poland. She defended her PhD thesis in 2019. The area of her research interests is the psychology of

management, occupational psychology, psychology of cognitive processes, as well as health and clinical psychology.

Robert Kuceba is an Associate Professor at Czestochowa University of Technology. The Vice-Director of the Department of Information Management Systems. Author of over 200 scientific papers in the scope of, among others: Information Management Systems, knowledge management, artificial intelligence, sustainable development and social responsibility, Smart Grid, prosumer energy dispersed micro- and mini-installations (including RES), eco-innovations.

Katarzyna Kukowska is an assistant professor at Częstochowa University of Technology. She received her PhD in economics from Poznań University of Economics in 2010. Author of scientific articles on individual entrepreneurship, social capital, organizational behaviour, evolutionary conditions of the flow of goods in social networks.

Naser Kazemi Eilaki currently works as PhD research fellow at the Department of Civil Engineering of western Norway university of applied science. Naser does research in Fire safety and risk assessment. He is a member of builder's project. Their current project is about design of home for at-risk group to improve current safety level of available and future homes.

Wioleta Kucharska holds a position as an Associate Professor at the Faculty of Management and Economics of the Gdansk TECH, Gdansk University of Technology, Fahrenheit Universities Union, Poland. Authored 56 peer-reviewed studies published with Wiley, Springer, Taylor & Francis, Emerald, Elsevier, IGI Global, and Routledge. Recently involved in such topics as tacit knowledge and company culture of knowledge, learning, and collaboration. Along with scientific passion and achievements, she has 12 years of managerial experience; therefore, her works next to theoretical foundations actively refer to management practice.

Harri Laihonen is a professor at the Department of Health and Social Management, University of Eastern Finland. His research focuses on knowledge management and performance management.

Carmem Leal is an assistant professor of Management at the University of Tras-os-Montes and Alto Douro in Portugal. She is the Head of the Department of Economics, Sociology, and Management at UTAD, and her primary areas of research are Knowledge Management, Knowledge Sharing, Leadership, and Finance Management. She is now a full member of the Centre for Transdisciplinary Development Studies' Innovation & Market Ecosystems Group.

Cristina Ledro, is a PhD student in Management Engineering and Real Estate Economics at the Department of Management and Engineering of the University of Padova, Italy. Her research and consulting interests lie in digital strategy, digital transformation, value creation and performance measurement, with specific expertise in the customer relationship/experience management field.

Małgorzata Łęgowik-Małolepsza is a lecturer at the Faculty of Management of the Częstochowa University of Technology (Poland). She has research and teaching experience gained while working in an international cement industry concern and in higher education. She focuses her research interests, among others on issues related to sustainable

development, eco-marketing, cost management, lean management culture and decision making.

Sylwia Łęgowik-Świącik is an assistant professor at the Faculty of Management of the Częstochowa University of Technology (Poland). She has research, teaching and managerial experience in higher education. She focuses her research interests, among others on issues related to knowledge and intellectual capital management, cost management, enterprise profitability and decision making.

Anna Lemańska-Majdzik works as associate professor at Faculty of Management, Czestochowa University of Technology, Poland. She is an author of 160 scientific papers/monographs. She was a supervisor of over 120 Bachelor, Master and PhD theses. In the scientific activity, she focuses on entrepreneurship and management, including family businesses, their flexibility and competitiveness.

Te-Yi Lin is an assistant professor of Department of Business Management at Tatung University, Taiwan. She received her PhD in business administration from National Chengchi university. Her main research areas are national intellectual capital, international business strategy and business groups.

Gang Liu (ORCID: orcid.org/0000-0002-3656-1630) is an Associate Professor at Business School, Shenzhen Technology University, China. His research interests cover knowledge management and organizational performance, innovation and entrepreneurship, and cross-cultural management.

Hoi Ngan Loi is an Associate Professor of Humanities and Social Sciences, Macau Polytechnic University. He obtained the Ph.D. degree from Peking University. He specializes in business ethics, gaming economy and management, and statistics. He is an expert at the Macau Development Strategy Research Centre.

Jane Lucia S. Santos Is doctor in Engineering and Knowledge Management, and currently is researcher at the School of Technology of the Pontifical Catholic University of Rio Grande do Sul - PUCRS, Brazil. She is a founding member of the HFACTORS Human Factors and Resilience Research (https://hfactors.pucrs.br/), and her main research interests are organizational capabilities, innovation, and organizational learning.

Master Duc Nghia Mai: Lecturer (School of Accounting), UEH. Master of Accounting degree (University of Melbourne, Australia) A member of CPA Aust from 2014. Worked as senior internal auditor at IA department of a Vietnam commercial bank and before that as independent auditor at Ernst &Young Vietnam. He is a PhD. candidate in accounting. Research includes accounting, internal / external audit, internal controls.

Johan Olaisen is a professor in Knowledge Management at BI. Johan holds a Ph.D. from UC Berkeley and a MA and a MSc. Publications within knowledge management, philosophy of science, leadership, and strategy. Johan was Statoil chair 2000-2012, chair for EURAM 2006 and head of several departments at BI 1992-2012. He was responsible for Bis Master program in Melbourne 2000-2009 and corporate Master programs for Scandinavian companies 1985-2022.

Margaret Mangion is a Senior Lecturer at The Edward de Bono Institute for Creative Thinking and Innovation and at the University of Malta. While actively working on research projects, Margaret is also involved in a number of outreach programmes engaging different sectors across society. Margaret also has experience on expert panels at policy making level.

Dora Martins is a senior lecturer with a PhD in Business Sciences. She teaches HRM at the Porto Accounting and Business School, Polytechnic of Porto, Portugal. She has been a research member of GOVCOPP, University of Aveiro, and CEOS.PP, Polytechnic of Porto. Her main research subject is competencies for work in the digital age.

Maurizio Massaro, PhD, is an Associate Professor in Accounting and Digital Management at the Department of Management, Ca' Foscari University of Venice, and H-Farm Education, Italy. He was a visiting professor and a guest lecturer in several universities in the USA, the UK, China, Hong Kong, Iran, and Australia among others. He is the Italian scientific Chief of the MIKE – Most Innovative Knowledge Enterprise Award.

Nuno Matos is the Operational Director of Diagonal - Insurance Brokers, part of the Luis Simões Group. He is currently an MSc Student for Management of Social Economy Organizations at the Polytechnic Institute of Santarém. Having always developed his activity in the business world, he has been Vice-President of the ICAA - International Association for the Management of Intellectual Capital since its foundation, where he carries out his research activity, with several publications subordinated to the Management of Intellectual Capital and Knowledge Management in organizations

Alfred Mazorodze is a software developer in South Africa. He received his MSc in Computing from the University of South Africa in 2018. His interests are on practical problem solving, involving exploration of new ways of executing organisational functions in a more effective way. Alfred's research interests are on Knowledge Management and cloud computing.

Anna Maria Melina is PhD in Economics and Health Management. She is adjunct professor in Organisation Theory at University of Catanzaro. Her research focuses on Knowledge management, Small & Medium Business, Generational Change and Healthcare System. She is a speaker in national and international conference and the author/co-author of several publications (books, articles, research reports).

Telma Mendes is a lecturer at the School of Technology and Management, Polytechnic Institute of Porto. She has a degree in Business Sciences, a master's degree in International Management, and serves as an effective member of the Certified Accountants Order's. Currently, she is attending her PhD on the University of Vigo (Spain).

Marit Meyer Solheim is a phd-student at Oslo Metropolitan University. She has experience as a manager in public services and software business. Her professional interests are leadership, organizational development and digitalisation in working life. Her PhD-project is about the role of leadership in the use of digital learning among employees.

Ludmila Mládková works at the Prague University of Economics and Business, Czech Republic. She specialises in management, knowledge management, management of knowledge

workers and managerial leadership and lectures and publishes in these topics. She strongly believes that only systemic approach to management brings benefits to organisations.

Donovan Nadison is a Doctor of Business Administration Student at Teesside International Business, Teesside University, Middlesbrough in the UK. He received his undergraduate bachelor's and post graduate master's degree in social work from the University of the Witwatersrand in Johannesburg, South Africa. His research interest is in knowledge management.

Nóra Obermayer, PhD is an Associate Professor, Head of Department of Management and Vice-dean for Development at the University of Pannonia in Veszprém, Hungary. She obtained her Ph.D. in Economics and Management (Knowledge management) in 2008. Her main fields of interest are knowledge management, HR, AI, social media and organizational/national culture.

Dr hab. Małgorzata Okręglicka works as associate professor at Faculty of Management, Czestochowa University of Technology, Poland. She is an author of over 200 scientific papers and 4 monographs. She was a supervisor of over 200 Bachelor, Master and PhD theses. In the scientific activity, she focuses on corporate entrepreneurship, sustainable development and SMEs.

Assoc. Prof. Małgorzata Okręglicka, Ph.D. represents Czestochowa University of Technology, Faculty of Management, Department of Economics, Investments and Real Estate, Poland. Her research interest is focused on corporate entrepreneurship, management of small and medium-sized enterprises and innovations. Author of over 200 articles and 4 monographs.

Mírian Oliveira is a professor and researcher at Business School, PUCRS, Brazil and invited professor and member of Advance/CSG at ISEG, Universidade de Lisboa, Portugal. She obtained her doctoral degree in Business Administration from the UFRGS in 1999. Her current research interests include Knowledge Management, Knowledge Sharing, Knowledge Hiding, and Research Method.

Roberta Oppedisano Ph.D is a Researcher (RtdA) in Business Organization at the Department of Business and Economic Studies, University of Naples "Parthenope". Thanks to the experience of Visiting research scholar at Columbia University, New York, and IESEG School of Management, Paris, she has developed research interests on organizational behavior, human resources management and compliance behavior.

Johanna Orjatsalo (M. Sc.) is a lecturer and doctoral candidate in LUT University, Finland. Prior to joining academia, she worked for over 20 years in leadership and strategic development roles on several industries, most recently as Managing Director of F-Secure Consulting. Her main research areas are strategic decision making and knowledge-based management.

Taha Osman is a principal lecturer in the Department of Computing, Nottingham Trent University, UK. He received his PhD in Fault-Tolerant Distributed Computing from Nottingham Trent University in 1998. His research interest includes the Semantic Web, Knowledge-based Information, Extraction, NLP & Sentiment Analysis, where he has numerous journal and conference publications

Victoria Yousra Ourzik received a Master's in Management from Grenoble Business School, France in 2015. She worked as an International Consultant for the L'Oréal Group, the Colgate-Palmolive Company and Expedia Group. She is currently pursuing Ph.D. degree with the University of Paris Dauphine, France. Her research interests include customer knowledge, big data and organizational agility.

Gregorio Pérez Arrau is Associate Professor, director of the diploma in knowledge management and head of the area of Human Resources Management at the Faculty of Management and Economy of the Universidad de Santiago de Chile. He received his PhD in management sciences from the University of Liverpool in 2010.

Monica Posada. Industrial engineer, Master of Business Administration and researcher for the Piensa group. Currently works as the leader of the processes of the Efigas S.A E.S.P human resources, administrative and sustainable development department.

Alina Praun is a researcher and doctoral student at the Disruption and Societal Change Center (TUDiSC) of Technische Universität Dresden. Her research focuses on science communication and higher education governance from educational and organizational perspectives.

Aleksandra Radziszewska works at the Czestochowa University of Technology (Faculty of Management). Her scientific interests include different aspects of marketing, consumer behavior, electronic commerce research, as well as quality management and intercultural management. She is the author of numerous scientific publications from this field in national and international journals as well as chapters in monographs.

Dominik Reisner has been working at the Austrian Federal Ministry of Education, Science, and Research (and its predecessors) since May 2008. He is the head of subunit IV/4a, intellectual capital reports and strategic plans and holds a law degree from the University of Vienna.

Marcin Relich is a researcher at the Faculty of Economics and Management, University of Zielona Gora. His main research areas are related to new product development, project management, knowledge acquisition, business analytics, management information systems, and decision support systems.

Emanuela Riccio is a Ph.D. Candidate at the Department of Industrial Engineering - University of Naples Parthenope (Italy). She received the M.Sc. degree in Engineering Management. Her-current scientific interests concern the role of Industry 4.0 enabling technologies and blockchain in the healthcare supply chain

Elżbieta Robak is an assistant professor at Częstochowa University of Technology, Poland. She received her PhD in social sciences from University of Silesia. Her main research areas are: organizational behaviour, human capital management, psychology of management, occupational psychology. She is the author of numerous scientific publications from this field.

Margaret C Robb: I completed an MSc Marketing in 2019. I was placed 2nd in the year and won the Top Dissertation prize. My area of interest was SME internationalisation. Not wishing to leave this area of study, I began a PhD in 2020 in the areas of Marketing, Internationalisation and Born Globals.

Daniela Robu, MSc, CPT, CRP, CHE, Director, Innovation and Business Intelligence, Health Evidence and Innovation, Provincial Clinical Excellence, Alberta Health Services. Daniela is a Certified Health Executive, has a Masters of Science in Biomedical Engineering, Certification in e-Learning, Adult Learning, Performance Technology and Return on Investment. Daniela integrates innovative approaches in her work that aim to solve complex business challenges to increase efficiency of core business processes, where decision intelligence/ innovation are central to organizational performance.

Gastón Rodríguez is a professor of business management University of Envigado, Colombia. He received his master's degree in Administration. From Rosario University in 1993. Recognition as a Research Associate by the government of Colombia of science, technology and innovation. Academic Peer of the Colombian education government.

Mauro Romanelli is Associate Professor in Organization and Human Resource Management at Parthenope, University of Naples Department of Business and Economics, Napoli, Italy. Research interests: Organizational change, innovation, ICT and sustainability within public sector organizations, smart and sustainable cities and communities, museums and cultural heritage, healthcare. He is member of Egos, Euram, itAIS, ICT, BSLab.

Helen Rothberg is dual degreed in business and behavioral science, is professor of strategy at the School of Management at Marist College, senior faculty at the Academy of Competitive Intelligence, and president of consulting firm HNR Associates. She has consulted with Fortune 500 companies, small technology start-ups, and nonprofit organizations and is contributing author for Money.com.

Anna Rybak, PhD, is Assistant Professor at the University of Technlogy, Czestochowa. Her research work focuses on innovation management, promoustiog and supporting entrepreneurship among non-governmental organizations and social innovation in the area of employment. She is an expert of the Intelligent Development Operational Program.

Mohammad Omar Sabri: Assistant professor, finished his PhD from the University of the West of England (UWE), UK. Mohammad is currently the vice dean of scientific research at Zarqa University. Mohammad has a demonstrated history of working in the software development industry and is skilled in different research areas; Knowledge Management, Business Process Architecture and Ontologies.

Josune Sáenz is an Associate Professor and Vice Dean for Research and Transfer at Deusto Business School (DBS, University of Deusto, Spain). She specializes in Management Accounting, Strategic Management Control, and Knowledge Management and Innovation. She has been main researcher of the Innovation Chair sponsored by BBVA at DBS.

Mustafa Sagsan is a professor of Business administration at Cyprus International University, Cyprus, He received his PhD in Business administration from **Başkent University** in 2008.

Besir Kemal Sahin is a graduate student at Istanbul Commerce University. He completed her undergraduate education at Middle East Technical University. He is an entrepreneur and is the CEO of Ekspoturk and Satur companies. At the same time, he is the event director of the

HIMSS Eurasia Health Technologies Conference and Fair and the General Secretary of the Turkish Health Platform. He is also the founder of the Future Leaders in Health Platform.

Oghenere Salubi is a Senior Lecturer at the Department of Library & Information Science, University of the Western Cape, Cape Town, South Africa having previously accumulated industry-based information science experiences as well as over five years' cumulative experience of teaching in higher education. He also volunteers as a Data instructor for The Carpentries.

Juha Saukkonen D.Sc. (econ.) is a Senior Lecturer of Management at the JAMK University of Applied Sciences in Finland. He teaches and publishes on topics of futures foresight, knowledge management, anticipation, and entrepreneurial education. He also acts in expert roles in various University-Industry cooperation projects.

Enrico Scarso Ph.D. is Professor of Engineering Management at the University of Padua (Italy). His current research interests are in the area of technology, innovation and knowledge management. He has published in several Journals and has presented papers at various International Conferences. He is co-founder of "International Association for Knowledge Management" – IAKM.

Yee Yee Sein and I am a second year Phd student who is currently studying at the University of Pardubice, in the Czech Republic. I have already participated in 21st and 22nd European Conference on Knowledge Management. At the moment, I am focusing on these research areas - knowledge, innovation policy and regional development.

Denilson Sell is professor of Knowledge Management at the Federal and State universities of Santa Catarina (Brazil). He is also a director at Instituto Stela. He has led several research and development projects with public and private organizations. His most recent work focuses on Knowledge Management, Analytics, Resilience, Digital Platforms and Digital Transformation

Chulatep Senivongse is a full-time academic Lecturer and Researcher at Bangkok University. He received Ph.D. in Knowledge and Innovation Management from Bangkok University in 2017. His research interest is in the area of organizational learning, organizational absorptive capacity, multidisciplinary knowledge knowledge transfer, and Marketing and Cognitive Semiotics.

Viivi Siuko is a Doctoral Researcher at Tampere University, in NOVI research group. Her doctoral thesis focuses on interorganizational knowledge management in project networks and the research is closely connected to ProDigial research program.

Tale Skjølsvik works as a professor in technology management at Oslo Metropolitan University. She holds a Ph.D. in Strategic Management and has experience as a management consultant. Tale has worked as a lecturer in strategic management, entrepreneurship and technology management. Her research concentrates on the strategic and knowledge management and digitalization.

Sebastian Skolik is an assistant professor at Częstochowa University of Technology. He received his PhD in social sciences from University of Silesia in 2008. His main research areas

are: social capital, social networks, knowledge sharing, open collaboration projects and institutionalization of free culture movement.

Graeme Smith: I specialise in strategy and business planning; business consultancy; academic and marketing research. Graeme is a lecturer in marketing at Solent University specialising in strategy and communications. Research interest follow the development of his PhD research on semiotics in strategy; strategy discourse and narrative; with a particular interest in stakeholder interpretation of strategy conversations.

Maria José Sousa (PhD in Management) is Pro-Rector for the Development of Distance Learning and a professor and a research fellow at ISCTE/Instituto Universitário de Lisboa. Her research interests currently are public policies, information science, innovation and management issues. She is a best seller author in Research Methods, ICT and People Management and has co-authored over 100 articles and book chapters and is the guest-editor of more than 5 Special Issues from Elsevier and Springer. She has coordinated several European projects of innovation and is also External Expert of COST Association - European Cooperation in Science and Technology and is former President of the ISO/TC 260 – Human Resources Management, representing Portugal in the International Organization for Standardization.

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.

Sonata Staniulienė is associated professor and Head of Academic Council at the Faculty of Economics and Management, Vytautas Magnus University. Research interests: organizational culture, behaviour, design, business ethics, organizational knowledge networks.

Gerald Stei is a PhD student at Babes-Bolyai University (Cluj-Napoca) and Reutlingen University (Reutlingen). His research integrates organizational management with information system studies. He examines the interplay of organizational management and knowledge management systems. In particular, he publishes on organizational performance effects of enterprise social media use.

Trine Marie Stene (Senior scientist) at SINTEF, Norway. PhD in Education, NTNU, Norway (2005). More than 30 years of R&D and innovation experience related to sectors as: Transport, Petroleum, Space, and Construction industry. Several national and international publications. Main research topics: Resilience and safety; Human-technology-organisation interactions; Socio-technical systems; Knowledge management; Learning as individuals, teams and organisations.

Marcin Stępień holds a PhD in management sciences at the Department of Finance, Banking and Accounting at the Faculty of Management of the Częstochowa University of Technology in Poland. Scientific and research achievements include 99 items. The mainstream interests covers the area of accounting and related elements of business management.

Ewa Stolarek-Muszyńska is a PhD candidate in Management at Doctoral School, Gdańsk University of Technology. Her research interests are in knowledge management and crisis. Prior to starting her PhD program, she worked for various companies in the business and NGO sector, gaining managerial experience in marketing and management field.

Fred H. Strønen is associate professor at Oslo Business School, OsloMet - Oslo Metropolitan University. He has a Ph.D. within strategy and organization, and he likes teaching. Strønen has extensive experience in working with strategic and managerial development for larger public and private organizations in Norway. In his leisure time Strønen enjoys biking and skiing.

André Sucena, PhD student in management at the University of Beira Interior (UBI), Portugal. He has a degree in management and an MSc in development studies. Additionally, I work full time in a construction company where I am the financial project manager.

Joanna Swietoniowska, Ph.D. She is an Assistant Professor in the Department of Management at the University of Information Technology and Management in Rzeszow, Poland. Her research and teaching expertise includes project management, as well as entrepreneurship and innovations. Over the past 18 years she has managed many national and international projects.

Emőke Takács is a researcher at ERI Hungary – European Research Institute. She worked with Toon Abcouwer on further developing the Adaptive Cycle of Resilience. Her experience with social economical challenges led to initiation of new insights for dealing with future uncertainties and the underlying logic. The Me-We-All approach is the result of this cooperation.

Manuel Tamayo Systems Engineer, Master in Computational Engineering. Researcher and leader of the group Piensa.

Angelina Taneva-Veshoska is Director of the Institute for Research in Environment, Civil Engineering and Energy – IECE. Her teaching and research interests are in: Sustainability, Intellectual Capital, Organisational Behaviour, Leadership, Ethics. Prof. Angelina has worked on more than 25 educational and research projects funded by Horizon 2020 and Erasmus+ programs, collaborating with academic and business partners from Europe.

Clare Thornley holds an MA in Philosophy, an MSc in Information Management and a PhD in Information Retrieval. She currently runs her own business, Clarity Research, and works on a range of national and EU projects concerning the development of professional ethics within the Information and Knowledge professions. She also teaches 'Information Organisation' for the Information and Library Management MSc at Dublin Business School.

Eduardo Tomé PhD (Economics, 2001, Thesis on the European Social Fund). Has published 50 papers in peer-reviewed Journals and presented 90 papers in international conferences. Since September 2020 he has worked at Universidade Lusófona (Lisbon, Portugal). Main interests are Intangibles (Human Resources, Knowledge Management and Intellectual Capital), Social Policy and International Economics (globalization and the European Integration).

Wiktoria Trzepizur is a PhD student at the Częstochowa University of Technology. Her main research areas are innovation, knowledge management and the high technology sector.

Man-Chie Tse is a PhD student. Her research focus surrounds engineering methods for analysis of intangible modelling properties in personal KM, strategic organisational design and development. Besides her research work, she is involved with exploring the practical application of new processes, methods, tools and techniques in organisations to achieve innovation and transformational change.

Rebecca P. Tumwebaze is a PhD student at Kemmy Business School, University of Limerick. Her PhD research is in Agriculture Knowledge Management and was borne out of her experiences in her previous work as well as her background, having grown up at a farm in rural Uganda.

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

Vivien Vágner is a PhD student at University of Pannonia in Hungary. Her PhD dissertation title is Ethics, trust and organisational success connection in knowledge-oriented organisations. The topic of her research is Organisational knowledge sustainability.

Wouter van Lelyveld, Tridense, earned a BSc from The Hague University of Applied Sciences, an MSc from the University of Amsterdam; recently acquired the MSc degree from the master's Information Studies: Information Systems; worked on lifelong-learning through knowledge-sharing in university and businesses; is currently employed at Tridense as a developer.

Gregório Varavakis is a Full Professor in the Post-Graduation Program in Knowledge Engineering and Management at the Federal University of Santa Catarina (UFSC), Brazil. He is the leader of the Management Center for Sustainability (NGS/UFSC). Ph.D. in Manufacturing Engineering.

Marzia Ventura: is a Research of Organizational Studies at the Magna Graecia University in Italy. Currently, she is Professor of in Organization theory and Human Resource Management at the Magna Graecia University. Her research is focused of HRM, ITC, HTA, Family business, and knowledge management.

Ass. Prof. Tone Vold lectures at The Inland Norway University of Applied Sciences, Norway, in courses within digitalization of workforms and knowledge management, and is particularly interested in knowledge management, e-learning and games for learning. Her PhD is about work relevance of higher education for innovative and entrepreneurial behavior in organizations.

Bo Wen is a PhD researcher at Liverpool Business School, Liverpool John Moores University, UK. Her main research areas are knowledge sharing or knowledge hiding in the small family

businesses and cultural dimensions in Chinese family firms. She had engaged in reviewing articles for Journal of Work Applied Management and Narti conferences.

S**eren Wendelken** is a PhD candidate with Human-Centred Computing at Monash University, Australia. Her research explores ideas of liminality in recordkeeping theory and practice with a focus on narrative, rights and records creation.

Dariusz Wielgórka is an assistant professor at the Faculty of Management, Czestochowa University of Technology, Poland. He is the President of the Polish Economic Society in Czestochowa and finance director at company. He has organised 8 conferences on SME management including 3 international ones. His main areas of research include: management, finance, CSR, KM.

Joanna Wojcik, Ph.D. She is an Assistant Professor in the Department of Cognitive Science and Mathematical Modeling at the University of Information Technology and Management in Rzeszow, Poland. Her main research focus is the domain of new technologies, e-learning, university management, business models and agile methodologies.

Magdalena Zalewska-Turzyńska is a professor of management at University of Lodz, Poland. She received PhD in organization and management methodology. Her main research areas are communication in management, including internal communication and communication with the broadly understood business environment, the management of operational processes and the research methodology used in organization research and management.

Ph.D. Izabela Ziębacz, research worker at the Jan Długosz University in Częstochowa, Poland, Department of Social Policy, Social Work and Tourism, Faculty of Social Sciences. Research interest: knowledge management, measurement of effectiveness of training, effectiveness of employee teams.

Krzysztof Zięba, PhD, DSc, works as a professor for the Department of Entrepreneurship at Gdańsk University of Technology, Poland. His teaching interests are focused on broad aspects of economics while major scientific interests include nascent entrepreneurship, family business, as well as small and medium size enterprises.

Zbigniew Zontek, lecturer and scientist at the University of Bielsko-Biala, working on research into innovation, business management, tourism services and social organizations. He has conducted guest lectures in Italy, Turkey, Germany, the Czech Republic and Slovakia. Currently, he is working also as a business consultant and board member of the tourism promotional organization in Bielsko-Biala.

Knowledge Management Competencies in Health and Social Care

Harri Laihonen and Kaija Saranto
University of Eastern Finland, Kuopio, Finland
harri.laihonen@uef.fi
kaija.saranto@uef.fi

Abstract: Knowledge management literature has thoroughly discussed the aims and objectives of managing knowledge, recognized critical success factors of knowledge processes, analyzed knowledge creation, transfer and sharing, and even some indications of the effects of knowledge management have been evidenced. However, despite skills, competences, and employees' knowledge and experience are among the recognized success factors, discussions on competence needs of effective knowledge management are lacking. To contribute to this knowledge gap, this article studies knowledge management competences with an aim to elaborate this critical component of organizational performance and renewal. The special focus of the article is on the management of health and social care and the article brings together two distinct disciplines, knowledge management and health informatics, to suggest a novel way to approach KM capabilities and competences in the given context. Based on the literature and empirical data gathered with two surveys targeted to health informatics and knowledge management practitioners in health and social care the article concludes that: 1) It is difficult to separate the discussion on competence needs from the discussions concerning the information content and tools of data management. The latter aspects dominate the debate and determine and limit in many ways the discussions on knowledge management, its nature, content, and people participating to these discussions, and 2) knowledge management in health and social care focuses extensively on issues of data management and decision-making support.

Keywords: health and social care; competences; capabilities; knowledge management; health informatics

1. Introduction

Knowledge management (KM) is a management paradigm of the knowledge society. The roots of KM are in strategic management literature and in knowledge-based view of a firm (Grant, 1996; Spender, 1996). The overall aim of KM is to attain sustainable competitive advantage and strategic KM connects an organization's business strategy to the required knowledge assets (Hansen et al, 1999; Zack, 1999). In the public sector, the objectives of KM are more diverse, and it aims to enhance decision-making in public services, aid the public to participate in public decision-making, build societal capabilities, and develop competitive work force (Wiig, 2002).

In Finland, a reform of healthcare, social welfare, and rescue services is under way. The responsibility for organizing these services will be transferred from municipalities to wellbeing services counties from 2023. The key objective of the reform is to improve the availability and quality of basic public services throughout Finland (see https://soteuudistus.fi/en/frontpage). This reform focuses not only to re-defined geographical regions to provide services but also to means of providing services, and especially, the role and support of digitalization. The reform provides a context for this study, and the central questions for KM are: how can KM support serving of public good and good governance, and what kind of competences and skills are needed to fulfil these tasks? The focus of this article is on the latter question.

KM literature has quite thoroughly discussed the aims and objectives of KM, recognized critical success factors of KM (Heisig, 2009), analyzed processes of knowledge creation (e.g., Nonaka & Takeuchi, 1995), transfer (e.g., Argote & Ingram, 2000) and sharing (e.g., Riege, 2005), and even some indications of the effects of KM have been evidenced (e.g., Heisig et al, 2016; Inkinen, 2016; Hujala & Laihonen, 2021). However, despite skills, competences, and employees' knowledge and experience are among the recognized success factors, discussions on the evolving competence needs of effective knowledge management are lacking. To contribute to this knowledge gap, this article studies KM capabilities and competences and elaborates this critical aspect of KM with an aim to better understand what competences are needed to support organizational performance and renewal. In this article we complement the organizational focused view of KM with health informatics (HI) literature, which offers various frameworks for mapping HI competences (e.g., Jidkov et al, 2019; Thye et al, 2020). The article answers to the following research questions: 1) what is meant by KM competences and skills, and 2) what are the competence needs related to KM in management of health and social care?

2. Theoretical background – KM competences in health and social care

2.1 KM capabilities and the management of health and social care

There are different ways to approach KM capabilities and competences. Typically, these are approached from an organization-centric standpoint (cf. Laihonen & Huhtamäki, 2021) and the focus is on the management of processes, services, organizations, or institutions. Gold et al (2001) developed an organizational capabilities perspective, which aimed to identify and assess the preconditions – capabilities – for KM to flourish in organizations. Authors categorize capabilities into infrastructures and processes. Infrastructure capabilities are further divided into technical, structural, and cultural capabilities. KM processes leverage infrastructure to collect, store, transform and transport knowledge throughout the organization, and authors named four dimensions of process capability – acquiring knowledge, converting it into useful form, applying or using it, and protecting it. The chosen focus on the organizational capabilities leaves individual's skills and competences mostly out of the equation. Alavi and Leidner (2001) consider 'capability' as one perspective to knowledge, which considers knowledge as 'the potential to influence action' or 'the capacity to use information' as Watson (1999) suggests. Different views to knowledge lead to different perceptions of KM, and the view of knowledge as a capability suggests that KM is centered on building core competencies, understanding the strategic advantage of know-how, and creating intellectual capital (Alavi & Leidner, 2001). KM capabilities can also be viewed from the viewpoint of knowledge assets or intellectual capital (IC). IC management categorizes knowledge assets into structural, relational, and human capital (cf. Edvinsson & Malone, 1997; Sveiby, 1997; Roos et al, 1997), which is less studied aspect in public sector (cf. Guthrie & Dumay, 2015) and in the contexts of healthcare (cf. Evans, Brown & Baker, 2015) or social care (cf. Sillanpää et al, 2010).

Taking the discussion to the context of health and social care means that we need to acknowledge that capabilities and competences vary at different levels of the service system (see Figure 1). Naturally, competence needs vary also between professions. Technological innovations, scarcity of resources and increasing expectations and needs of customers and citizens are important change drivers throughout the society and have an impact also on knowledge needs and competence requirements at all levels of the service system. Indeed, in health and social care, KM is not only about streamlining information processes but also about coordinating multi-professional and intersectoral collaboration that introduce different values, objectives, and control mechanisms (Laihonen & Kokko, 2020) necessitating continuous performance dialogue (Laihonen & Mäntylä, 2017; Rajala & Laihonen, 2019). Approaches focusing only on rationality of decision-making and operational efficiency may neglect the social aspects of KM and the overall benefits of KM may become unachievable (cf. Hujala & Laihonen, 2021).

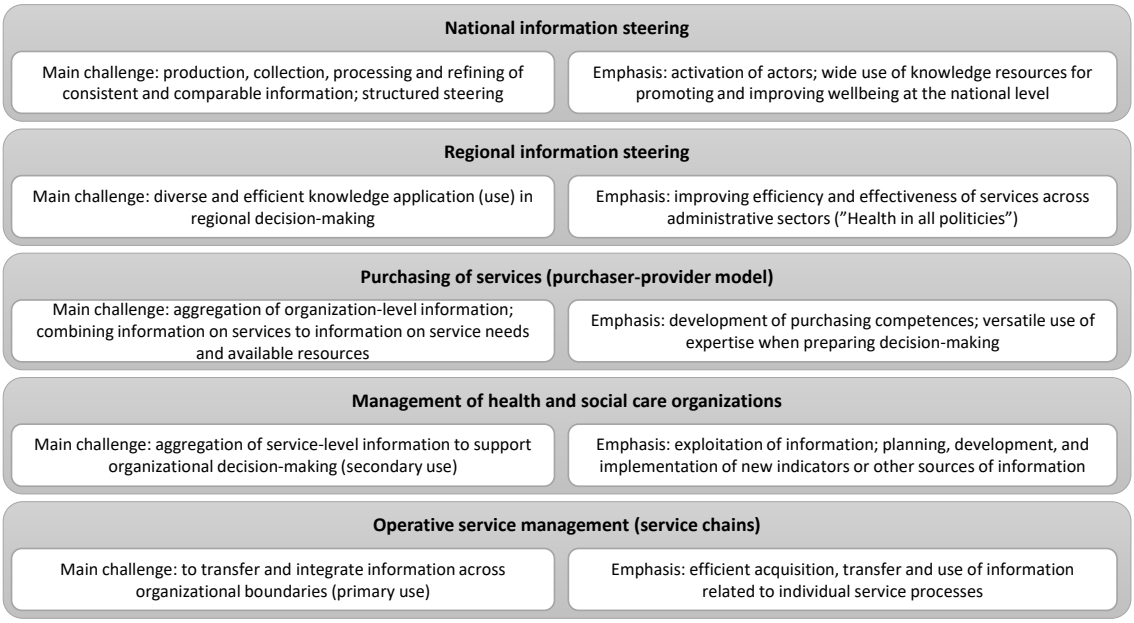


Figure 1: Data, information and knowledge are created and used at different levels of the service system (modified and summarized from Laihonen 2012; 2015)

Ongoing digital transformation and increasing connectedness of societal sectors and actors link the future competence needs not only to technological development but also to ways how organizations and organizing are perceived (cf. Laihonen & Huhtamäki, 2020). Hierarchical structures and management models take very different view to openness and to sharing and use of knowledge compared to those models that underscore the self-organizing nature of knowledge work (cf. Laihonen, 2006; Lönnqvist & Laihonen, 2017). Therefore, while considering the institutional and organizational context of KM, it is also important to pay careful attention to the special nature of health and social care data and its secondary use. Therefore, to complement the strategic and organizational viewpoint to managing knowledge, there is a need to acknowledge the developments in health informatics where the competence needs have been more explicitly discussed.

2.2 Health informatics competencies in health and social care

Different concepts are used for referring to competences needed to support the transition from the paper to the digital world in healthcare. Thye et al (2018) study eHealth competencies, Jidkov et al (2019) assess health informatics training in UK, and Thye et al (2020) approach the same topic by analyzing professionalism of information management in healthcare. All these approaches share the aim to understand and develop competences that would help organizations to respond to increasing digitalization in healthcare. This aim builds on an idea that a professional information management is required to successfully plan, implement, and evaluate information technology, and to ensure a high quality of health data and health information systems to support patient care (Thye et al, 2020). In addition to these academic contributions to the discussion, the European Federation for Medical Informatics (EFMI, see https://www.efmi.org), and the International Medical Informatics Association (IMIA, see https://imia-medinfo.org/wp/), have enhanced multidisciplinary education of professionals working in health care (Thye, 2020).

IMIA recommendations for Biomedical and Health Informatics Education were launched in 1999 and in spring 2022 the second updated version was published to guide not only academic institutions but also service providers and developers to reach optimum level of competencies in digitalized work environments. According to the IMIA, as of spring 2022, there were 31 academic institutions providing health and biomedical informatics education. IMIA recommendations have also been applied in several academic studies to map HI competences. For example, Jidkov et al (2019) developed a framework of 50 HI competencies in postgraduate medical education and training. These competences were categorized into six domains. The domain of 'Information and Knowledge Management' covers three themes: 1) understanding the properties of different media, 2) decision support – finding and recording sources of information digitality, and 3) secondary use of data. The third domain contains three sub-categories: nuances of digital data recording, e.g. use of terminologies and nomenclatures, for high quality data capture; accessing and using digitally recording data for research and audit; data analyses (Jidkov et al, 2019). In Finland, which is the context of this study, the IMIA recommendations have guided the establishment of the master's degree programme in health and human services informatics (HHSI) at the University of Eastern Finland (UEF) in 2000 (Saranto et al, 2017). The discipline has its origin in the implementation of digital technologies in health and social sciences (Saranto & Kinnunen, 2021). As an interdisciplinary programme, HHSI applies data, implementation, information, and management sciences to study the role of information technology in health and social care. HHSI is understood as the management of information resources covering data, actions, actors, and technology in the production of health and social care (Saranto et al, 2017). As the only interdisciplinary program in Finland authorities, service providers, and system developers have taken advantage of graduates' knowledge and skills by recruiting them for various positions all over the sector (Kinnunen & Saranto, 2018).

Another way to approach KM and HI competences is provided by Choo (2002) whose information management cycle enables the categorization of the needed competences according to the information value chain. This value chain begins with the identification of information needs, moves on through information acquisition, organization, and storage, products and services, distribution, and closes with information use. As pointed out in the previous section, in a health and social care system multiple information management cycles become intertwined and it is essential to understand that information needs of different actors at different levels of the system vary depending on their role and accountabilities. This urges for a user-centered perspective of KM that is aware of the contingencies. Often it is not enough to know what the users want to know, but also why a certain knowledge need is raised and how the users will use the information (cf. Choo, 2002).

3. Empirical examination – KM competences in health and social care

3.1 Methods and data

Two surveys were used to map the competence needs of practitioners. The first survey targeted for KM specialists in health and social care was implemented in April 2021. Respondents (18/55, response rate 32%) participated into an online seminar dealing with timely issues of KM and effectiveness of health and social care. In addition to background questions, the survey had five open-ended questions and 10 items measuring the success of national-level information steering, fluency of regional collaboration, and the prevailing level of KM competences. Based on the learnings of the first survey, a second survey was constructed to map the level of KM competences by following Choo's (2002) information management cycle, which is a common point of reference both in KM and health informatics literature. The second survey had four categories of questions: 1) service system governance and management (information needs), 2) data production (information acquisition), 3) data storage and analyses (information organization and storage), and 4) knowledge sharing and application (information distribution and use). Each category contained 6-8 statements that respondents evaluated on the scale of 1 (weak) to 5 (very good). In addition, they were asked to provide an overall grade for each competence categories on the scale of 4-10. The second survey was shared in a national conference on ICT in social and healthcare in May 2021. Later, a link to the survey was shared also in national networks of "KM in health and social care" and "IT management in health and social care". The second survey received 29 responses. The results of the surveys are summarized in the following paragraph.

3.2 KM competences in health and social care

The first survey brought up respondents' views on KM competences from various perspectives. They underscored the importance of technical understanding related to the possibilities of modern information systems as well as the ability to picture the system-level possibilities for renewal. A clear need for connecting KM to the context was perceived. This means that development of KM must be tightly connected to the practice of health and social care. Also, common performance indicators were called for. Lack of resources both in terms of quality and quantity was reported. More specific competence needs related, for example, to data protection, information security, and responsibilities of registrars. Further, information systems, analytics, and artificial intelligence were listed as technical competences that health and social care organizations are in a need of.

The respondents recognized that an emphasis of KM is in healthcare although social care depicts a large part of the integrated service system. Some respondents stated that a shortage of skills and competences is an attitude problem, which leads to sub-optimizing behavior, and often at the expense of social care. The survey was implemented in the middle of a major reform of health and social care services, and therefore, some respondents found it difficult to estimate the status of KM competences and imagine how the competence needs would evolve in the near future. Also, respondents recognized major differences between the different organizations and geographical areas. Critics were targeted at national-level information steering, and it was stated that clear objectives are needed to guide the development of KM. The shortage of skills was recognized regarding legislation, data lakes, and data-analytics. Also, management skills in information use are lacking. Figure 2 summarizes the level of KM competences in four areas on the scale of 1 (weak) – 5 (very good): technical competences (mean 2,7), knowledge production (mean 3,2), analysis (mean 2,8), and knowledge application/use (mean 2,4).

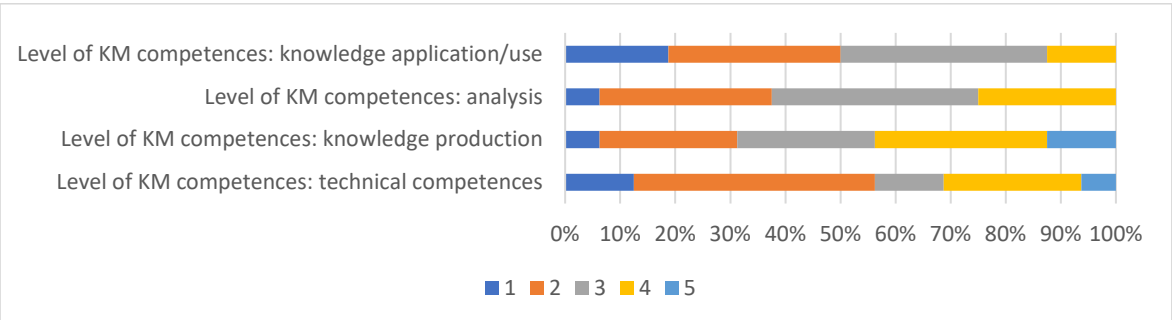


Figure 2: Level of KM competences in four areas (n=17)

Next, the main results of the second survey are shortly summarized (n=29). *Service system governance and management.* An average for this category was 3,2. Respondents found that competences were strongest in the

areas of data privacy and information security (mean 3,8) and in recognizing customer needs (mean 3,5). The weakest areas were forecasting (mean 2,8) and recognition of managerial knowledge needs (mean 2,9). Only slightly better areas were competences related to knowledge in strategic management and operations management. The poor results in the latter category may relate to the ongoing reform and unclear objectives.

Data production. An average for this category was 3,2. Respondents found that competences were strongest in the areas of use of customer and patient information systems (mean 3,6), commitment to data production (mean 3,4) and structured documentation (mean 3,3). A lot of development work has taken place in these areas in Finland during the last years, which may explain the good results. The weakest ratings in this category were reporting of comparative information (mean 2,8), governance of operations data (mean 2,9), and evaluation of data quality (mean 3,0). Rating of these areas was difficult because the new wellbeing services counties were not established yet. However, these results may be valuable when planning the future education and development needs in new organizational entities.

Data storage and analyses. An average for this category was 3,0. Data storage (mean 3,6), data integration (mean 3,2), and data analysis (mean 3,0) were the strongest competence areas in this category. Majority of the respondents represented information technology and information systems specialists, which may explain the results. Weakest areas were future technologies (mean 2,5), data visualization (mean 2,7), and recognition and use technology platforms (mean 2,8), which pinpoints a clear need for training in these innovative areas of KM.

Knowledge sharing and application. An average for this category was 2,6. The strongest competences were in using information in operations and financial management (mean 3,1), knowledge sharing across sectoral boundaries (mean 2,8), and using information in operations management (mean 2,8). Overall, competences in this category received the weakest evaluations. This is an important observation because these competences have a significant role in regional information steering and knowledge-based decision-making. Ecosystem-thinking (mean 2,2), benefiting from comparative information (mean 2,4) and use of information in multi-professional collaboration and decision-making (mean 2,5) received the weakest evaluations.

4. Discussion and concluding remarks

The article aimed to better understand what is meant by KM capabilities and competences and what are the competence needs related to KM in the management of health and social care. The article brought together two distinct disciplines, knowledge management and health informatics and provided various ways to approach KM capabilities and competences. It seems that KM literature has mostly applied an organizational perspective to KM capabilities (e.g. Gold et al, 2001) and KM competences have not been very thoroughly discussed. However, the importance of individual capacity and competences can be detected in definitions where knowledge is considered as a capacity to use information (Watson, 1999) or the potential to influence action (Alavi & Leidner, 2001). Indeed, this view underscores Grant's (1996) ideas of knowledge-based view stating that "knowledge resides within the individual and the role of the organization is knowledge application rather than knowledge creation". This also highlights the importance of knowledge assets and society's intellectual capital (cf. Wiig, 2002; Laihonen & Mäntylä, 2018) when the discussion turns into public services, and especially management of health and social care. KM in this context should not be reduced only to streamlining of reporting and decision-making processes, nor solving tame organizational problems (Dumay, 2020).

Health informatics research on the other hand has quite extensively studied and developed frameworks for mapping HI competences (e.g., Jidkov et al, 2019; Thye et al, 2020). Also, international actors like EFMI and IMIA have been active in promoting international standards. Whereas the KM discipline origins from the strategic management literature, health informatics research has its roots in health sciences and information management (cf. Kinnunen & Saranto, 2021). This orientation sets a different tone and focus for studying KM competences as shown for example by Thye et al (2020) and Jidkov et al (2019). Here the focus is on creating future-proof training for doctors and other health specialists, and in producing even more effective physicians for the future as Jidkov et al state.

Clearly, it would be ideal that the clinical and information management focused views would be complemented with the strategic and organizational perspectives of KM research, and taken into the practice in strategic, tactical, and operational management of health and social care (cf. Thye et al, 2020). Now however, Thye et al (2020) report severe deficits in the areas of tactical and strategic information management. According to authors

this may be due to a lack of priority, competencies, or resources. The results of this study support the findings of Thye et al, 2020. KM competences were strongest in technical areas related to the different phases of the information management cycle and the weaker areas were found in knowledge application, system-level governance, and in strategic management.

This article opened a discussion on KM competences in the specific context of health and social care, which is a multidimensional context for KM necessitating a thorough understanding of the context as well as a careful consideration of the varying competence needs of different professions at different levels of the service system. Distinct roles and responsibilities set different requirements and needs for KM competences. Therefore, it is difficult to see that there could be only one job description that would cover all the various aspects of KM in health and social care. Further, it is important to acknowledge that the need for KM competences evolve as a part of societal change. Especially in a sector like health and social care these competences are connected to a wider discussion on organizational capabilities and society's intellectual capital (cf. Wiig, 2002). Three main findings can be made.

First, many of the so-called KM competences can be considered as basic skills for the future. For example, the World Economic Forum (WEF) regularly lists skills that are needed in the future work life. In their list of top 10 skills of 2025, competences like analytical thinking and innovation, active learning, and complex problem-solving are highlighted. For sure, these are mandatory skills also for KM. The list continues with critical thinking and analysis, creativity, originality, and initiative. Further, leadership and social influence, technology use, monitoring and control, technology design and programming are skills that WEF lists on top. Finally, resilience, stress tolerance and flexibility, reasoning, problem-solving and ideation conclude the list. All these call for reskilling or upskilling of the work force as WEF puts it. In the Finnish context, the national forum for skills and anticipation organized by the Finnish National Agency for Education (https://www.oph.fi/en) has developed education and training needs cards containing information about the future competence needs covering all industrial sectors. Social, health and well-being services have their cards as well. These cards underscore technical competences related to digital transformation, but also ethicality, collaboration, interaction, and communication skills are considered as important future skills in both health and social care. It is noteworthy that KM competences are not explicitly listed.

Second, in addition to the general skills and competences of the knowledge society, there are competence needs posed by the institutional context, which in this case refers to the governance of health and social care. Here, we refer to the governance and management category, which was included in our survey. In this category, the needed competences range from mastering the legislative framework of health and social care to being able to recognize various knowledge needs related to strategic management, customer needs, operations management, supervision, and anticipation of the future expectations (cf. Jidkov et al, 2019). At various levels of the service system, these aspects of governance scale differently. Third, KM competence needs to relate specifically to the information management cycle (cf. Choo 2002). This process proceeds from the recognition of information needs and gathering and producing of information to organizing and storing of the information, and ends with the analysis, sharing and use of information. Several different competences are needed within this process as evidenced by our survey.

As we see, an answer to the question regarding KM competences in health and social care is not straightforward. Whereas in some other context it could be reasonable to focus more narrowly on some specific expertise, in this context, a more diverse analysis is called for. Especially when the system is looked from the viewpoint of national-level information steering, and when the research question is set up to map the status of KM competences at the system-level, a thorough understanding of the application context is called for.

Finally, based on the literature on KM capabilities (e.g., Gold et al, 2001; Alavi & Leidner, 2001) and empirical data gathered through surveys targeted to practitioners, the article concludes that: 1) It is difficult to separate the discussion on competence needs from the discussions concerning the information content and tools of data management. These dominate the current debate and determine and limit in many ways the discussion on KM in the management of social and health care – its nature, content, and people participating in the discussion. Our empirical data evidenced how difficult it is for practitioners to engage in a discussion on KM competences. It was easier to guide the discussion on the technical challenges or the missing information contents. 2) There seems to remain a knowledge gap, both in theory and in practice, regarding KM competences. Research on KM in management of health and social care has focused on issues of data management and decision-making

support. The focus has been extensively on organizational capabilities and the individual perspective has been forgotten despite it is widely agreed that human capital is often the most important resource for modern organizations.

References

Alavi, M. & Leidner, D.E. (2001) "Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues", *MIS Quarterly*, Vol. 25, No. 1, pp 107-136.

Argote, L. & Ingram, P. (2000) "Knowledge transfer: a basis for competitive advantage in firms", *Organizational Behavior and Human Decision Processes*, Vol. 82, No. 1, pp 150-169.

Choo, C.W. (2002) *Information Management for the Intelligent Organization. The art of Scanning the Environment*. USA, Information Today.

Dumay, J. (2020) "Using critical KM to address wicked problems", *Knowledge Management Research & Practice*, Vol. ahead-of-print No. ahead-of-print, pp. 1-9.

Gold, H., Malhotra, A. & Segars, A.H. (2001) "Knowledge management: An organizational capabilities perspective", *Journal of Management Information Systems*, Vol. 18, No. 1, pp 185-214.

Grant, R. M. (1996) "Toward a Knowledge-Based Theory of the Firm", *Strategic Management Journal*, Vol. 17, pp 109-122.

Edvinsson, L. & Malone, M.S. (1997) *Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower*, Harper Business, New York, NY.

Evans, J.M., Brown, A. & Baker, G.R. (2015) "Intellectual capital in the healthcare sector: a systematic review and critique of the literature", *BMC Health Serv Res,* 15, 556-570.

Guthrie, J. & Dumay, J. (2015) "New frontiers in the use of intellectual capital in the public sector", *Journal of Intellectual Capital*, Vol. 16, No. 2, pp 258-266,

Hansen, M.T., Nohria, N. & Tierney, T. (1999) "What's your strategy for managing knowledge?", *Harvard Business Review*, pp 106-116.

Heisig, P. (2009) "Harmonisation of knowledge management – comparing 160 KM frameworks around the globe", *Journal of Knowledge Management*, Vol. 13, No. 4, pp 4–31.

Heisig, P., Suraj, O.A., Kianto, A., Kemboi, C., Perez Arrau, G. & Fathi Easa, N. (2016) "Knowledge management and business performance: global experts' views on future research needs", *Journal of Knowledge Management*, Vol. 20, No. 6, pp 1169–1198.

Hujala, T. & Laihonen, H. (2021) "Effects of Knowledge Management on the Management of Health and Social Care: a systematic literature review", *Journal of Knowledge Management*, Vol. 25, No. 11, pp 203-221.

Inkinen, H. (2016) "Review of empirical research on knowledge management practices and firm performance", *Journal of Knowledge Management*, Vol. 20, No. 2, pp 230–257.

Jidkov, L., Alexander, M., Bark, P., Williams, J.G., Kay, J., Taylor, P., Hemingway, H. & Banerjee, A. (2019) "Health informatics competencies in postgraduate medical education and training in the UK: a mixed methods study", *BMJ Open*, Vol. 9

Kinnunen, U-M. & Saranto, K. (2018) "A Synthesis of Students' Theses in the Accredited HHSI Master's Programme", in Ugon, A., Karlsson, D., Klein, G.O., Moen, A. (eds.) Building Continents of Knowledge in Oceans of Data: The Future of Co-Created eHealth. IOS Press, Amsterdam, *Studies in Health Technology and Informatics 247*, 815-818.

Laihonen, H. & Kokko, P. (2020) "Knowledge Management and Hybridity of Institution-al Logics in Public Sector", *Knowledge Management Research & Practice*.

Laihonen, H. & Huhtamäki, J. (2020) "Organizational Hybridity and Fluidity: Deriving New Strategies for Dynamic Knowledge Management", *Knowledge Management Research & Practice*.

Laihonen, H. & Mäntylä, S. (2017) "Principles of performance dialogue in public administration", *International Journal of Public Sector Management*, Vo. 30, No. 5, pp 414-428.

Lönnqvist, A. & Laihonen, H. (2017) "Management of knowledge-intensive organizations: what do we know after twenty years of research?" *International Journal of knowledge-based development*, Vol. 8, No. 2, pp 154-167.

Laihonen, H. (2015) "A managerial view of the knowledge flows of a health-care system", *Knowledge Management Research & Practice*, Vol. 13, No. 4, pp 475-485.

Laihonen, H. (2012) "Knowledge structures of a health ecosystem", *Journal of Health Organization and Management*, Vol. 26, No. 4, pp 542-558.

Laihonen, H. (2006) "Knowledge flows in self-organising processes", *Journal of Knowledge Management*, Vol. 10, No. 4, pp 127-135.

Nonaka, I. & Takeuchi, H. (1995) *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press, New York.

Rajala, T. & Laihonen, H. (2019) "Managerial choices in orchestrating dialogic performance management", *Baltic Journal of Management*, Vol. 14, No. 1, pp 141-157.

Riege, A. (2005) "Three-dozen knowledge-sharing barriers managers must consider", *Journal of Knowledge Management*, Vol. 9, No. 3, pp 18-35.

Roos, J., Roos, G., Dragonetti, N. & Edvinsson, L. (1997) *Intellectual Capital: Navigating the New Business Landscape*, Macmillan Press Ltd, London.

Saranto, K. & Kinnunen, U-M. (2021) "Applied Informatics Research in Nursing for eHealth", in Hussey P. &, Kennedy M.A. (eds) *Introduction to Nursing Informatics*. Springer, Cham.

Saranto, K., Kinnunen, U-M., Kivekäs, E., Huusko, J., Kuusisto-Niemi, S. (2017) "The Guiding Role of a Paradigm in Informatics Education and Research", *Studies in Health Technology and Informatics*, Vol. 238, pp 235-238.

Sillanpää, V., Lönnqvist, A., Koskela, N., Koivula, U., Koivuaho, M. and Laihonen, H. (2010) "The role of intellectual capital in non-profit elderly care organizations", *Journal of Intellectual Capital*, Vol. 11, No. 2, pp 107-122.

Spender, J.C. (1996) "Making Knowledge the Basis of a dynamic theory of the firm", *Strategic Management Journal*, Vol. 17, pp 45-62.

Sveiby, K.-E. (1997) *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*, Berrett-Koehler Publishers Inc., San Francisco, CA.

Thye, J., Esdar, M., Liebe, J-L., Jahn, F., Winter, A. & Hübner, U. (2020) "Professionalism of Information Management in Health Care: Development and Validation of the Construct and Its Measurement", *Methods of Information in Medicine*, Vol. 59, No. 1, pp e1-e12

Thye, J., Shaw T., Hüsers J., Esdar M., Ball M., Babitsch B. & Hübner U. (2018) "What Are Inter-Professional eHealth Competencies?", *Studies in Health Technology and Informatics*, Vol. 253, pp 201-205.

Watson, R. T. (1999) *Data Management: Databases and Organizations* (2nd ed.), John Wiley, New York.

Wiig, K.M. (2002) "Knowledge management in public administration", *Journal of Knowledge Management*, Vol. 6, No. 3, pp 224-239.

Zack, M. (1999) "Developing a knowledge strategy", *California Management Review*, Vol. 41, pp 125-45.

Knowledge Sharing in Private Social Solidarity Institutions during Pandemics

Carmem Leal[1], Carla Susana Marques[1], Pedro Gaspar[2] and Ana Fermento[2]
[1]CETRAD, University of Tras-os-Montes and Alto Douro, Vila Real, Portugal
[2]University of Tras-os-Montes and Alto Douro, Vila Real, Portugal
cleal@utad.pt
smarques@utad.pt
pedrogaspar@utad.pt
ana.meskfermento@gmail.com

Abstract: The COVID-19 pandemic period resulted in a global crisis, whether in the economy, personal or professional life. Because of the pandemic, people and institutions had to change the way they did things. Even though people are becoming more aware of the value of knowledge and it is becoming more common in some institutions, knowledge management methods are still not well known in the social sector and as a key tool for institutions in crisis. Considering the beneficial role that knowledge sharing (KS) practices play in organizations, the current study aims to investigate the impact of KS practices in Portuguese private social solidarity institutions in adapting to the COVID-19 pandemic period. To achieve the purpose and considering the exploratory nature of the research, semi-structured interviews were conducted with fifteen professionals from four private social solidarity institutions in northern Portugal. Nvivo processed the interviews. Because COVID-19 is new, there is no research on knowledge sharing in these institutions, so the study can be considered as original. Before and during pandemics, the presence of knowledge sharing practises, such as the integration of new employees, the proactivity of learning, the sharing of new ideas and mistakes, and the sharing relationship between peers and superiors and other institutions, was observed through the interviews. In this study, we discovered that trust, communication, technology, and social networks, as well as the role of leadership in creating an environment conducive to formal and informal sharing, were elements that facilitated knowledge sharing practises, even throughout the pandemics. During the interviews, both technical directors and employees acknowledged the following: the relationship between superiors and employees in decision-making processes; recognition, feedback and incentives from leaders and the presence of formal and informal communication networks. When it came to sharing, which could happen in a formal or informal setting, employees seemed to prefer informal interactions.To summarise, the institutions were able to adjust to the limits imposed by the pandemic, and the basic practises of KS are part of the daily routine of the organisations analysed.

Keywords: Knowledge sharing practices, private social solidarity institutions, trust, informal sharing, social economy

1. Introduction

The process of globalisation that has taken place in recent decades has changed communities, economies, and procedures, which has necessitated the creation of new answers in the most varied domains (Grinin, 2022). Organizations function in an increasingly complex world due to their size, the goals they set for themselves, and the strategies they devise to achieve those goals. In order to ensure sustainability, competitiveness, and value creation in businesses as well as to help them manage appropriately in light of the current reality, knowledge mastery and application have therefore turned into a valuable asset (Davenport and Prusak, 1998; Zaragoza-Sáez *et al.*, 2020).

Thus, the concept of knowledge management emerges in the management field as one of the promising tools that, when used effectively, allow for better results and, as a consequence, greater wealth for organisations (Leal *et al.*, 2016; Gravili *et al.*, 2020). This has a positive impact on the environment in which organisations operate, whether it is social, economic, or environmental (Akhavan *et al.*, 2016; Perez-Trujillo and Lacalle-Calderon, 2020). Knowledge management is founded on knowledge, which stands out as a distinct, valuable, and abundant resource in that it is limitless in both its use and transfer (Nag and Gioia, 2012). Regardless of its distinguishing characteristics, it is critical that appropriate processes and tools exist to maximise the benefit from its exploitation (Donate and de Pablo, 2015). The benefit will never be what was hoped for unless it is managed well, which means that the concept is put into action (Dezi *et al.*, 2019).

1.1 Area of investigation and research questions

Salamon and Anheier, (1992) highlighted five distinguishing characteristics of third sector organisations, the social economy, namely that they are (1) formally structured, (2) privately owned and independent from the government, (3) non-profit distributing, (4) self-governing, and (5) benefiting from voluntary activities

(Hardwick, Anderson and Cooper, 2015). To minimise misunderstanding regarding the arbitrary distinction between these names, we will use the more generally used phrase "third sector organisation" (Rees and Mullins, 2016) to refer to any organisation in this category.

In December 2019, the new coronavirus disease (COVID-19) became a severe pandemic danger to communities globally, having a serious impact on human health (White and Van Der Boor, 2020). Furthermore, the COVID-19 pandemic has had a substantial influence on many parts of public life, including economic, and social factors affected by regulations restricting the distribution system; education, tourism, exports, imports, and transportation systems; and the integration of all of these components (Rela *et al.*, 2022).

For this purpose, the current study will use a qualitative approach and semi-structured interviews to examine the impact of KS practises in Portuguese private social solidarity institutions (PSSI) on adaption to the COVID-19 pandemic.

This paper is structured as follows: In the second section, the pertinent theoretical foundations of knowledge management and knowledge sharing are discussed. The methodology that was utilized in this study is discussed in Section 3. The findings and their discussion are presented in Section 4. In Section 5, a new summary of all of the research's findings is presented, along with the limitations of the study and some suggestions for additional research.

2. Literature Review

2.1 Knowledge Sharing

Bock *et al.*, (2005) define knowledge sharing as the willingness of an individual to share his or her created or acquired knowledge with others. Sharing is a conscious decision made by an individual who participates in the exchange without being compelled to do so.

Knowledge sharing (KS) is a social interaction culture that involves the exchange of employee knowledge, experiences, and abilities throughout an entire department or organisation. Knowledge sharing involves providing employees with access to pertinent information and constructing and employing knowledge networks within firms (Hoegl, Parboteeah and Munson, 2003).

Scholars have become increasingly aware over the past half-century that organisations that are able to transfer knowledge effectively are frequently more productive than others (Nahapiet and Ghoshal, 1998; Argote and Ingram, 2000; Mostafa and Klepper, 2018).

Despite the crucial function of knowledge sharing in organisations, employees are not always receptive to this practise (Hislop, 2003). As a response to this issue, the following strategies are presented: motivation by superiors and peers (Husted and Michailova, 2002); sharing climate in the organisation (Connelly *et al.*, 2019); promotion of trust (Jarvenpaa and Majchrzak, 2008); financial incentives or recognition (Bartol and Srivastava, 2002); and equity (Bouty, 2000).

To improve and control the usage of knowledge, it is vital to have a deeper comprehension of the factors that influence the outcome of knowledge dissemination operations. Extensive research has been conducted on KS, and multiple authors have found various elements that influence these processes.

In this research facilitator is defined as a factor that positively influences knowledge sharing. This definition relates to Søndergaard, Kerr and Clegg, (2007). Inhibitor is described as a factor with a negative moderating effect, whereas barrier is defined as a component that impedes KS until specified conditions or levels are met.

Numerous critical factors, also known as sharing barriers or inhibitor, frequently obstruct KS behaviours (Riege, 2005). The presence of these barriers can have an impact on an institution’s competitive advantage. As a result, Table 1 presents the most commonly recognised knowledge sharing barriers and facilitators.

Table 1: Facilitators and Inhibitors of knowledge sharing practices

Facilitators	Authors
Communication	(Yang, Ye and Wang, 2021)
Leadership	(Davenport and Prusak, 1998; Leal, Cunha and Couto, 2017)
Trust	(Yang, Ye and Wang, 2021; Jian and Ali, 2022)
Organizational culture	(Yang, 2007; Enwereuzor, 2021)

Inhibitors	Authors
Lack of Time	(DeVoe and Pfeffer, 2011)
Trust	(Goh SK, 2013; Mura *et al.*, 2016)
Poor verbal and written communication skills	(Riege, 2005; Ghobadi and Mathiassen, 2016)
lack of organizational rewards	(Bell, Lee and Yeung, 2006)

As we can see in table 1, the factors that act as obstacles to KS can also serve as boosters for the practise of KS. We are able to draw the conclusion that the obstacles that prevent people from sharing their knowledge are frequently the result of insufficient or non-existent application of the factors that can encourage this practise.

3. Research questions, objectives and methodology

Taking into consideration the primary goal of our research and based on the above review of literature, we have formalized the following research questions:

- Does the PSSI implement Knowledge Sharing procedures, according to staff and technical directors?
- What factors in the PSSI operate as facilitators or inhibitors of knowledge sharing?
- Does the Covid-19 pandemic affect PSSI's existing Knowledge Sharing practises?

Two interview procedures were devised for the current study; one for the technical directors of the institutions and the other for the staff. The interview script was created based on the major theme's literature review (Leal, Cunha and Couto, 2017). The interview methodology was designed to investigate themes such as collaboration, factors supporting KS, KS obstructions, relationships between peers, and relationships between employees and superiors before and after the COVID-19 outbreak.

As previously stated, a qualitative technique was applied in this study, as well as a content analysis. The major data collecting approach was semi-structured interviews, and the study's goal was to obtain answers to the research questions that were addressed. The NVivo programme was utilised to carry out the interview analysis.

The first step consisted of conducting 15 interviews across four institutions with the help of a semi-structured script that was developed using the information gleaned from the literature review. After that, the data from these interviews were coded and processed with the help of the NVivo software.

4. Results and discussion

With the assistance of NVivo, three nodes were built, including: i) procedures linked to KM practices; ii) facilitators and inhibitors of KS; iii) Covid-19 and KS practices.

4.1 Procedures linked to KM practices

Regarding the initial node, just two of the fifteen respondents were unable to identify KM practises within their organisations.

As can be seen in the following transcripts, Table 2, the remaining professionals all had at least a rudimentary awareness of the principles, having gained their knowledge through trainings or by studying the practises they encountered in their professional routines and contexts.

Table 2: Knowledge of the concepts under study in the interviewed institutions

Theme	Citations from interviews:
Existence of knowledge management practices in the institution	"So, since we work in a multidisciplinary team, there has to be the question of sharing knowledge, a little bit from each one's area. So, I already knew about the concept, but not in such depth." D10E "Yes, I was already aware of it, we get the ideas in training and on a daily basis" C8E

Following the observation of the presence of KM concepts in the institutions, the interviewees were asked about the activities they believed favourable to Knowledge Sharing in the context of the organisation to which they

belonged. During the survey, 16 criteria were mentioned, either spontaneously by the interviews or after being asked directly whenever the interviewees had difficulty replying.

4.2 Facilitators and inhibitors of KS.

Table 3: Facilitators of Knowledge Sharing practices

Themes	**Citations from interviews:**
Facilitators of Knowledge Sharing practices – training sessions	"(...) because there is a sharing, the assistants go to training courses on how to clean and how to do it, and pass it on to the others. Because we all have to know everything, we have to be multi-skilled and sometimes do work that is not within our competence, but is necessary. And everybody benefits from that relationship and that sharing." A1D
Facilitators of Knowledge Sharing practices – communication	"The idea we have about institutions, especially PSSI, is that they are untouchable, but they are not. It is easy to expose our idea, maybe it is not put into practice, but in the long run we are heard. (...)." A3E "That's fundamental, and it really has to be for things to work, for things to keep flowing and working well. Because everyone has to know the changes and how things have to work so that there's no doubt." B4E
Facilitators of Knowledge Sharing practices – trust	"If I make a mistake, I am one of the people who go to the director and tell her what happened. There is that trust and willingness to come and say: 'Look, I admit that I made a mistake'. A2E
Facilitators of Knowledge Sharing practices - Technology and social networks	"(...) In recent times, in the context of the pandemic, the trainings are in Webinar (...) And there is also a lot of information that I started to send by email. I also created a WhatsApp group, ".C3D
Facilitators of Knowledge Sharing practices - the role of leadership in creating a favourable environment	"So yes, those are the policies that are used the most, a general sharing without formality so that everybody knows." B5E

In line with previous research, and according to Table 3 the following facilitating factors were the most frequently mentioned by the interviewees in the current study: trust (von Krogh, 1998; Cohen and Prusak, 2001); communication (Levinthal and March, 1993; Leonard and Sensiper, 1998; De Vries, Van Den Hooff and De Ridder, 2006; Lee *et al.*, 2020); technology and social networks (Kim and Lee, 2006; Yang, Ye and Wang, 2021; Blagov and Anand, 2022); and the role of leadership in creating an environment conducive to formal and informal sharing (Kim and Lee, 2006; Lee *et al.*, 2020), which was acknowledged by both technical directors and employees in the survey conducted and trainings (Kim and Lee, 2006; Castaneda and Durán, 2018).

Along with the factors that promote knowledge sharing, the potential barriers to knowledge sharing were investigated, and often the barriers result from inadequately applied promoting factors. The non-recognition, whether in terms of remuneration or formal recognition in the group, was the most frequently cited factor by some interviewees: "(…) I think we could have been recognised, even if it was something, but it was recognition, even if it was 5 euros in the salary or a day's holiday, I think a person deserved it" C7E. The pandemic itself was identified as yet another factor that was shown to be inhibiting KS.

4.3 Covid-19 and KS practices

Blagov and Anand, (2022) state that the Covid-19 pandemic brought the need for institutions to adapt in a short period of time to new routines such as online work, and simultaneously adapt the KM and KS processes in the institutions, since their routines underwent intense changes.

Throughout the course of the interviews, it became plainly obvious that during the pandemic period, the institutions were required to adjust to a new reality and develop new habits. However, there were a few activities that they were able to keep going, either at the same frequency as before or at a lower frequency, but they did so while still adhering to the necessary safety standards. Activities such as team meetings, communication, the practise of sharing ideas and issues in an informal way, the climate of freedom and openness to share, and training sessions were the activities considered by the interviewees to have been maintained in the institutions during the pandemic period. Although fewer in number and operating under new logistical conditions, these activities were the ones that were considered to have been maintained.

Along with the activities that they were able to maintain or readapt, the pandemic period also led to the adoption of new communication strategies in which virtual communication technologies and networks came to play an important role. This was in addition to the fact that they were able to maintain or readapt the activities that they had been performing previously. The interviewees highlighted the use of phone calls, email, Zoom as a means to hold meetings and participate in training sessions, and WhatsApp. During the time of the pandemic, they were able to keep in contact with one another, maintain a connection with the team, and feel supported thanks to this strategy.

Here are some quotes that support our conclusions: "The technical team meetings continue to happen (...) this issue of talking and sharing has not changed at all." B5E

"(...) In recent times, in the context of the pandemic, the trainings have been delivered via Webinar (...) There is also a lot of information that I have begun to send via email. I also started a WhatsApp group where we use new technologies to get feedback. I always ask if they received, if they understood, and if I can explain or clarify anything." C3D

Although some activities could be maintained and new habits formed, the interviewees stated that it was a difficult period both personally and professionally. Because they were dealing with something unknown at a time when there was little, and sometimes contradictory, information, interviewees B2D and C3D mentioned the need to change work routines.

Another factor frequently mentioned as a negative aspect during the pandemic period was the General Direction of Health imposed strategy of working in a "bubble" or "mirror team." Both designations correspond to the division of the team into two, with one team providing service for twelve hours for a period of 3 to 15 consecutive days and the other remaining in isolation; at the end of the time period considered by each institution, these teams would swap positions.

> "It appeared that the team had been divided into two groups. Then it seemed like there were two groups, and they weren't supposed to mix. It was almost as if my team had done this and my team had done that. But it no longer occurs; it has faded away because they all now collaborate. (…) I belong to this one, and the other belongs to that one. " B5E

> *"We worked with mirror teams for a long time with great difficulty in bringing people together (...) And it is reflected in the lack of information sharing."* B2D

> *"Of course, emotionally I was affected (...)"* C3D

4.4 Knowledge Sharing as an Advantage for Adaptation during the Pandemic

When interviewees were asked about the impact of their sharing relationship prior to the pandemic on their ability to adapt to it, there was a consensus that the way they worked as a team and shared information with one another had been an asset in adapting to the new reality.

> *"It helped because it was necessary to maintain that communication, perhaps more with all of us, but I believe there was even more connection because we were anxious and called each other more, even within the group, to discuss what we should do. I believe it was crucial that we were already organised at that time".* A1D

5. Conclusion

Despite the fact that the application of KM is also advantageous in non-profit organisations, the bibliographic support for this relationship lags significantly behind that of KM in for-profit businesses. Consequently, this study contributes to this deficiency in the subject area and demonstrates that, despite the paucity of bibliographic support, institutions recognise the existence of the concept, as well as its application and added value in the reality in which they operate, and continue to develop their practises, as can be seen in the institutions studied.

We were able to respond to the three research questions that prompted this paper. Through the analysis of the interviews, it was possible to confirm that the studied organisations employ some KS and KM practises in their

daily operations. It was also possible to recognise that there are also facilitators and barriers to KS in the social economy, as listed in the consulted literature, even though the majority of these studies have been conducted in the business sector.

Regarding the question of the pandemic's impact on KS practises, we were able to illustrate what interviewees reported, but due to the topic's recency, it was not possible to support these results with international studies. This may demonstrate the originality and significance of this exploratory work.

The main conclusion of this work is that even with the strong impact of the pandemic on the whole society for almost two years, these institutions managed to stay organised, even in the face of an uncertain future, because they already had some deep-rooted knowledge sharing and management practices, as well as encouraged, before the pandemic, a facilitating environment for these practices, which somewhat reduced the impact of the pandemic on the interviewed institutions.

One of the KS practices that contributed most positively in the period in question was the use of technology. From holding online meetings through digital platforms, informal contact through calls, or WhatsApp groups, technology became a constant presence in the routines adopted at organisations. We also concluded that the pandemic had the greatest effect on the level of the individual and the relationships between people, but that this effect was felt by all institutions, not just the institutions that were studied.

Despite meeting the proposed objectives, this study has some limitations. The main factors are the size of the unit of analysis and its origin in northern Portugal. The small number of institutions prevents us from making broad comparisons, and the fact that the institutions all belong to the country's north, despite the fact that it includes institutions from the coast to the interior, may influence the observations made. Because these are PSSI and provide a social service, it is implicit that this is dependent on the social context in which they are located, the city, and the resources they provide.

A mixed qualitative and quantitative study in the post-pandemic phase would be the best approach for future research. This would allow for a more objective examination of this period as well as the long-term impact of the pandemic on the KS practises adopted by the institutions.

Acknowledgements:

This work was supported by the FCT–Portuguese Foundation for Science and Technology under the project [UIDB/04011/2020].

References

Akhavan, P. *et al.* (2016) 'Major trends in knowledge management research: a bibliometric study', *Scientometrics*, 107(3), pp. 1249–1264. doi: 10.1007/s11192-016-1938-x.

Argote, L. and Ingram, P. (2000) 'Knowledge Transfer: A Basis for Competitive Advantage in Firms', *Organizational Behavior and Human Decision Processes*, 82(1), pp. 150–169. doi: 10.1006/obhd.2000.2893.

Bartol, K. M. and Srivastava, A. (2002) 'Encouraging Knowledge Sharing: The Role of Organizational Reward Systems', *Journal of Leadership & Organizational Studies*, 9(1), pp. 64–76. doi: 10.1177/107179190200900105.

Bell, B., Lee, S. and Yeung, S. (2006) 'The impact of e-HR on professional competence in HRM: implications for the development of HR professionals.', *Hum Res Manag*, 45(3), pp. 295–308.

Blagov, E. Y. and Anand, A. (2022) 'The onlinezation influence on knowledge sharing for corporate innovation during the CoViD crisis', *Knowledge and Process Management*, 29(1), pp. 92–105. doi: 10.1002/kpm.1705.

Bock, G.-W. *et al.* (2005) 'Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological forces, and organizational climate', *MIS quarterly*, pp. 87–111.

Bouty, I. (2000) 'Interpersonal and interaction influences on informal resource exchanges between R\&D researchers across organizational boundaries', *Academy of Management journal*, 43(1), pp. 50–65.

Castaneda, D. I. and Durán, W. F. (2018) 'Knowledge sharing in organizations : Roles of beliefs, training , and perceived organizational support', 10(2), pp. 148–162.

Černe, M. *et al.* (2014) 'What goes around comes around: Knowledge hiding, perceived motivational climate, and creativity', *Academy of Management Journal*, 57(1), pp. 172–192. doi: 10.5465/amj.2012.0122.

Cohen, D. and Prusak, L. (2001) *In Good Company: How Social Capital Makes Organizations Work*. Harvard Business School Press.

Connelly, C. E. *et al.* (2019) 'Understanding knowledge hiding in organizations', *Journal of Organizational Behavior*, 40(7), pp. 779–782.

Davenport, T. H. and Prusak, L. (1998) 'Working Knowledge How Organization Manage What They Know', *Harvard Business School Press*, (January 1998), pp. 1–15. doi: 10.1145/348772.348775.
DeVoe, S. E. and Pfeffer, J. (2011) 'Time is tight: How higher economic value of time increases feelings of time pressure.', *The Journal of Applied Psychology*, 96(4).
Dezi, L. *et al.* (2019) 'The role of external embeddedness and knowledge management as antecedents of ambidexterity and performances in Italian SMEs', *IEEE Transactions on Engineering Management*, 68(2), pp. 360–369.
Donate, M. J. and de Pablo, J. D. S. (2015) 'The role of knowledge-oriented leadership in knowledge management practices and innovation', *Journal of business research*, 68(2), pp. 360–370.
Enwereuzor, I. K. (2021) 'Diversity climate and workplace belongingness as organizational facilitators of tacit knowledge sharing', *Journal of Knowledge Management*, 25(9), pp. 2178–2195.
Ghobadi, S. and Mathiassen, L. (2016) 'Perceived barriers to effective knowledge sharing in agile software teams.', *Inf Sys J.*, 26(2), pp. 95–125. doi: 10.1111/isj.12053.
Goh SK, S. M. (2013) 'Knowledge sharing among Malaysian academics: influence of affective commitment and trust.', *Elec J Know Manag.*, 11(1), pp. 38–48.
Gravili, G. *et al.* (2020) 'Value that matters: intellectual capital and big data to assess performance in healthcare. An empirical analysis on the European context', *Journal of Intellectual Capital*. doi: 10.1108/JIC-02-2020-0067.
Grinin, L. (2022) 'Revolutions of the twenty-first century as a factor in the World System reconfiguration', in *Handbook of Revolutions in the 21st Century*. Springer, pp. 975–999.
Hardwick, R., Anderson, R. and Cooper, C. (2015) 'How do third sector organisations use research and other knowledge? A systematic scoping review', *Implementation Science*, 10(1), pp. 1–12.
Hislop, D. (2003) 'Linking human resource management and knowledge management via commitment: A review and research agenda', *Employee Relations*, 34(1), pp. 6–24. doi: 10.1108/02656710210415703.
Hoegl, M., Parboteeah, K. P. and Munson, C. L. (2003) 'Team-level antecedents of individuals' knowledge networks', *Decision Sciences*, 34(4), pp. 741–770.
Husted, K. and Michailova, S. (2002) 'Diagnosing and fighting knowledge-sharing hostility', *Organizational dynamics*, 31(1), pp. 60–73.
Jarvenpaa, S. L. and Majchrzak, A. (2008) 'Knowledge collaboration among professionals protecting national security: Role of transactive memories in ego-centered knowledge networks', *Organization science*, 19(2), pp. 260–276.
Jian, Z. and Ali, O. M. (2022) 'The impacts of trust, specific asset investment, knowledge sharing, and collaborative design on service innovation performance: a service-dominant logic perspective', *International Journal of Services Technology and Management*, 28(1–2), pp. 86–119.
Kim, S. and Lee, H. (2006) 'The impact of organizational context and information technology on employee knowledge-sharing capabilities', *Public Administration Review*, 66(3), pp. 370–385.
von Krogh, G. (1998) 'Care in Knowledge Creation.', *California Management Review*, 40(3), pp. 133–153. doi: 10.2307/41165947.
Leal, C. *et al.* (2016) 'The role of intellectual capital and corporate strategy on sustainable value creation', *International Journal of Foresight and Innovation Policy*, 11(4), pp. 215–224.
Leal, C., Cunha, S. and Couto, I. (2017) 'Knowledge sharing at the construction sector - Facilitators and inhibitors', in *Procedia Computer Science*. doi: 10.1016/j.procs.2017.11.129.
Lee, Y. *et al.* (2020) 'Enhancing employees' knowledge sharing through diversity-oriented leadership and strategic internal communication during the COVID-19 outbreak', *Journal of Knowledge Management*, 25(6), pp. 1526–1549. doi: 10.1108/JKM-06-2020-0483.
Leonard, D. and Sensiper, S. (1998) 'The role of tacit knowledge in group innovation', *California management review*, 40(3), pp. 112–132.
Levinthal, D. A. and March, J. G. (1993) 'The myopia of learning', *Strategic management journal*, 14(S2), pp. 95–112.
Mirzaee, S. and Ghaffari, A. (2018) 'Investigating the impact of information systems on knowledge sharing', *Journal of Knowledge Management*, 22(3), pp. 501–520. doi: 10.1108/JKM-08-2017-0371.
Mostafa, R. and Klepper, S. (2018) 'Industrial development through tacit knowledge seeding: Evidence from the Bangladesh garment industry', *Management Science*, 64(2), pp. 613–632.
Mura, M. *et al.* (2016) 'Behavioural operations in healthcare: a knowledge sharing perspective', *International Journal of Operations & Production Management*, 36(10), pp. 1222–1246.
Nag, R. and Gioia, D. A. (2012) 'From common to uncommon knowledge: Foundations of firm-specific use of knowledge as a resource', *Academy of Management journal*, 55(2), pp. 421–457.
Nahapiet, J. and Ghoshal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', *Academy of management review*, 23(2), pp. 242–266.
Perez-Trujillo, M. and Lacalle-Calderon, M. (2020) 'The impact of knowledge diffusion on economic growth across countries', *World Development*, 132, p. 104995.
Rees, J. and Mullins, D. (2016) *The third sector delivering public services: developments, innovations and challenges*. Policy Press.
Rela, I. Z. *et al.* (2022) 'COVID-19 Risk Management and Stakeholder Action Strategies: Conceptual Frameworks for Community Resilience in the Context of Indonesia', *International Journal of Environmental Research and Public Health*, 19(15), p. 8908. doi: 10.3390/IJERPH19158908.

Riege, A. (2005) 'Three-dozen knowledgesharing barriers managers must consider', *Journal of Knowledge Management*, 9(3), pp. 18–35. doi: 10.1108/13673270510602746.

Salamon, L. M. and Anheier, H. K. (1992) 'In search of the non-profit sector. I: The question of definitions', *Voluntas: International Journal of Voluntary and Nonprofit Organizations*, 3(2), pp. 125–151.

Saleh, S. *et al.* (2017) 'Critical success factors affecting knowledge management systems applications: A theoretical framework', in *22nd Annual Conference of the UK Academy for Information Systems (UKAIS 2017)*, pp. 3–5.

Søndergaard, S., Kerr, M. and Clegg, C. (2007) 'Sharing knowledge: contextualising socio-technical thinking and practice', *The Learning Organization*.

Valmohammadi, C., Sofiyabadi, J. and Kolahi, B. (2019) 'How do knowledge management practices affect sustainable balanced performance? Mediating role of innovation practices', *Sustainability*, 11(18), p. 5129.

De Vries, R. E., Van Den Hooff, B. and De Ridder, J. A. (2006) 'Explaining knowledge sharing: The role of team communication styles, job satisfaction, and performance beliefs', *Communication Research*, 33(2), pp. 115–135. doi: 10.1177/0093650205285366.

White, R. G. and Van Der Boor, C. (2020) 'Impact of the COVID-19 pandemic and initial period of lockdown on the mental health and well-being of adults in the UK', *BJPsych open*, 6(5).

Yang, J. Te (2007) 'Knowledge sharing: Investigating appropriate leadership roles and collaborative culture', *Tourism Management*, 28(2), pp. 530–543. doi: 10.1016/J.TOURMAN.2006.08.006.

Yang, X., Ye, H. J. and Wang, X. (2021) 'Social media use and work efficiency: Insights from the theory of communication visibility', *Information & Management*, 58(4).

Zaragoza-Sáez, P. C. *et al.* (2020) 'Corporate social responsibility and strategic knowledge management as mediators between sustainable intangible capital and hotel performance', *Journal of Sustainable Tourism*, pp. 1–23.

The Process of Sharing Knowledge In The Implementation of a Marketing Project: A Proposal for a Data Selection Model

Małgorzata Łęgowik-Małolepsza
Technical University of Częstochowa, Poland
m.legowik-malolepsza@pcz.pl

Abstract: The study addresses the problem of sharing knowledge, indicating its impact on the implementation of a marketing project in enterprises. All the considerations presented have been divided into two main parts, theoretical and empirical. The considerations presented in the first part include the characteristics of designing the company's marketing activities in the context of sharing knowledge. The next, second part of the study presents the possibilities of using information management in the process of sharing knowledge during the implementation of a marketing project. The third part discusses the processes of sharing knowledge in a marketing project. The next part describes the research methods. Subsequently, the study is an attempt to answer the research question - how does the sharing of knowledge create the implementation of the marketing project of the surveyed company? As a consequence of this question, the aim of the study was to develop a model of data selection determining sharing knowledge and information management during the implementation of a marketing project in an enterprise. The issue of sharing knowledge in the implementation of a marketing project is important and current due to its impact on decision-making processes in enterprises in the perspective of maintaining a competitive position on the market. The publication contributes to the discussion on the extent to which enterprises use sharing knowledge processes in order to gain a competitive advantage through the implementation of marketing activities.

Keywords: sharing knowledge, marketing project, business models, decisions making.

1. Introduction

Marketing projects play a particular role in the process of increasing competitiveness of modern enterprises. They become an accelerator of structural changes as well as changes in the operation of enterprises. However, not all enterprises can properly develop and use marketing projects (Skaates, Tikkanen, 2003). Moreover, the lack of efficient methods for sharing knowledge in the implementation of marketing projects may result in a decline in the competitiveness of enterprises, leading to a reduction in the efficiency of operations.

Hence, the following research question was formulated in the study – how does sharing knowledge create the implementation of a marketing project of the company? As a result of this question, the objective of the study was to develop the model for selecting data determining sharing knowledge while implementing a marketing project in the enterprise. The problem of sharing knowledge in the implementation of a marketing project presented in the subject literature is fragmented and dispersed. The current knowledge in this field is at the initial stage of exploration. The above arguments resulted in an attempt to theoretically analyze the development of the model for selecting data that determine sharing knowledge during the implementation of a marketing project since it is an important and up-to-date issue due to its impact on decision-making processes in enterprises from the perspective of maintaining a competitive position in the market. To accomplish the objective of the study, the applied research methods were critical analysis of the literature and descriptive analysis.

2. Designing the company's marketing activities in terms of sharing knowledge

Constantly increasing competition forces entrepreneurs to search for new ways of satisfying the growing needs of their customers. Market activities that entrepreneurs undertake place marketing among the key components of the effective business management. Modern marketing originates from the function of the sale of products, which consists in creating and maintaining the sales market to provide the enterprise with the source of revenue. In the subject literature, one may come across various interpretations of the concept of marketing. According to J. Altkorn (2002), marketing means both appropriate planning, coordination, and control of all the company's activities, which are directed to current and potential sales markets. This means that marketing relates to the process of setting market goals and the ways of their achievement. According to Ph. Kotler, marketing is a process serving to meet social needs of an individual and groups through the creation, offering, and free exchange of products and services both.

When considering marketing from the company's perspective, it can be noticed that the primary objective of marketing activities is to strive to maximize profits from the sale of products that can be realized by satisfying the exchange partner. Therefore, the task of marketing is to ensure the accomplishment of the intended

objectives. At the same time, marketing becomes the way facilitating the sale of products, which has become the system of conducting business activities. In this context, Ph. Kotler pays attention that the concept of marketing is the key to achieve the company's objectives and to learn the needs of target market customers (Kotler, 2012).

Nowadays, designing marketing activities is one of the most important areas of modern enterprise management since it determines its policy and strategy. Therefore, marketing is often considered as a certain philosophy of the operation of enterprises, becoming a rational reaction of the enterprise to economic changes. At the same time, marketing as a set of instruments and operations has both a systemic and instrumental and functional nature. The systemic nature of marketing consists in the fact that there are instruments and operations in the market that could not exist independently since they form an interconnected whole. The above-mentioned instruments are not directly related to performing certain activities, they constitute a group of classic regulatory activities, whereas the activities of operation are performed to exert an impact on the market. In instrumental and functional terms, marketing is considered as a source of principles, methods and techniques of the operation concerning making decisions, which enable the study of the needs of potential customers, their specific preferences, showing the needs previously not revealed and effectively encouraging the purchase of specific products, and their sale at the right place and time, while striving to satisfy the customer (Anand, Centobelli, Cerchione, 2020). In terms of this approach, marketing is a system consisting of components, such as the market and entities in it, marketing rules governing entities in the market and marketing instruments and activities (Kotler et al, 2015). This means that marketing represents an internally integrated set of instruments and operations, i.e., it presents a mutual adjustment and reconciliation of individual instruments and activities.

Designing the company's marketing activities should consider the variability of business conditions. Therefore, when designing marketing activities, it is necessary to demonstrate the knowledge of the market and customer needs to adjust both production and sales processes. The basis for the implementation of a marketing project should be the planned product cycle in the relevant market segment. On the other hand, planning the product cycle in a marketing project should be continuous, beginning prior to deciding on production and sales, and undergo modification at each stage of product manufacture to satisfy customer needs. Hence, the knowledge of the selection of effective marketing instruments and methods for attracting customers for products provided (Baines, Fill, Rosengren, 2017) is so important in a marketing project, considering the processes of sharing knowledge, which enable the coordination of all operations implemented in the enterprise. The role and function of a marketing project in the company's activities is based on the conditions of its operation and the processes of sharing knowledge. In the subject literature, it is pinpointed that there is the evolution that took place in marketing applications since, initially, it constituted the function supporting sales processes, then it became a type of customer service, at the subsequent stage, it became an innovation function, moving to the form related to the entire business management (Molenaar, 2013). Therefore, designing marketing activities ought to consider building the information environment, which will be conductive to the achievement of the company's objectives.

To sum up, it is worth pinpointing that designing marketing activities of the enterprise should be integrated with the processes of sharing knowledge in the company, considering the system of measurement and assessment of the efficiency of a marketing project in the information environment (Keh, Nguyen, Ng, 2007). Moreover, the practices of sharing knowledge in the processes of designing marketing activities of the enterprise ought to consider generating, processing, and using knowledge resources in the company, enabling the achievement of objectives of sharing knowledge in relation to the implementation of a marketing project.

3. The objectives of sharing knowledge in the context of the marketing project implementation

Sharing knowledge relates to a very wide range of activities related to the implementation of a marketing project in the enterprise. Therefore, the objectives of sharing knowledge considered in the context of the implementation of a marketing project ought to consider the area of both the company's resources and the company's functions as well as the area of the current monitoring of the efficiency of the implementation of a marketing project (Setini et al, 2021).

When considering the possibility of the implementation of a marketing project in terms of the company's resources, the objectives of sharing knowledge (Cerchione, Esposito, 2016) should support processes related to

the management of all the company's resources, beginning with human resources, including recruitment processes, through motivating, ending with dismissal. Another important resource of the enterprise is its finance, including, among others, supporting cash flows. Subsequently, the objective of sharing knowledge in terms of resources, is to support processes related to the management of fixed and current assets, their purchase and use and involvement in the manufacturing process. Eventually, sharing knowledge is to support and streamline information flows, and consequently, supplying knowledge to the company and its employees. Therefore, sharing knowledge is to support knowledge and information management throughout the company's value chain, by providing information in the right quantity and quality (Subramani, Rajagopalan, 2003).

From the point of view of the enterprise function, the objectives of sharing knowledge enabling the implementation of a marketing project in this area should relate to functional areas that occur in the company. This means that, e.g., the implementation of a marketing project in terms of procurement management is to streamline the flow of information on suppliers, supplies and delivery dates. Another functional area is production management where sharing knowledge in the implementation of a marketing project is to facilitate the planning and controlling of the production process. Providing knowledge and information in the right quantity and quality is also necessary for the operation of other areas, e.g., distribution management in the implementation of a marketing project (Richardson, Domingos, 2002). Hence, achieving objectives of sharing knowledge in these terms ought to include gathering, analyzing, and processing the current sets of information in terms of market research, taste, and preferences of current and potential customers of the marketing project.

When considering the possibility of the implementation of a marketing project in terms of management problems, the objective of sharing knowledge should be the current monitoring of the efficiency of its implementation. It is to provide information for the calculation of performance indicators, and in the case of obtaining incorrect parameters of these indicators, indicate the areas causing these distortions. Sharing knowledge in this area is to serve to obtain the expected level of quality during the implementation of a marketing project (Skaates, Tikkanen, Lindblom, 2002). This means that the current monitoring of efficiency of the implementation of a marketing project ought to enable the control of the level of quality in all the implemented ranges and, at the same time, justify the reasons for the lack of quality if such cases occur.

To sum up, the issue of sharing knowledge in the context of the implementation of a marketing project, it is worth pinpointing that their consideration in terms of the identified areas allows for the identification of information a s one of the company's resources and its management. Additionally, the identification and analysis of information needs of the company's managers improves the use of information in decision-making processes concerning the context of the implementation of a marketing project. Therefore, sharing knowledge should consider the development of the company's information environment and skillful use of information technology in the implementation of a marketing project.

~~4.~~ The process of sharing knowledge in a marketing project

The process is understood as a sequence of activities carried out within the enterprise, performed in order to deliver a specific product to the customer. In this approach, the process of sharing knowledge will be understood as a set of activities carried out in a specific sequence, aimed at generating knowledge and sharing this knowledge. This means that the process of sharing knowledge is aimed at the implementation of individual activities that will increase the value of the created or delivered product, and their implementation leads to meeting customer expectations.

The implementation of marketing activities in the company, when considering the complexity of processes related to sharing knowledge, will be possible when the entire system of coexisting and interacting plans is developed. The development of the marketing plan, which is a set of programs or projects for achieving objectives defined in relation to the product in the market segment (Luo, Wang, Han, 2013), depends on the nature of conducted marketing activities and their size. Therefore, planning marketing activities can be performed at various levels (Wawrowski, Otola, 2020), which results in the need to generate, aggregate and process different information and to share it skillfully.

Planning marketing activities may apply to the entire company and reflect all its aspects or include only selected areas of its operations. In the case when the enterprise operates in many markets and provides a wide range of products, planning marketing activities relates to the strategic unit of business (Pulendran, Speed, Widing, 2003),

which can be the company's subsidiary (Naik, Raman, Winer, 2005), department or specific area of operation identified by relationships between the product and the market (Fig. 1).



Figure 1: Stages of planning marketing activities

Source: Own study.

The first stage of planning marketing activities is collecting knowledge and information enabling the careful observation of the market. The information is processed to recognize market opportunities before it is used by competitors. The marketing plan should include specified intentions, therefore, on this stage of planning marketing activities, it is necessary to identify information needs and allocation of essential knowledge needed to formulate the objectives of the marketing strategy. The implementation of planning marketing activities requires the collection of both internal and external information and sharing it among employees. This is because the marketing plan can be addressed to the management staff of the company, becoming an internal document indicating the directions for the development of marketing activities. The marketing plan can be also addressed to external recipients, such as banks or other potential investors (Simkin, 2002), and then it will be the basis for obtaining foreign capital needed to finance the company's marketing activities. At the next, second stage, there is the development of the plan of marketing activities (Wilson, 2010). The marketing plan should contain the methods for achieving the adopted market objectives, present the distribution of responsibility for their implementation and predict the costs and deadlines for the performance of individual activities. The implementation of the plan is another and the most difficult stage of planning marketing activities (Shane, Delmar, 2004). If there are some problems with the implementation of the plan at the implementation stage, they are most frequently the result of errors in the planning process consisting in inappropriate sharing knowledge between individual decision-making cells. The last stage of planning marketing activities is the monitoring and control of the results achieved, allowing for assessing the adjustment of the enterprise to changing conditions in the market. This means that the market success of the company is largely determined by the quality of the developed marketing plan and the consistency it is implemented with.

The assumptions of the marketing plan may be implemented using projects. The project is a sequence of interrelated tasks (Stevens et al, 2021) which are unique and complex. The project has a common goal for all the tasks to be performed within specific time in accordance with the budget agreed.

The marketing project should concentrate on obtaining the end result and setting priorities during the project implementation (Pichler, Schulze, 2005). Thus, for a marketing project, to be considered effective, it should consider the involvement of the organizational units of the company (Mir, Pinnington 2014), which are essential to achieve the assumed objectives. The order of performance of tasks in a marketing project is determined by

the adopted principles of conduct oriented to customers and their needs. The implementation of a marketing plan using projects is conductive to the development of marketing activities and improves marketing effectiveness (Christopher, Payne, Ballantyne, 2013). The marketing project, by focusing on efficiency, adaptability, and cooperation, reduces the risk in the occurrence of unforeseen costs.

To sum up, it should be pinpointed that the marketing plan can be a plan for the entire company or a plan of only a particular venture. However, if the enterprise wants to achieve an increase in competitiveness in the market, the marketing plan should be creative, innovative and result from the process of sharing knowledge in the enterprise. Moreover, it should create and define new fields and methods of the company's operation in the market. Therefore, the objective of marketing project management ought to be to succeed in a particular project. At the same time, a marketing project should serve not only the project implementation within the specific time, quality, and budget, but it should also contribute to creating value in the enterprise, which ought to be reflected while developing the model of selecting data for sharing knowledge in the implementation of a marketing project.

5. The research methods

The research was conducted based on a critical analysis of the literature. Critical analysis of the literature is a research method that exposes the previous theoretical and research approaches and demonstrates the way of preparing research works aimed at expanding existing knowledge or developing a specific research field. Therefore, a critical analysis of the literature should be treated as a synthetic, objective and reliable summary of a specific theoretical area. The process of critical literature analysis consists of three basic steps. The first step is to identify published papers on the topic under study. In the second stage, the separate works are assessed in terms of the dominant theoretical perspectives, research directions and research approaches. The third stage is to document the actions taken by justifying the purposefulness of undertaking the research.

In the second part of the research process, the research method used was the descriptive method. Descriptive methodology aims to describe cognitive activities and their products. This means that the descriptive methodology has an idiographic function in empirical cognition and consists in describing a single organization or structure. It can also describe one event, phenomenon, process, separate community, or a relatively strictly defined research problem. This allows you to formulate research questions and, in the further research procedure, verify them and recognize them as true or falsify and recognize them as false.

Additionally, a decision model was used in the research procedure. Models in scientific research are a specific form of scientific cognition (Dawson, 2014). This means that models in scientific research perform theoretical functions by providing a specific picture of reality (Imenda, 2014). At the same time, models in scientific research also fulfill practical functions, becoming tools in conducting empirical research. It is worth noting that the models in scientific research are closely related to the theory and constitute its complement. Thus, models in scientific research allow for simplifying theories or adopting specific forms of a paradigm or preliminary theory. In management sciences, research models play an important role because they provide a specific picture of reality and enable empirical research with a specific methodological rigor.

6. The data selection model for sharing knowledge in the implementation of a marketing project of the company – research procedure

Developing the model for selecting data determining sharing knowledge during the implementation of a marketing project in the enterprise is an activity consisting in the development of the diagram of specific consequences. The basic component of the model is the label (Carvalho, Patah, De Souza Bido, 2015), which means the beginning of the model sequence. The label is an oval for labelling the beginning or the end of the diagram sequence. Each label is tied with only one arrow: input or output. Each diagram has at least two labels: the label beginning the entire diagram: START and the label ending the entire diagram: STOP. At the same time, in the presented model for selecting data determining sharing knowledge during the implementation of a marketing project in the enterprise, the label means the beginning of the sequence of data selection, and the integration of information is the first stage of ordering the sets (Fig. 2).
The source of data at this stage of the research is knowledge concerning the systematic evaluation in terms of recognizing the market, its changes, and trends. At this stage of the research, a predicate (Nowicki ed., 1998), e.g., a diamond was used, to which only the selection instructions are entered. There is only one arrow entering the predicate (the same as the operand), but there are always two coming from it, whereas one way is

implemented in the event of meeting the condition entered in it and is marked YES, otherwise the way marked NO is implemented. The predicate was indicated with an arrow, which clearly shows the connections and direction of these connections between two components of the diagram, which is to enable responding to the question if the collected information on the target market and the company's capabilities is sufficient to develop a marketing project.

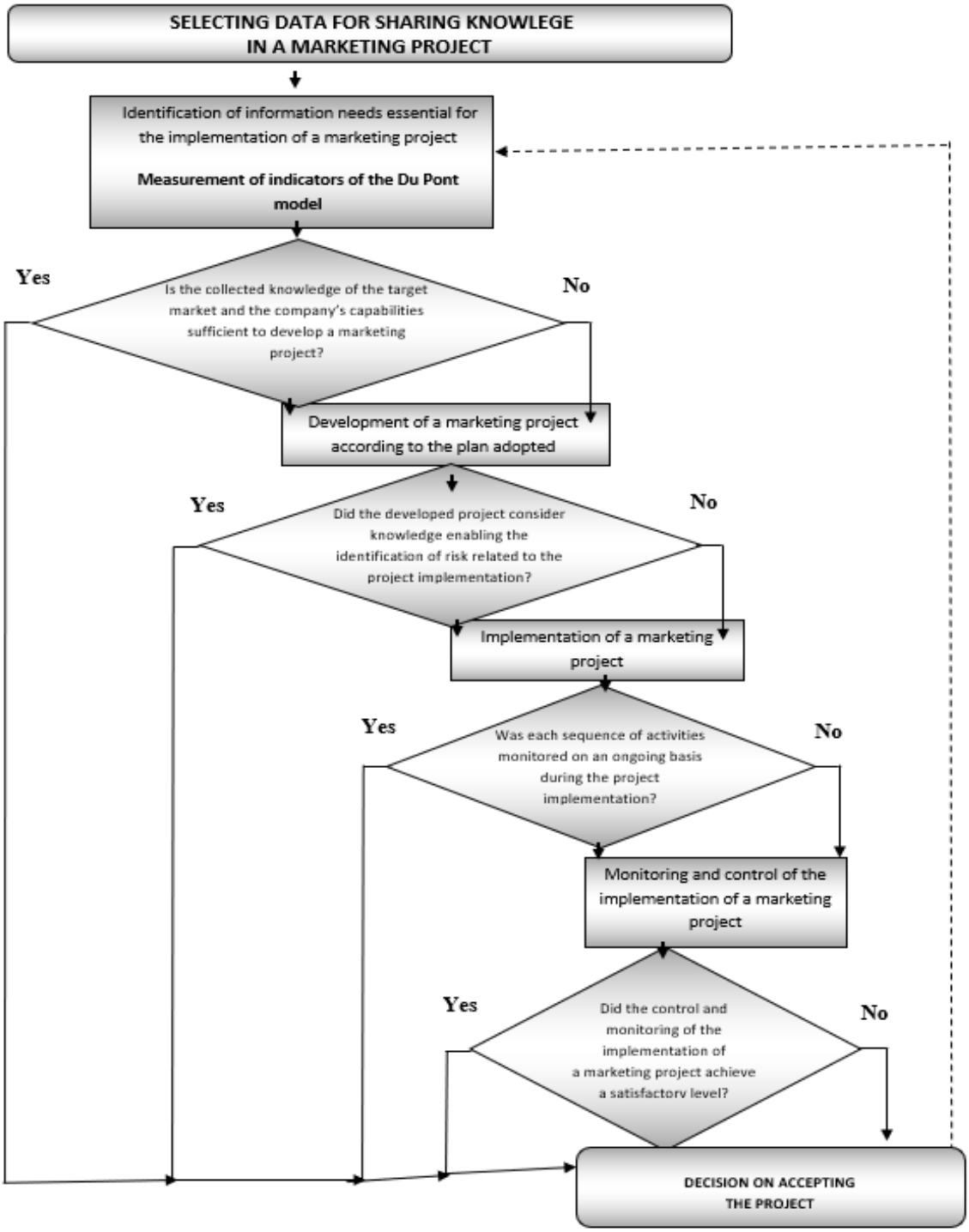


Figure 2: The model for selecting data determining sharing knowledge during the implementation of a marketing project in the company

Source: Own study.

Obtaining the expected data in terms of quality and quantity means that the decision-maker has necessary knowledge to take a decision on the development of a marketing project (the second predicate). The detection of threats and identification of risk related to the implementation of a project make it necessary to select the third degree information in the area of current control of each sequence of operations (the third predicate). If the risk is at an acceptable level, this means the situation in which a marketing project was implemented with sufficient knowledge and information. At the last stage of data selection, the operand relates to the processes of monitoring and control of the implementation of a marketing project. Obtaining a negative response from the fourth predicate may result in the repetition of the entire procedure where the manager acknowledges that they have not received sufficient knowledge to make a decision on the implementation of a marketing project.

To sum up, it should be emphasized that the presented model enables the creation of the potential for selecting directions for sharing knowledge during the development of a marketing project in the enterprise. The developed algorithm is a strictly formalized research procedure allowing for making decisions concerning selecting knowledge in the marketing project development procedure. The presented model is a decision-making model, which means that it can be an instrument supporting the choice between short and long-term decisions of the company in terms of the development of a marketing project.

7. Discussion

According to the dynamic approach in the theory of management, the presented model for data selection determining sharing knowledge during the implementation of a marketing project is a decision-making model. The model presents the logic of the company's operations. Moreover, the model statically maps the development of the adopted marketing project, by considering a broad set of information and knowledge between these relationships (Skowron-Grabowska, 2015).

In the theory of management, decision-making models, which include the model developed, are a conceptual instrument of enterprise management, being a unique, to the given company, method of operation in the market, which ensures that it maintains a long-term competitive advantage by providing customers with value-added, understood as fulfilling or even exceeding expectations as to the widely understood quality of the product (Otola, Grabowska, Szajt, 2020). Making decisions based on decision-making models consists in solving problems, selecting between several obvious options, which are usually economical in their nature.

The course of the decision-making process in the first stage of data selection consists in gathering knowledge about the target market. At this stage, sales and marketing managers share the accumulated knowledge and make decisions regarding the use of opportunities in the company's environment in the field of the marketing project. In the second stage of data selection, sales managers share their knowledge with the commercial director and verify whether the developed project took into account the identification of risks related to the implementation of the project. After two stages, the project participants should obtain comprehensive knowledge about the opportunities and threats of its implementation. The third stage of the developed model is of key importance for achieving the assumed goals of the project. At this stage, the developed marketing project is implemented. In the third stage, sales and marketing managers share their knowledge with employees of units involved in the project implementation and verify the effectiveness of work on an ongoing basis. The last stage consists in controlling and monitoring the implementation of the marketing project in order to achieve a satisfactory level of its implementation.

The advantage of the developed model for selecting data determining sharing knowledge during the development of a marketing project in the company is the possibility of reducing the complexity of the data possessed by selecting knowledge to show opportunities for the continuation and development of activities and to avoid threats. The knowledge concerning the observation of the boundary areas of the conducted activities, which include marketing activities, is of particular importance in the presented model.

Thus, when answering the research question, how sharing knowledge creates the implementation of the company's marketing project, it can be assumed that the application of the presented model not only allows for determining the flow of knowledge in the development of a marketing project in the company, but also sheds light on the methodology of systematic and rational increasing the probability of achieving effective solutions of the decision-making problem.

However, it should be pinpointed that the presented model has some significant constraints, which affect the possibility of its empirical application. First, the model is only the one, according to which it is possible to implement the process of sharing knowledge during the implementation of a marketing project in the enterprise and it maps the reality in a simplified way. Secondly, the model does not consider legal factors which may have an impact on the selection of right decisions during the development of a marketing project. Despite such constraints, it is worth noting that the efficiency of the developed model for selecting data determining sharing knowledge during the implementation of a marketing project in the company allows the integration of managers' knowledge to recognize customer preferences, their acquisition, maintenance, market recognition and implementation of innovative marketing solutions.

To sum up, it should be stated that, based on the critical analysis, it can be assumed that the application of the model for selecting data determining sharing knowledge during the development of a marketing project in the enterprise may bring satisfactory results, which will contribute to revealing both positive and negative trends. The presented model allows for a comprehensive and objective analysis of the process of sharing knowledge and creates the conditions for taking actions which may guarantee the achievement of better results of a marketing project.

8. Conclusions

To sum up, it is worth pinpointing that the operation of enterprises in the turbulent environment forces managers to search for modern management instruments to increase the efficiency of decisions taken. Therefore, managers are willing to implement modern decision-making models which improve the effectiveness of the company's business processes. When responding to the research question formulated in the study, one may assume that the consistency and relevance of the applied decision-making models, which include the developed model for selecting data determining sharing knowledge during the implementation of a marketing project in the company, may contribute to creating the conditions for continuous generation of free market spaces. It should be noted that the most significant factor determining the construction and choice of the decision-making model ought to be knowledge since the decision-making process is the transformation of knowledge into a managerial decision. Importantly, the developed model provides information on decision-making processes in terms of the development of a marketing project, constituting the basis for forecasting future conditions for the company's development, at the same time, it can be assumed that the objective of the article has been achieved.

The main contribution of the article is the in-depth understanding of the possibility of building the model for selecting data determining sharing knowledge, which is to meet the primary objective, which is the implementation of a marketing project in the company. Therefore, the organization of the flow of knowledge in the processes of the development of a marketing project ought to support decision-making processes in the enterprise. At the same time, the flow of knowledge concerning the development of a marketing project is the determinant of rationality and efficiency of the developed model and is one of the basic components which determines the effectiveness of a marketing project. The further direction of the research will concern the application of the developed model for selecting data determining sharing knowledge during the implementation of a marketing project in the chemical industry company, which conducts activities in 50 countries of the world, and the scope of its operations is global.

References

Altkorn, J. (ed.) (2002) *Fundamentals of Marketing*, Wyd. Marketing Institute, Kraków, p. 28.

Anand, A. Centobelli, P. and Cerchione, R. (2020) "Why should I share knowledge with others? A review-based framework on events leading to knowledge hiding". *Journal of Organizational Change Management*, pp. 379-391.

Baines, P., Fill, C., and Rosengren, S. (2017) *Marketing*, Oxford University Press, p. 45.

Carvalho M.M. de, Patah L.A. and De Souza Bido D. (October 2015) "Project Management and Its Effects on Project Success: Cross-country and Cross-industry Comparisons", *International Journal of Project Management*, Vol. 33, Iss. 7.

Cerchione, R., and Esposito, E. (2016) "A systematic review of supply chain knowledge management research: State of the art and research opportunities", *International Journal of Production Economics*, *182*, pp. 276-292.

Christopher, M., Payne, A., and Ballantyne, D. (2013) *Relationship marketing*, Routledge, p. 258.

Dawson, J. (2014) "Moderation in management research: What, why, when, and how", *Journal of Business and Psychology*, Vol. 29, No. 1, pp. 1–19.

Keh, H. T., Nguyen, T. T. M., and Ng, H. P. (2007) „The effects of entrepreneurial orientation and marketing information on the performance of SMEs", *Journal of business venturing*, *22*(4), pp. 592-611.

Kotler, P. (2012) *Kotler on marketing*, Simon and Schuster, p. 16.

Kotler, P., Burton, S., Deans, K., Brown, L., and Armstrong, G. (2015) *Marketing*, Pearson Higher Education AU, p. 58.

Luo, L., Wang, Y., and Han, L. (2013) Marketing via social media: a case study, *Library Hi Tech*, p. 33.
Mir F.A., Pinnington A.H. (2014) "Exploring the Value of Project Management: Linking Project Management Performance and Project Success", *International Journal of Project Management*, Vol. 32, Iss. 2.
Molenaar, C. (2013) *E-Marketing: Applications of information technology and the internet within marketing*. Routledge, p. 55.
Naik, P. A., Raman, K., and Winer, R. S. (2005) *Planning marketing-mix strategies in the presence of interaction effects*, Marketing Science, 24(1), pp. 25-34.
Nowicki, A. (ed.) (1998) *Computer Science for Economists, Theoretical and Practical Study*, PWN, Warsaw, pp. 101-102.
Otola, I., Grabowska, M. and Szajt, M. (2020) *Value Composition for Business Models of High-Growth Enterprises*, [in:] Business Models. Innovation, Digital Transformation, and Analytics (ed.) I. Otola, M. Grabowska, Taylor and Francis Group, New York, pp. 33-47.
Imenda, S. (2014) "Is there a conceptual difference between theoretical and conceptual frameworks?", *Journal of Social Sciences*, Vol. 38, No. 2, pp. 185–195.
Pichler R. and Schulze S. (2005) "Book Reviews: Agile Project Management: Creating Innovative Products by Jim Highsmith, and Agile Project Management with Scrum by Ken Schwaber", *Journal of Product Innovation Management*, No. 22, pp. 371–373.
Pulendran, S., Speed, R., and Widing, R. E. (2003) „Marketing planning, market orientation and business performance", *European journal of marketing*, p.78.
Richardson, M., an Domingos, P. (2002, July). Mining knowledge-sharing sites for viral marketing. [in:] *Proceedings of the eighth ACM SIGKDD international conference on Knowledge discovery and data mining,* pp. 61-70.
Setini, M., Yasa, N., Supartha, I., and Giantari, I. G. A. K. (2021) „The effects of knowledge sharing, social capital and innovation on marketing performance", *International Journal of Data and Network Science*, *5*(3), pp. 257-266.
Shane, S., and Delmar, F. (2004) „Planning for the market: business planning before marketing and the continuation of organizing efforts", *Journal of Business Venturing*, *19*(6), pp. 767-785.
Simkin, L. (2002) „Tackling implementation impediments to marketing planning", *Marketing Intelligence & Planning*, p. 81.
Skaates, M. A. and Tikkanen, H. (2003) "International project marketing: an introduction to the INPM approach", *International Journal of Project Management*, *21*(7), pp. 503-510.
Skaates, M. A., Tikkanen, H., and Lindblom, J. (2002) „Relationships and project marketing success", *Journal of Business & Industrial Marketing*.
Skowron-Grabowska, B. (2015) *Logistics and Marketing Determinants of Enterprises Management*, Vysoka skola banska - Technicka univerzita Ostrava, p. 28.
Stevens, R. E., Loudon, D. L., Wrenn, B., and Warren, W. E. (2021) *Marketing planning guide*, CRC Press, p. 48.
Subramani, M. R., and Rajagopalan, B. (2003) Knowledge-sharing and influence in online social networks via viral marketing. *Communications of the ACM*, *46*(12), pp. 300-307.
Wawrowski, B. and Otola, I. (2020) „Social media marketing in creative industries: How to use social media marketing to promote computer games?", *Information*, *11*(5), p. 42.
Wilson, R. M. (2010) *Strategic marketing planning*, Routledge, p. 81.

Multidimensionality of Knowledge in Strategic Innovation Processes of Enterprises in the Light of Research Results

Sylwia Łęgowik-Świącik
Czestochowa University of Technology the Faculty of Management, Poland
s.legowik-swiacik@pcz.pl

Abstract: The publication raises the research question: what dimensions of knowledge are significant in strategic innovation processes of enterprises and what implications in this area can be observed in the case of enterprises of the logistics industry. By focusing on the use of the three dimensions of knowledge in the process of building strategic innovation, the strength and direction of the linear relationship between knowledge understood as the company's ability to learn and strategic innovation was examined. In the counterpoint, the attention was drawn to the concept of 'a sustainable enterprise' which integrates knowledge and strategic innovation, providing the framework for the implementation of new solutions. This article is both a theoretical and practical contribution to the research into the determinants of strategic innovation in the context of the company's ability to learn. The empirical research was based on the sample of 100 enterprises belonging to the logistics industry in Poland. The research period was the years of 2020-2021. The applied research methods were critical literature analysis, survey questionnaire and Pearson's correlation analysis. The conclusions from the research suggest that along with an increase in knowledge in the surveyed enterprises there is an increase in innovation strategy in decision-making processes. Moreover, the publication deepens the understanding of various contexts of positive relationships between the three dimensions of knowledge and strategic innovation, which leads to the search for new implications in the changing economic environment. The subject of the significance of knowledge in strategic innovation processes of enterprises is important and up to date since it contributes to the discussion on the extent to which enterprises ought to implement knowledge to gain a competitive advantage.

Keywords: knowledge, strategic innovation, enterprise management.

1. Introduction

Nowadays, the innovativeness of enterprises is becoming a factor that dynamizes the situation in the industry or the market sector, thus creating challenges for other market players that must adapt to situations created by innovation. In the Blue Ocean Strategy, W. Chan Kim and R. Mauborgne (2007) underline that innovation is a strategic imperative of the development of modern enterprises. This means that innovation is the basis for making effective decisions aimed at staying at a competitive market. Furthermore, innovation plays an important role in the process of creating value by the enterprise since the company's structure of innovative and competitive potential ought to serve its transformation (Prahalad, Krishnan, 2010).

In this context, building strategic innovation, on the one hand, requires making immediate decisions to maintain a market advantage, on the other, it is a long-term process which covers both technical, technological, product and market areas, implemented on a micro and macro scale. Therefore, the strategic innovation process forces the coordination and integration of knowledge of managers in order to recognize customer preferences, their acquisition, maintenance, market recognition, organization of production process and implementation of innovative technological or product solutions (Bilton, Cummings, 2010).

The concept of strategic innovation directs the attention of managers to the organizational aspect of enterprises related to knowledge, which reflects the company's ability to learn and to shape an intelligent organization. This means that knowledge becomes a critical resource which allows resources to be transformed into key success factors (Cyfert, Krzakiewicz, 2016). Hence the question arises: what dimensions of knowledge are significant in strategic innovation processes of enterprises and what implications in this area can be observed in the case of logistics industry companies? In order to answer the research questions, the objective of the study was to investigate the strength and direction of the linear relationship between knowledge understood as the company's ability to learn and strategic innovation. The ability to use knowledge by the company's managers can be a source of increased effectiveness of innovative processes in the long term. Therefore, it is worth taking a closer look at the concept of strategic innovation, the effect of which should be knowledge built on the basis of the observation of socio-economic phenomena, reflected in the efficiency of the use of intellectual capital which is the rooting system of the enterprise.

2. The use of knowledge in the process of building strategic innovation

Strategic innovation is defined as such a transformation and reformulation of the company's strategy, which, through the commercialization of innovation, enables the creation of new value for both customers and the enterprise (Johnston Jr, Bate, 2007). Strategic innovation processes are long-term in nature, therefore they require management staff to possess tacit and explicit knowledge, to share their expertise, information flow, planning skills, implementation of bottom-up initiatives, and the acquisition of sources of financing activities related to the development of entrepreneurship (Graetz, 2002). At the same time, strategic innovation combines alternately the processes of discovering existing things and the processes of creating new ones (Bilton, Cummings, 2010). Therefore, management staff representing all levels of management in the company, ought to concentrate their activities on achieving the assumed results by using knowledge and innovation, in order to maintain and increase the competitive position on the market.

The occurrence of strategic innovation forces the need to consider its costs and benefits in business models. Therefore, the business model should be the component of strategic management that provides management staff with reliable information (Itami, Nishino, 2010) on strategic innovation implemented by the company (Szajt 2020). Information generated in the business model should be both ex ante, ex modernum and ex post, since it ought to be the stimulus creating the development of innovativeness of enterprises.

Providing the framework for the implementation of strategic innovation solutions in the business model requires the possession of up-to-date information (Davenport, Prusak 2000), particularly in the field of the virtualization of economic reality (Grudzewski et al, 2010). Shaping the business model to create value requires taking into account the control of strategic innovation processes. This means that enterprises enter the cooperation relations and by implementing strategic innovation, they influence the shaping of innovative attitudes of stakeholders.

In the subject literature, it is assumed that strategic innovation can take one of the three forms [Renko et al, 2009]. The first one is a technological capability. It is a bunch of processes related to the management of knowledge, intellectual capital (Chluska, 2020) and investment in research and development. At the same time, strategic innovation is realized through research and development (R+D) activities, which include product development, patent and licensing policies (Hitt, et al, 2011). The second form of innovation strategy is market orientation in which the company's innovative activities focus on customers. Due to strategic innovation, the enterprise significantly changes customary organizational forms to approach the accomplishment of the assumed objectives (Hamel, Breen, 2008). The third form of strategic innovation is entrepreneurial orientation, according to which the enterprise focuses on radical innovation, which leads to aggressive actions against competitors, but this is associated with risk. This risk may be neutralized by applying the principle of "the appropriate order of strategic elements", in line with the concept of the Blue Ocean Strategy (Chan Kim, Mauborgne, 2007).

To sum up, it should be pinpointed that the application of the listed forms of strategic innovation is limited. Large enterprises focus mainly on entrepreneurial orientation, due to the need for growth. Small enterprises prefer market orientation due to resource constraints. On the other hand, the largest corporations ought to develop technological skills through investments in research and development. Further considerations require addressing the issues related to the integration of knowledge and strategic innovation, which are closely linked to the strategy understood as a set of competitive activities and adequate approaches to business, expressed in obtaining and maintaining a competitive advantage. Therefore, subsequently the attention will be paid to the "sustainable enterprise" model in the context of the ability to build sustainable business success.

3. Knowledge integration and strategic innovation in the "sustainable enterprise" model

In the subject literature, knowledge is one of the four components of the "sustainable enterprise" model (Grudzewski et al, 2010). In this model, knowledge, innovation, entrepreneurship, and trust are features that most construct or reconstruct business. Knowledge in the "sustainable enterprise" model (Figure. 1.) is a smooth combination of experience, selected information and expert insight into the quality of the issue, which is to provide a framework for the evaluation and implementation of new information and experience (Davenport, Prusak 2000). Innovation in the "sustainable enterprise" model is to enable the implementation of knowledge about how to transform new ideas (Linder, Jarvenpaa, Davenport, 2003) into products or services,

and at the same time to keep this knowledge secret from competitors. This means that innovation becomes the basic mechanism for acquiring and maintaining competitiveness by enterprises.

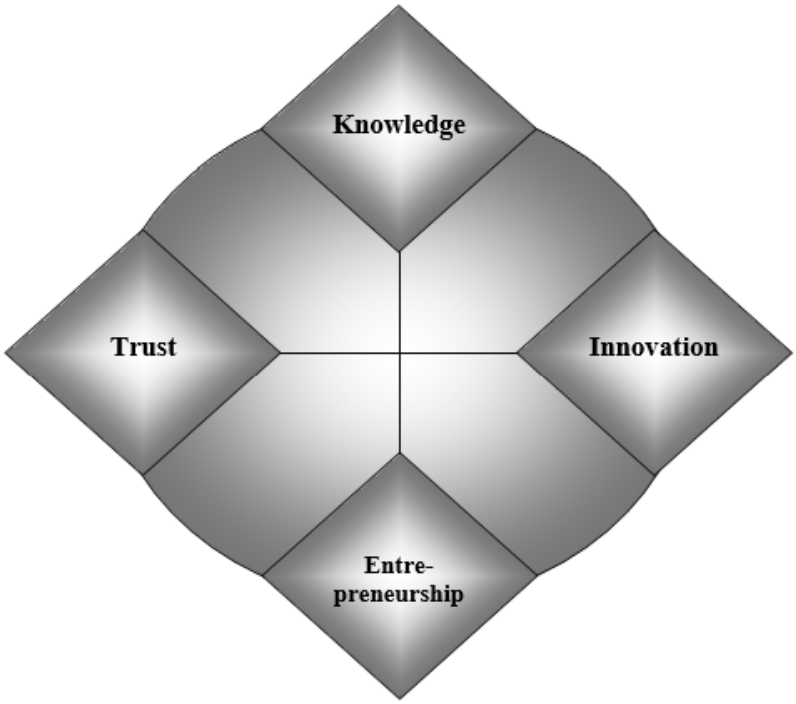


Figure 1: The components of the "sustainable enterprise" model

Source: Grudzewski et al, 2010, Sustainability in Business, Poltext, Warsaw 2010, p. 36.

Combining innovation with cost proposals, usability and price create value innovation that arises in areas influencing both the structure and level of costs and the value proposal for the customer. Another component of the "sustainable enterprise" model is entrepreneurship. It concerns not only starting and developing new ventures (Dyduch, 2019), but most of all it includes business reorganization and the ability to renew it (Grudzewski et al, 2010). The process of entrepreneurship in the "sustainable enterprise" model ought to consider the ability to see opportunities and create organizations to follow them. An essential component of the „sustainable enterprise" model is trust that allows for achieving a sustainable competitive advantage (Kramer, 2009). At the same time, trust becomes the key organizational adhesive in modern business (Evans, 2005).

To sum up, it is worth pinpointing that, in addition to knowledge, innovation, entrepreneurship and trust, which are the key components of the "sustainable enterprise" model, an important role for the implementation of this model is played by management staff, who will be open to changes, visionary, and ultimately will be able to shape the company's position on a competitive market. The "sustainable enterprise" approach is a young field of knowledge that is just emerging in the world, which is a turning point on the way to the company's sustainable development. The further direction of the research will be around the search for the answer to the research question concerning the dimensions of knowledge in strategic innovation processes of enterprises and the implications that can be observed in this area in the case of companies of the logistics sector.

4. Characteristics of the research sample and description of the research methodology

The empirical research is to investigate the strength and direction of the linear relationship between strategic innovation and knowledge. The empirical research was carried out using the survey questionnaire. The statements included in the survey questionnaire were rated by the respondents on a scale from 1 to 5. The scope of the research in terms of entities included 100 enterprises (micro, small and medium) belonging to the logistics sector.

The enterprises covered by the survey operate in Poland in the area of the Silesian Voivodeship. The selection of the region was determined by the fact that the region is undergoing continuous economic changes from

the area predominated by the heavy industry to the one related to the dominance of services, knowledge management, creative industries, and innovation development. The choice of the region for the empirical research was also dictated by the conditions, such as, a relatively high number of small and medium enterprises established, a large number of consumers, a high urbanization index, convenient transport connections, which is conductive to the development of the logistics service sector and the highest population density in Poland, which brings about that the translation of innovation and knowledge into the market may be of particular importance in this area.

The vast majority of the surveyed entities was microenterprises (68%), with a European scope (53%). In the opinion of the senior management (71%), the profitability of the surveyed enterprises is determined by the concentration on a cost advantage (43%), differentiation (33%) or the market niche (24%) in one narrow market segment, which allows for high specialization. The selection of the research sample was random. The time range of the research included the years 2020 - 2021. The research was carried out using the Computer Assisted Telephone Interview (CATI) technique (Hair et al, 2014) at the turn of the years 2020 - 2021. The advantages of using the CATI method to accomplish the objective of the study are, among others, a short period of carrying out a large number of tests, high-quality results, regularity of stages during the research, an integrated course of data collection (Oláh, 2019). The applied research method has also constraints, related to difficulties in the case of conducting research consisting of a large number of open questions, or discussing issues too complex to respondents.

5. Results of the conducted empirical research

The research procedure was carried out in two stages. In the first stage of the research process, the frequency of responses given by the respondents was examined. In the second stage of the research process, the strength and direction of the linear relationship between strategic innovation and knowledge understood as the company's ability to learn were examined.

5.1 The first stage of the research process

On the basis of the research results, it can be concluded that the vast majority of the surveyed logistics companies use knowledge to learn from their own mistakes or the ones made by others (35% - I agree and 47% I completely agree). This proves that micro, small and medium enterprises of the logistics sector not only acquire knowledge on the basis of their own experience, but despite resource difficulties they observe competitors in the market in order to avoid mistakes in the future (Figure. 2).

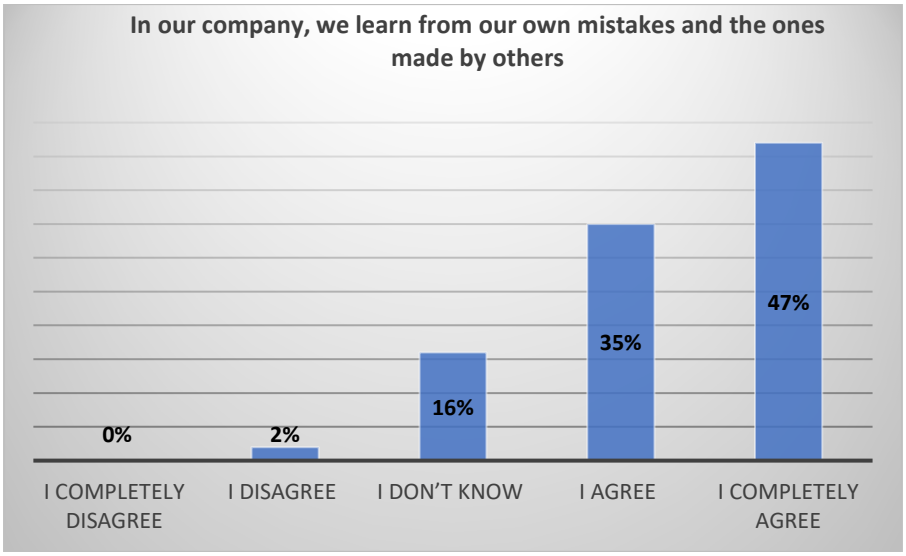


Figure.2: Processes of learning and avoiding mistakes

Source: Own study based on the conducted research

The conducted research has indicated that the surveyed logistics companies are interested in searching for good practices and their implementation in the activities conducted (40% - I agree and 27% - I completely agree). This

may prove the ability of the surveyed enterprises to adapt to changing tasks while enabling the creation of simple organizational structures (Figure. 3).

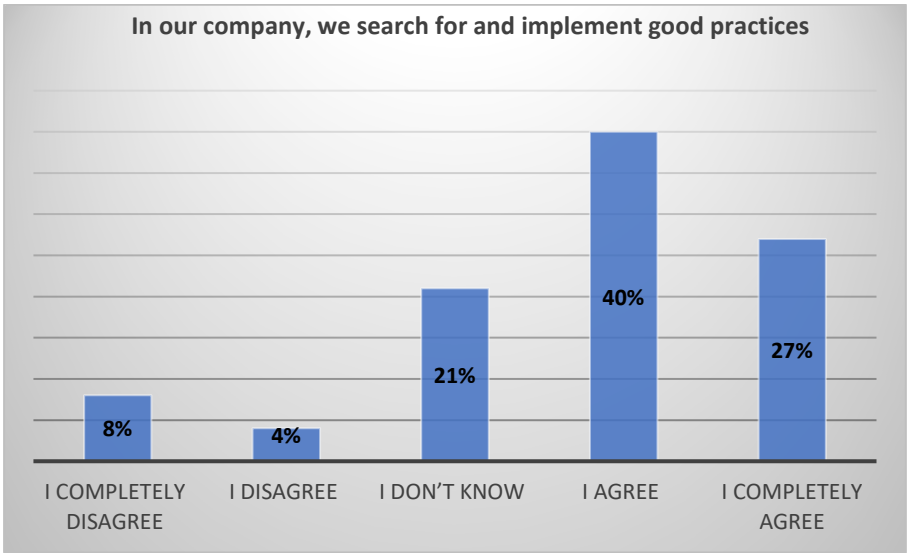


Figure 3: Implementation of good practices

Source: Own study based on the conducted research.

In the surveyed logistics companies, an important role is played by the processes of creation of new organizational practices (34% - I agree and 26% I completely agree). This means that the decision-making process in the surveyed enterprises is directed not only to the adaptation to market trends but also the identification of changes in the internal environment and the creation of organizational innovation (Figure. 4).



Figure 4: Creation of organizational innovation

Source: Own study based on the conducted research.

The research indicates that the decision-making process in which emerging opportunities are exploited and innovative decisions are made to implement them is relevant in the practice of activities of the surveyed enterprises (40% - I agree and 24% - I completely agree). The combination of knowledge and strategic innovation allows the surveyed enterprises to commercialize innovation and to create a unique offer, which allows micro, small and medium enterprises to survive in the market (Figure. 5).

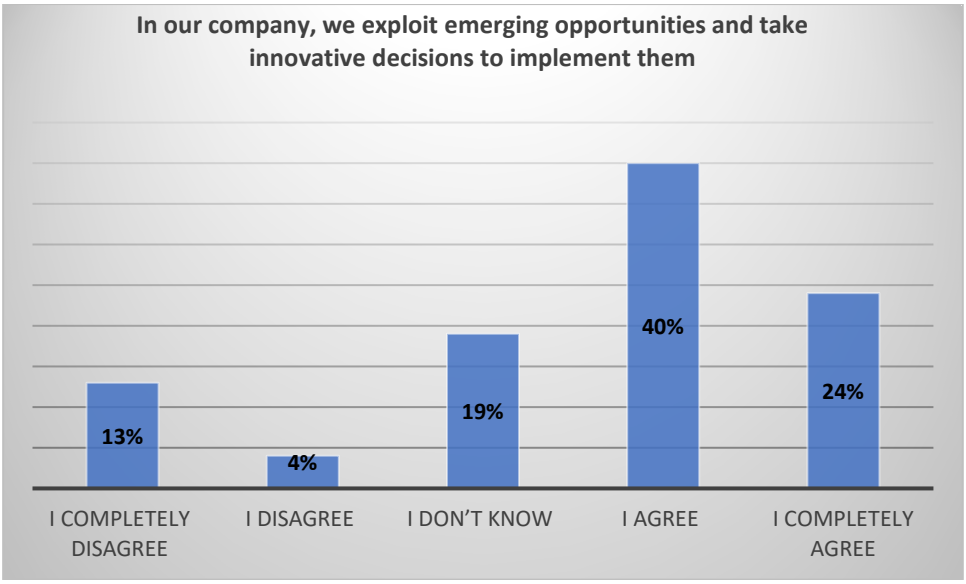


Figure 5: Strategic innovation in decision-making processes

Source: Own study based on the conducted research.

Among the surveyed respondents, one may observe the benefits resulting from planning new ventures (29% - I agree and 28% - I completely agree). The possibility of effective planning the conducted activities creates positive effects for both the surveyed enterprises and their customers, which is reflected in a wider and flexible offer (Figure. 6).

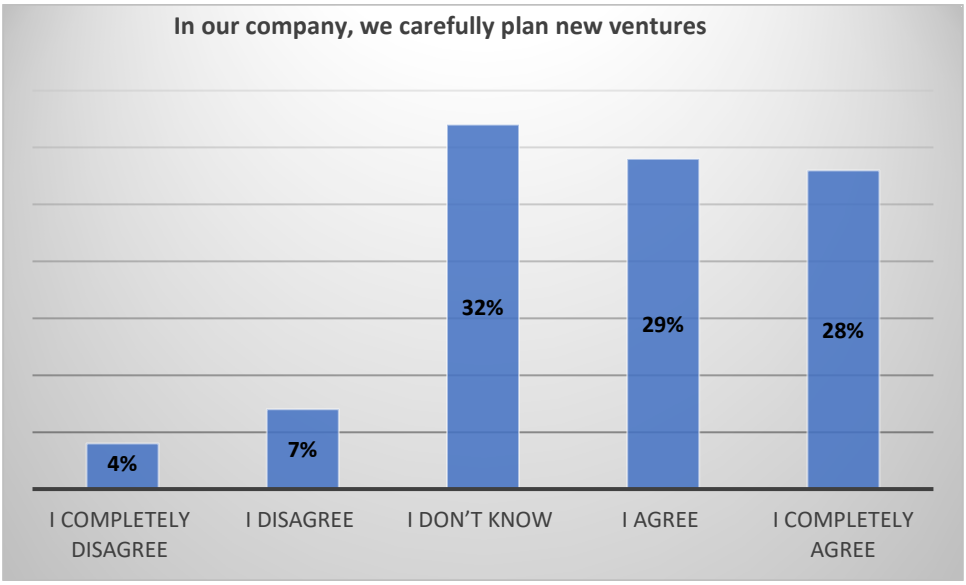


Figure 6: Strategic innovation in planning new ventures
Source: Own study based on the conducted research.

Most of the surveyed respondents agreed with the statement that the positively evaluated opportunities result in taking actions aimed at their implementation (37% - I agree and 20% I completely agree). This means that exploiting business opportunities by the surveyed logistics companies reflects the adopted business model which describes the content, structure, and principles of the functioning of exchanges for creating value (Figure. 7).

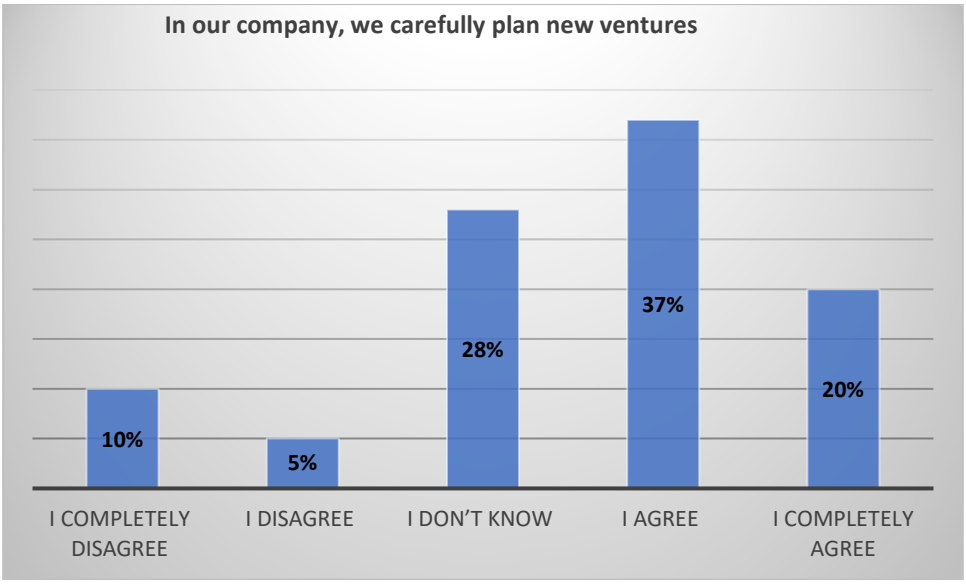


Figure 7: Strategic innovation in exploiting business opportunities

Source: Own study based on the conducted research.

It is worth pinpointing that the ability to identify opportunities by the surveyed enterprises should be combined, however, with the ability to identify threats related to competitors and integrating resources essential for exploiting emerging opportunities to create new value. At the same time, the strategic innovation process should consider the ability to notice opportunities and the ability to take advantage of them for further development. Moreover, giving responses by the indecisive respondents is noteworthy. This may be the evidence of the lack of knowledge among the surveyed respondents in the field of the given answers and the need for greater integration of knowledge and strategic innovation in micro, small and medium enterprises of the logistics sector.

5.2 The second stage of the research process

While searching for the response to the question: what dimensions of knowledge are significant for strategic innovation processes of enterprises and what implications in this area can be observed in the case of enterprises of the logistics sector, in the second stage of the research procedure, the strength and direction of the linear relationship between strategic innovation and knowledge were examined. For this purpose, the analysis of the Pearson correlation between the input variables was carried out. In the research procedure, three dimensions of knowledge understood as the company's ability to learn were isolated. These are: *Processes of learning and avoiding mistakes*, *Implementation of good practices* and *Creation of organizational innovation*. The strategic innovation of the surveyed enterprises was analyzed in terms of decision-making processes, planning new ventures, and exploiting business opportunities.

Figure 8 indicates that in the case of the surveyed logistics companies there is a strong positive relationship between strategic innovation realized in decision-making processes and implementation of good practices (0.66), and the creation of organizational innovation (0.75) in this field. The surveyed enterprises of the logistics sector are aware of the potential of the possessed knowledge and exploit opportunities to increase efficiency. A relatively low positive relationship was obtained between strategic innovation realized in decision-making processes and processes of learning and avoiding mistakes in the surveyed companies (0.32). This may be related to the fact that micro and small enterprises have a limited opportunity to learn from mistakes made by others.

When analyzing the relationship between strategic innovation in planning new ventures and implementation of good practices, a weak positive relationship can be observed (0.27). There is a similarly weak relationship between strategic innovation in planning new ventures and creation of organizational innovation (0.31). This may mean that the surveyed logistics companies cannot use the significance of knowledge in planning processes resulting from good practices or creating organizational innovation since they do not have sufficient (human and financial) resources, to use the significance of knowledge understood as the ability to learn. The moderate positive relationship is observed between strategic innovation in planning new ventures and creation of

organizational innovation (0.54). Organizational innovation may contribute to reduction in operating costs of logistics companies and imply new services or products with the same amount of expenditure incurred, which is conductive to strategic innovation processes in planning new ventures. The results are presented in Figure 8.

Strategic innovation				
Strategic innovation in decision-making processes: In our company, we exploit emerging opportunities and take innovative decisions to implement them	***Strategic innovation in planning new ventures:*** In our company we carefully plan new ventures	***Strategic innovation in exploiting business opportunities:*** In our company, the positively evaluated opportunities result in taking actions aimed at their implementation		
0.32	0.27	0.31	***Processes of learning and avoiding mistakes:*** In our company, we learn from our own mistakes and the ones made by others	Knowledge as the company' s ability to learn
0.66	0.31	0.49	***Implementation of good practices:*** In our company, we search for and implement good practices	
0.75	**0.54**	**0.67**	***Creation of organizational innovation:*** In our company, new organizational practices are created	

Figure 8: Matrix of the Pearson's correlation of the input variables

Source: Own study based on the conducted research.

When examining the relationship between strategic innovation in exploiting business opportunities and creation of organizational innovation, a strong positive correlation is observed (0.67). The enterprises that implement new organizational practices configure their value chain so that they could make different choices within the framework of the possessed resources, which provides the enterprise with the opportunity to build its competitiveness. There is a moderate positive relationship between strategic innovation in exploiting business opportunities and creation of organizational innovation (0.49). This may result from the need to reconcile contradictions between building a competitive position and building internal relations in enterprises. The surveyed logistics companies do not use the potential of knowledge resulting from the relationship between strategic innovation in exploiting business opportunities and processes of learning and avoiding mistakes (0.31). This may be due to the fact that the cost of knowledge transfer from the inside of the company becomes an important factor of a competitive advantage in the case of enterprises operating on a micro scale.

6. Discussion

This study was based on the assumption of the existence of complex relationships between the two variables. The first variable is knowledge understood as the company's ability to learn. The other variable is strategic innovation defined as a long-term process requiring management staff to share knowledge, have knowledge, the ability to plan and also to take innovative activities that develop entrepreneurship. In the study, the response to the question was searched for, concerning what dimensions of knowledge are significant for the processes of strategic innovation of enterprises and what implications in this area can be observed in the case of enterprises of the logistics sector. The results of the conducted research suggest that knowledge has a positive impact on the strategic innovation processes of the surveyed companies. A clear implication from the conducted research is that along with an increase in knowledge in creation of organizational innovation, there is an increase in strategic innovation in decision-making processes. An increase in knowledge due to implementation of good practices in the company also results in an increase in strategic innovation in decision-making processes. This is the confirmation of the adopted assumption on the occurrence of the relationship between the two analyzed variables. Furthermore, in the case of strategic innovation in decision-making processes, the analyzed relationships may prove an increase in awareness of the management staff of the surveyed logistics companies in terms of the potential related to the possession of knowledge.

The significance of knowledge related to creation of organizational innovation in the processes of strategic innovation of enterprises is also noticeable in the area of exploiting business opportunities. Along with an increase in knowledge concerning innovative organizational practices, there is an increase in the level of positively evaluated opportunities which result in taking actions aimed at their implementation. This means that micro, small and medium enterprises of the logistics sector search for opportunities to build their competitiveness and eagerly create organizational innovation so as to benefit from the acquired knowledge.

However, it is worth pinpointing that despite the management staff of the surveyed enterprises are aware of the significance of the three identified dimensions of knowledge in strategic innovation processes, the results of the examined relationships are weak in the area of planning new ventures and implementation of good practices and creation of organizational innovation. The similarly weak relationships are observed between processes of learning and strategic innovation in exploiting business opportunities. The fact of the occurrence of weak relationships in the indicated areas may prove that the surveyed micro, small and medium enterprises of the logistics sector have problems with using knowledge to achieve strategic innovation. Maintaining a competitive advantage by micro, small and medium logistics companies does not concentrate only on discovering ideas. In the conditions of the turbulence of the environment, micro, small and medium enterprises of the logistics sector shift the center of gravity from strategic to operational objectives. Therefore, from the point of view of the significance of knowledge in the processes of strategic innovation of enterprises, it becomes very important to pay attention to a creative search for new areas of generating value, considering interactive ties of the company with its constantly changing economic environment, which will allow the creation of the sustainable enterprise by companies of the logistics sector.

7. Conclusions and summary

In the conditions of uneasy and complex business environment, understanding the significance of knowledge and relationships between knowledge and strategic innovation is one of the basic factors determining the company's success. The major theoretical contribution of this study is strong empirical evidence confirming the significance of knowledge and the occurrence of the relationship between knowledge understood as the company's ability to learn and strategic innovation. By describing and analyzing the strength and direction of the linear relationship between difficult and multidimensional variables such as knowledge and strategic innovation, the study contributes to the existing literature by combining the two relevant factors of the operation of modern enterprises. When generalizing the above considerations, it can be assumed that enterprises actively implementing knowledge effectively generate new ideas in terms of strategic innovation and the listed implications in this field allow for reducing the gap between the organization and changes in the environment.

It is worth emphasizing that the relationships between the identified dimensions, knowledge, and strategic innovation, intertwine and complement each other, but they are not the same. Moreover, micro, small and medium enterprises of the logistics sector must urgently solve current management problems, thus, the understanding of the relationship between knowledge and strategic innovation will allow them to enter new areas of activities, enabling the long-term competition in the market, according to the concept of the sustainable enterprise.

However, the research into micro, small and medium enterprises has its constraints. Firstly, the subject literature in this field is dispersed, which was a challenge during the construction of the theoretical framework of this study. Secondly, obtaining a broader perspective of the analyzed problem was problematic due to the limited research sample. For these reasons, one of important research subjects in the future can be a discourse related to the understanding of the multidimensional nature of the issue of knowledge management in strategic innovation processes of contemporary enterprises.

To sum up, the major objective of this study was to examine the strength and direction of the linear relationship between knowledge understood as the company's ability to learn and strategic innovation. The presented considerations allow for the following observations:

- in a situation of the variability of the environment, knowledge, which demonstrates the cohesion between strategic innovation processes, is of great importance,
- appropriate configuration of knowledge and strategic innovation is conductive for exploiting development opportunities and realization of innovation.

In the light of the conducted considerations, it can be assumed that the dimensions of knowledge are significant in the processes of strategic innovation of enterprises and the revealed implications in this field are important for enterprises of the logistics sector. In conclusion, the considerations presented in this study allowed the accomplishment of the assumed research objective. The discussed issue of the significance of knowledge in terms of strategic innovation is important and up-to-date due to its impact on strategic decision-making in the surveyed enterprises.

References

Bilton C., Cummings S. (2010), *Creative Strategy. Reconnecting Business and Innovation*, John Wiley and Sons, Chichester. p. 62.

Chan Kim W., Mauborgne R. (2007), *Blue Ocean Strategy*, MT Biznes, Warsaw, pp. 42-43.

Chluska J. (2021), *The Intellectual Potential of Employees in Hospital Management*, [in:] Proceedings of the 22nd European Conference on Knowledge Management (ed.) Garcia-Perez Alexeis, Simkin Lyndon, Academic Conferences and Publishing International Limited, pp. 153-160.

Cyfert S., Krzakiewicz K. (2016), The role of opportunitysensing and learning processes in shaping dynamic capabilities in Polish enterprises, „Management", Vol. 20, No. 1, p. 277-291.

Davenport T.H., Prusak L. (2000), *Working Knowledge: how Organizations Manage What They Know*, Harvard Business School Press, Boston-Massachusetts, s. 46.

Dyduch W. (2019), *Entrepreneurial strategy stimulating value creation: Conceptual findings and some empirical tests*, „Entrepreneurial Business and Economics Review", Vol. 7, No. 3, p. 65-81.

Evans C. (2005), *Knowledge management*, PWE, Warsaw, s. 59.

Graetz F. (2002), *Strategic Thinking and Strategic Planning*, „Management Decision", Vol. 40, No. 5/6, pp. 456.

Grudzewski W.M., et al, (2010), *Sustainability in Business*, Poltext, Warsaw, p. 36.

Hair J.F. et al, (2014) *Multivariate Data Analysis*. 7th Edition, Pearson Education, Upper Saddle 525 River, 129, pp. 282-288.

Hamel G., Breen B. (2008), *The Future of Management*, Harvard Business School Press, Red Horse, Warsaw, p. 35.

Hitt M.A., Ireland R.D., Sirmon G., Trahms Ch.A. (2011), *Strategic Entrepreneurship: Creating Value for Individuals*, Organizations and Society, Academy of Management Perspectives, May, s. 57-75.

Itami H., Nishino K. (2010), Killing Two Birds with One Stone: Profit for Now and Learning for the Future, „Long Range Planning", 43 (2), s. 364-369.

Johnston Jr R.E., Bate D. (2007), The Power of Strategy Innovation: A New Way of Linking Creativity and Strategic Planning to Discover Great Business Opportunities, Amacom, New York. p. 4

Kramer R.M. (2009), *Rethinking Trust*, Harvard Business Review, 87(6), p. 68

Linder J.C., Jarvenpaa S., Davenport T.H. (2003), *Toward an Innovation Sourcing Strategy*, Harvard Business Review 2003, 44 (4), pp. 43-49.

Oláh, J., et al. (2019) Analysis and comparison of economic and financial risk sources in SMEs of the Visegrad group and Serbia. 515 Sustain., 11.7. 1853

Prahalad C.K., Krishnan M.S. (2010), *The new age of innovation*, PWN, Warsaw 2010, pp. 38-47.

Renko M., Carsrud A., Brannback M. (2009), *The Effect of a Market Orientation*, Entrepreneurial Orientation, and Technological Capability on Innovation: A Study of Young Biotechnology Ventures in the United States and Scandinavia, „Journal of Small Business Management", Vol. 47, No. 3, pp. 331-369.

Szajt M. (2020), Innovation Distance of Polish Regions in Relation to European Models, *Studies of the Industrial Geography Commission of the Polish Geograp, Hical Society* Vol.34, nr 2, pp, 7-17.

Actions for Knowledge Integration capability in Building an Innovative Enterprise: Organizational Perspective

Anna Lemańska-Majdzik
Czestochowa University of Technology, Faculty of Management, Częstochowa, Poland
a.lemanska-majdzik@pcz.pl

Abstract: The functioning of modern organizations requires not only the constant collection of information and its analysis, but also adaptation to changing business requirements. Enterprise owners and managers must indicate which directions of development are important for business maintenance, its development or adaptation to changes in the environment. Achieving and maintaining a business competitive advantage depends on the implementation of innovation in individual entities, use of modern technologies, including advanced IT solutions and the construction of processes and knowledge resources focused on the market environment. Knowledge is perceived as the crucial source to gain a competitive advantage, and knowledge management becomes an important element of the entire process of managing an organization. KI or the ability to collect and process specific information resources of an organization is also crucial for business innovation. KI is difficult to achieve, however, it is the basis for competitive abilities of companies. The aim of the article is to identify the capability to integrate knowledge influencing the innovativeness of enterprises. The review of the current subject literature focuses on the analysis of capability in the knowledge integration based on international experience. The article is based on the results of research conducted at the turn of 2021 and 2022 on a group of 355 enterprises operating in Central Europe, where the business innovation level is quite low. Therefore, an attempt was made to set recommendations for activities for knowledge integration for enterprises intending to increase innovation. The analysis of the practical knowledge integration capability is based on statistical analyses allowing for indicating the correlation and dependence between the studied variables. The empirical research using the proposed research tool was the basis for building a knowledge integration model in terms of enterprise innovation. The analysis showed that selected knowledge integration capability positively correlates with the level of enterprise innovativeness.

Keywords: management, knowledge management, knowledge integration capability, innovation, competitiveness

1. Introduction

A particularly turbulent business environment, exposed to permanent changes, requires not only the continuous collection of information and its analysis, but also adaptation to variable internal and external environmental conditions of organizations. The adaptation of enterprises and maintaining a competitive advantage is possible due to relevant internal operations, including knowledge management, consisting of a range of components and actions (Brzostek 2015). Knowledge is considered as the most important source allowing for gaining a competitive advantage, and knowledge management is becoming a vital component of the entire management process of organizations. Knowledge management is an integrated set of activities the objective of which is to properly shape knowledge resources in enterprises to transform the knowledge of employees and knowledge from the environment into resources that allow for gaining a competitive advantage (Probst, Raub, & Romhardt, 2000; Brzostek 2015, p. 35). Following the international literature review, knowledge integration (KI) is an important component affecting the company's performance, the ability to collect and process characteristic information resources, moreover, it is crucial for enterprise innovativeness (Abubakar et al. 2019). KI is difficult to achieve, however, it is the basis for the competitiveness of enterprises (Lyu et al. 2022). Undoubtedly, integration is an important factor in the process of implementation and use of knowledge management in organizations (Mohammed, 2015). On the other hand, implementing innovation in individual entities, using modern technologies, including advanced IT solutions, and constructing processes and knowledge resources directed to the market environment are the conditions to gain the competitiveness of economic entities in the contemporary operating conditions (Morgan et al. 2019; Lyu et al. 2020). Despite a wide range of research into KI and enterprise innovativeness, in the literature, there is certain scarcity of research concerning enterprises with a low level of innovation. Especially in the case of the identification of individual capabilities of employees in the process of the integration of knowledge that builds innovation of the organization.

The aim of the article is to identify the capability to integrate knowledge influencing the innovativeness of enterprises. The review of the subject literature enabled the construction of the model, which was verified based on the results of the own research conducted at the turn of 2021 and 2022 on a group of 355 companies operating in Poland. This part of the EU is characterized by a low level of enterprise innovativeness (Community Innovation Survey 2021), thus, an attempt was made to identify capability to knowledge integration which may affect an increase in the business innovation level. The constructed research tool, subjected to the reliability

analysis, allowed for data collection that enabled verifying the correlations, relationships and the model as well as making recommendations in terms of KI operations for enterprises that wish to increase their innovativeness. The novelty of the research is visible in the identification of selected capabilities of the organization members in the process of the integration of knowledge building the innovativeness of enterprises

2. Literature Review

2.1 Knowledge Integration

Contemporary management conditions, including a high level of competition, unpredictable turbulence of the environment, business instability, exert pressure on the operations and growth of enterprises. Difficult operating conditions and threats from the competitive environment force organizational behavior (Bao, Chen, & Zhou, 2012; Lyu et. al. 2020), which contributes to market adaptation. This includes certain behavior in the field of learning and knowledge management (KM). Therefore, according to Brzostek (2015), enterprises, among others, generate the available knowledge from the compa`ny's external environment, systematically collect and optimally use knowledge to achieve a competitive advantage, disseminate it among employees, enrich knowledge through its integration and dissemination, and measure the effects resulting from the operations using IT tools. The KM process conceptualization allows the creation of formal mechanisms ensuring the capture, analysis, interpretation, and integration of various types of knowledge, both marketing, technical, and expertise in companies. These mechanisms are complementary to the organization inter-functional coordination; however, it should be pinpointed that knowledge integration (KI) reflects the structures and processes through which different sources of knowledge become integrated to implement common objectives and tasks undertaken within the company's operations. It becomes particularly important in the context of enterprise innovativeness (Ode, & Ayavoo, 2020; De Luca, & Atuahene-Gima, 2007). Therefore, after Caridi-Zahavi, Carmeli and Arazy (2016), it can be indicated that KI is the ability to manage and use the existing and newly acquired knowledge in enterprises. As the company's key ability, KI allows enterprises to acquire, share and use knowledge (Eslami, Lakemond, & Brusoni, 2018), and these activities are a prerequisite for achieving a market advantage.

2.2 Innovativeness of Enterprises

While referring to the previous research, it is assumed that various types of innovation require various sources of knowledge (Snihur, & Wiklund, 2019) and different KM operations (Lyu et al. 2020). Depending on the possessed organizational skills, various activities, including KI, moderate the innovation of products and processes determining enterprise innovativeness (Teece, 2018). Effective organization management depends on innovative activities undertaken, but also on the adopted operation strategy and the possibility of taking risk (Snieska et al. 2020), hence, the company's readiness to deliberately accept risk while taking advantage of innovative opportunities. Therefore, the adopted organizational behavior of enterprises, no organizational rigidity, determine the method of processing and using knowledge in enterprises (Choo, 2013) and its innovation level (Chirico, & Salvato, 2008). Dealing with unpredictable actions and accidental events is characteristic of the innovative environment, in which the change and implemented innovation are essential operations, also in the process of the organizational management function. As indicated by Jensen et al. (2007), the most successful companies in terms of product and process innovation are those the organizational structures of which supports knowledge development through formal research and development processes and expansion of knowledge resources based on experience, practice and interaction between employees, customers, and suppliers. Therefore, more flexible and agile structures are required, which enable interaction and communication between employees, with no rigidly defined functional areas, but with functional integration instead. Such a structure of enterprises open to changes will allow for the development of knowledge based on practical experiences and interactions, consequently using innovative organizational skills (Jensen, et al. 2007).

2.3 The Impact of the Capability to Integrate Knowledge on the Innovativeness of Enterprises

The literature review indicates there are formal relationships between the organization source of knowledge and its scope and area in enterprises, as well as organizational skills, both internal and external, and the level of enterprise innovativeness (Zahra, Ireland, & Hitt, 2000; Zahra, & Nielsen, 2002), where the company's KI is the moderator. The cooperation between employees, also consisting in the exchange of knowledge enables innovation. This happens by recombining appropriate resources to produce innovative solutions (Nerkar, & Roberts, 2004). Consistency between employees and their KI positively influences the development of new products (Guler, & Nerkar, 2012; Nguyen, et al. 2018).

Moreover, De Luca and Atuahene-Gima (2007) indicated that the KI process moderates the relationships between the dimensions of market knowledge and an innovative product (Ode, & Ayavoo, 2020; Atuahene-Gima, Slater, & Olson, 2005). Therefore, an attempt was made to identify the capabilities in the area of knowledge integration that moderate the level of innovation of an enterprises. For the purposes of the study, the following research hypothesis was adopted H1: The capabilities of the members of the organization in the area of knowledge integration have a positive impact on the innovativeness of enterprises.

3. Methodology and Characteristics of the Research Group

The aim of the article is to identify the capability to integrate knowledge influencing the innovativeness of enterprises The objective was accomplished based on the own research carried out on a group of 355 companies operating in the south-central Poland. The pilot study was conducted prior to the actual research in 2021 on a group of 20 targeted enterprises operating in the south-central Poland. The actual research was conducted at the turn of 2021 and 2022. The study used the author's survey questionnaire, consisting of closed questions and using a 5-point Likert scale based on (Sheng, Zhou, & Li, 2011; Peng, & Luo, 2000), in which the respondents evaluated the phenomenon. The paper-based questionnaire was completed by the surveyed enterprise managers/owners. The participation to the survey was anonymous.

To assess the KI level, the scale by Carlile (2004) was applied, relating to the standard for the communication of the company's staff to understand roles, responsibilities and time needed to implement new projects, common processes required to perform tasks and commonly interpret organizational principles as well as the KI assessment scale by Caridi-Zahav, Carmeli and Arazy (2016) and Lyu et al. (2022), indicating that KI among the company's employees enables the implementation of new initiatives by using internal and external knowledge jointly for new projects and innovative solutions (Ekemen, & Şeşen, 2020). The scale thus created consisted of six items, measuring KI level on a 5-point scale:

KI_1 Employees in company are capable of applying their expertise to bring new initiatives to fruition,
KI_2 Employees in company are capable of integrating the external knowledge with their existing knowledge,
KI_3 Employees in company are capable of integrating and applying the external knowledge to new projects,
KI_4 Employees of company understand the roles, responsibilities and time needed to complete the task together,
KI_5 Employees have a common understanding of the processes required to complete the task,
KI_6 Employees of company interpret the organizational principles in a similar way.

When assessing the I of enterprises, the scale by Li and Atuahene-Gima (2002) was applied, which requires the respondents to evaluate the statements concerning their company's innovativeness level in relation to the main competitors in the last 3 years. The scale created consisted of five items measuring the company's innovativeness level on a 5-point scale:

I_1 Our company places great emphasis on new product/service development, using vast financial resources.
I_2 Our company has developed a wide range of new products/services.
I_3 Our company has made dramatic changes in the existing products/services.
I_4 Our company has increased the pace of implementation of new products/services to the market.
I_5 Our company has increased overall commitment to new product/service development.

The research tool constructed for the purposes of the quantitative research was subjected to reliability testing. The method of estimating reliability was used, which is the internal validity analysis using the Cronbach's Alpha coefficient, proposed by Taber (2018). The research showed the correct reliability of the variables - the KI capability was 0.913 and the I was 0.889. Therefore, it can be indicated that the constructed research scales meet the criteria and their use in the quantitative research is justified.

In the next step, it was examined if there were statistically significant relationships between the variables and the descriptive statistics were reviewed to assess the bonds between the I variable and the individual scale items measuring the KI level. Following the characterization applying basic descriptive statistics, the normality of their distribution was analyzed using the Shapiro-Wilk test (Razali & Wah, 2011). It was checked if there was a linear relationship between the variables – thus, the Kendall's tau-b correlation index was used (Schober, Boer & Schwarte, 2018), which is a non-parametric equivalent of r-Pearson. The multivariate linear regression analysis using the stepwise method was also conducted. The data model fitting was assessed with the R2 coefficient (Bedyńska & Cypryańska, 2013). The final model was described and, based on the value of the b coefficient (non-

standardized regression coefficient), it was assessed how other predictors in the model predicted enterprise innovativeness.

Table 1: Characteristics of the research sample

Companies' specification	n	%
	355	100
Company age		
up to 1 year	9	2.53
1-5 years	66	18.59
6-10 years	69	19.44
11-20 years	81	22.82
Over 20 years	130	36.62
Employment level in the company (Size of the company)		
0-9 (Micro)	151	42.54
10-49 (Small)	90	25.35
50-249 (Medium-Sized)	51	14.37
250 and more (Large)	63	17.74
Dominant profile of activity		
Trade	92	25.91
Production	80	22.53
Services	183	51.56

The dominant group among the surveyed enterprises were those operating for over 20 years belonging to the micro-enterprise sector, i.e. enterprises employing up to 9 employees, as well as companies providing services (Table 1).

4. Results

The analysis of the research results showed that the average level of selected capability of employees influencing KI in all enterprises is 4.06 on a 5-point scale, and therefore it is relatively high. On the other hand, the average level of innovativeness of the surveyed enterprises is 3.27 on a 5-point Likert scale, which is quite surprising, because in this part of Europe the level of innovativeness of companies is generally low or very low (Community Innovation Survey 2021; Alegre at al. 2013).

Table 2: Descriptive statistics and correlations

	M	SD	I	KI_1	KI_2	KI_3	KI_4	KI_5	KL_6
I	3.27	0.958	1.000						
KI_1	4.06	0.940	0.313*	1.000					
KI_2	4.09	0.868	0.191*	0.464*	1.000				
KI_3	3.93	0.941	0.295*	0.496*	0.555*	1.000			
KI_4	4.12	0.873	0.242*	0.441*	0.434*	0.450*	1.000		
KI_5	4.17	0.837	0.208*	0.424*	0.405*	0.425*	0.625*	1.000	
KI_6	3.97	0.895	0.277*	0.430*	0.398*	0.439*	0.529*	0.573*	1.000

*Kendall's tau-b correlation ($p<0.05$)

In the next stage of the study, it was checked if the general level of enterprise innovativeness was related to the selected capabilities as part of knowledge integration in an enterprises. For this purpose, the correlation analysis was conducted using the Kendall's tau-b coefficient. The conducted analysis showed that all the relationships between the company's KI operations and enterprise innovativeness were found statistically important since p is lower than 0.05 and were positively correlated with I (Table 2).

The multivariate linear regression analysis was conducted using the stepwise method, allowing for examining the significance of the subsequent variable introduced, as well as examining a different ordering of variables in each subsequent step (Montgomery, Peck & Vining 2012). The modeling results after introducing all the variables are shown in Table 3. Eventually, four variables remained in the model, namely KI_1, KI_3, KI_6, KI_2. The data model fitting was assessed with the R2 coefficient, which amounted to 0.2105, thus it can be indicated that four variables entered the model with $p<0.05$, they explain it in 21.05%.

Table 3: Modelling result, final model

	b*	SD with b*	b	SD with b	T (348)	p
Intercept			1.442	0.257	5.61	0.000
KI_1	0.227	0.071	0.231	0.072	3.21	0.001
KI_3	0.265	0.076	0.270	0.077	3.49	0.001
KI_6	0.192	0.075	0.205	0.080	2.55	0.011
KI_2	-0.156	0.073	-0.172	0.081	-2.12	0.034
KI_5	-0.167	0.085	-0.191	0.097	-1.96	0.051
KI_4	0.114	0.085	0.125	0.094	1.34	0.182
Multiple R =0.4588; Multiple R2=0.2105; Adjusted R2=0.1970; F(6,348)= 15.466; p=9.76657576E-16; Standard error of estimation=0.858						

To sum up, one may indicate that the multivariate linear regression analysis using the stepwise method showed that four KI capability remained significant in the final model (Figure 1): employees in the company can apply their expertise to bring new initiatives to fruition; employees in the company can integrate and apply external knowledge to new projects, employees of the company interpret organizational principles in a similar way; employees in the company can integrate external knowledge with their existing knowledge. They explain little over 21.05% of the variance of I of enterprises.

5. Discussions

Research (Enberg, 2012) has shown that in a highly competitive environment, during conscious or unconscious communication between members of an organization, knowledge is transferred through e.g. knowledge integration. The exchange of information, as well as the use of skills and capabilities in an organizational perspective allow for integrating knowledge in order to gain market advantage. The capabilities of individual members of the organization that enable the integration of knowledge turn out to be crucial. The individual abilities of the members of the organization, and not the entire organization, may create favorable conditions for enterprises to integrate knowledge, which, in the conditions of a changing business environment, enables the organization to adapt to the prevailing conditions among competitors (Alexiev, Volberda, & Van den Bosch, 2016; Wang, Chen, & Fang, 2018). The research confirmed the previous study of Eldor (2020) which shows that the capabilities of organization members in the area of integration and use of external knowledge in projects increase the possibilities of knowledge integration. Moreover, the capability of the members of the organization to use professional knowledge in combination with external knowledge has a positive impact on the innovativeness of enterprises. The innovativeness of enterprises is perceived through the prism of development and the pace of introducing new products to the market. The dynamic capability of the organization members - as part of the knowledge integration and the use of external knowledge, which were identified during this research, are confirmed by some international studies (Chen, Damanpour, & Reilly, 2010; Zhao, & Wang, 2020). They emphasized, that the capability of members of the organization to integrate external knowledge with the existing knowledge, which was indicated in the study, is an important condition for shortening the process of introducing new products, and indicating an increase in innovation.

6. Conclusions and limitations

The presented research has allowed to indicate the abilities of the members of the organization influencing the integration of knowledge, which positively moderate the level of innovativeness of Polish enterprises (Figure 1).

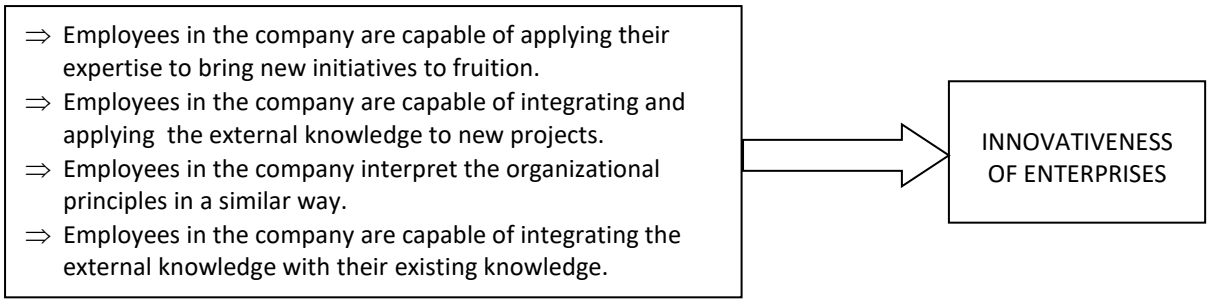


Figure 1: Organizational capability in terms of KI moderating the innovativeness of enterprises

In the case of Polish enterprises, it occurred that not all operations described as those integrating knowledge in the literature create a positive relationship with the innovation level. Furthermore, the identified capability KI describe only 21.5% of the model, thus it can be indicated that other capability may determine enterprise innovativeness. Nevertheless, the above research indicates the direction of the further research, which should focus on other variables moderating enterprise innovativeness.

The conducted research has some constraints. Firstly, they are due to the Covid-19 pandemic, which disrupted the process of entrepreneurship of enterprises and their operations in extremely turbulent and unpredictable conditions of management. Secondly, there is no research in individual sectors, in which the level of enterprise innovativeness varies significantly and is determined by different variables. However, the author is planning to extend the research and conduct it in the identified industries where enterprises wish to increase their innovativeness.

7. Theoretical and practical implications

The research offers several implications for practitioners. Recommendations in the area of activities for the integration of knowledge in enterprises that want to increase their innovativeness should focus on identifying and strengthening the capability of organization members - in certain areas. Managers should undertake initiatives aimed at identifying the abilities of employees implementing joint projects in order to achieve specific results that build the level of innovation in the enterprise. If companies want to increase the innovation of their products, they should strengthen the position of specialists in a given field by motivating and rewarding of own specialists. They should provide trainings in the identification of external information, and the use of external knowledge in the organization's projects.

References

Abubakar, A.M., Elrehail, H., Alatailat, M.A. and Elçi, A. (2019) "Knowledge Management, Decision-Making Style and Organizational Performance", *Journal of Innovation & Knowledge*, Vol 4(2), pp 104-114.

Acharya, Ch., Ojha, D., Gokhale, R. and Patel, P.C. (2022) "Managing Information for Innovation Using Knowledge Integration Capability: The Role of Boundary Spanning Objects", *International Journal of Information Management*, Vol 62, 102438, [online] **https://doi.org/10.1016/j.ijinfomgt.2021.102438**.

Alegre, J., Sengupta, K. and Lapiedra, R. (2013) "Knowledge Management and Innovation Performance in a High-Tech SMEs Industry", *International Small Business Journal*, Vol 31(4), pp 454-470.

Alexiev, A.S., Volberda, H.W., and Van den Bosch, F.A.J. (2016) "Interorganizational collaboration and firm innovativeness: Unpacking the role of the organizational environment", *Journal of Business Research*, Vol. 69(2), pp. 974-984.

Atuahene-Gima, K., Slater, S.F. and Olson, E.M. (2005) "The Contingent Value of Responsive and Proactive Market Orientations for Product Innovation", *Journal of Product Innovation Management*, Vol 22, No. 6, pp 464-82.

Bao, Y., Chen, X. and Zhou, K.Z. (2012) "External Learning, Market Dynamics, and Radical Innovation: Evidence from China's High-Tech Firms", *Journal of Business Research*, Vol 65, No. 8, pp 1226–1233.

Bedyńska, S. and Cypryańska, M. (2013) *Statystyczny drogowskaz*, Wydawnictwo Akademickie Sedno, Warszawa.

Brzostek, K. (2015) „Zarządzanie Wiedzą w Aspekcie Orientacji Rynkowej Małych i Średnich Przedsiębiorstw", *Menagement Rorum*, Vol 3, No. 2, pp 9-18.

Caridi-Zahavi, O., Carmeli, A. and Arazy, O. (2016) "The Influence of CEOs' Visionary Innovation Leadership on the Performance of High-Technology Ventures: The Mediating Roles of Connectivity and Knowledge Integration", *Journal of Product Innovation Management*, Vol 33(3), pp 356-376.

Carlile, P.R. (2004) "Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries", *Organization Science*, Vol 15, No. 5, pp 555-568.

Chen, J., Damanpour, F., and Reilly, R.R. (2010), "Understanding antecedents of new product development speed: A meta-analysis, *Journal of Operations Management*, Vol. 28(1), pp. 17-33.

Chirico, F. and Salvato, C. (2008) "Knowledge Integration and Dynamic Organizational Adaptation in Family Firms", *Family Business Review*, Vol 21(2), pp 169-181.

Community Innovation Survey: Latest Results (2021), [online] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210115-2.

De Luca, L.M. and Atuahene-Gima, K. (2007) "Market Knowledge Dimensions and Cross-Functional Collaboration: Examining the Different Routes to Product Innovation Performance", *Journal of Marketing*, Vol 71, pp 95-112.

De Luca, L.M., Verona, G. and Vicari, S. (2010) "Market Orientation and R&D Effectiveness in High-Technology Firms: An Empirical Investigation in the Biotechnology Industry", *Journal of Product Innovation Management*, Vol 27(3), pp 299-320.

Ekemen, M.A. and Şeşen, H. (2020) "Dataset on Social Capital and Knowledge Integration in Project Management", *Data in Brief*, Vol 29, 105233, [online] https://doi.org/10.1016/j.dib.2020.105233.

Eldor, L. (2020) "How collective engagement creates competitive advantage for organizations: A business-level model of shared vision, competitive intensity, and service performance", *Journal of Management Studies*, Vol. 57(2), pp. 177-209.
Enberg, C. (2012) "Enabling knowledge integration in competitive R&D projects – The management of conflicting logics", *International Journal of Project Management*, Vol. 30, (7), pp. 771-780.
Eslami, M.H., Lakemond, N., and Brusoni, S. (2018) "The Dynamics of Knowledge Integration in Collaborative Product Development: Evidence from the Capital Goods Industry", *Industrial Marketing Management*, Vol 75, pp 146-159.
Guler, I. and Nerkar, A. (2012) "The Impact of Global and Local Cohesion on Innovation in the Pharmaceutical Industry", *Strategic Management Journal*, Vol. 33, No. 5, pp 535–549.
Jensen, M.B., Johnson, B., Lorenz, E. and Lundvall, B.A. (2007) "Forms of Knowledge and Modes of Innovation", *Research Policy*, Vol 36(5), pp 680-693.
Li, H. and Atuahene-Gima, K. (2002) "The Adoption of Agency Business Activity, Product Innovation, and Performance in Chinese Technology Ventures", *Strategic Management Journal*, Vol 23(6), pp 469-490.
Lyu, C., Yang, J., Zhang, F., Teo, T.S. and Guo, W. (2020) "Antecedents and Consequence of Organizational Unlearning: Evidence from Chin", *Industrial Marketing Management*, Vol 84, pp 261-270.
Lyu, C., Zhang, F., Ji, J., Teo, T.S.H, Wang, T. and Liu, Z. (2022) "Competitive Intensity and New Product Development Outcomes: The Roles of Knowledge Integration and Organizational Unlearning", *Journal of Business Research*, Vol 139, pp 121-133
Mehta, A. and Mehta, N. (2018) "Knowledge Integration and Team Effectiveness: A Team Goal Orientation Approach", *Decision Sciences*, Vol 49(3), pp 445-486.
Mohammed, A. (2015) "Knowledge Management Process in Several Organizations: Analytical Study of Modeling and Several Processes", *Procedia Computer Science*, Vol 65, pp 726-733.
Montgomery, D.C., Peck, E.A. and Vining, G.G. (2012) *Introduction to linear regression analysis*, Wiley, New York.
Morgan, T., Anokhin, S.A., Song, Ch. and Chistyakova, N. (2019) "The Role of Customer Participation in Building New Product Development Speed Capabilities in Turbulent Environments", *International Entrepreneurship and Management Journal*, Vol 15, No. 1, pp 119-133.
Nerkar, A. and Roberts, P.W. (2004) "Technological and Product-Market Experience and the Success of New Product Introductions in the Pharmaceutical Industry", *Strategic Management*, [online] **https://doi.org/10.1002/smj.417**.
Nguyen, H.A., Nguyen, H., Nguyen, H.T., Phan, A.C. and Matsui, Y. (2018) "Empirical Study on the Role of Collaboration in New Product Development in Manufacturing Companies", *International Journal for Quality Research*, Vol 12(2), pp 363-384.
Ode, E.R. and Ayavoo R. (2020) "The Mediating Role of Knowledge Application in The Relationship Between Knowledge Management Practices and Firm Innovation", *Journal of Innovation & Knowledge*, Vol 5, No. 3, pp 210-218.
Peng, M.W., and Luo, Y. (2000) "Managerial Ties and Firm Performance in a Transition Economy: The Nature of a Micro-Macro Link", *Academy of Management Journal*, Vol 43, No. 3, pp 486-501.
Probst, G., Raub, S. and Romhardt, K. (2000) *Managing Knowledge: Building Blocks for Success*, Wiley, Chichester.
Razali, N.M., and Wah, Y.B. (2011) „Power comparisons of Shapiro-Wilk , Kolmogorov- Smirnov, Lilliefors and Anderson-Darling tests", *Journal of Statistical Modeling and Analytics*, Vol 2, No. 1, pp 21-33.
Schober, P., Boer, C., and Schwarte, L.A. (2018) "Correlation coefficients: appropriate use and interpretation", *Anesthesia & Analgesia*, Vol 126, No. 5, pp 1763-1768.
Sheng, S., Zhou, K.Z., and Li, J.J. (2011) "The Effects of Business and Political Ties on Firm Performance: Evidence from China", *Journal of Marketing*, Vol 75(1), pp 1-15.
Snieska, V., Navickas, V., Haviernikova, K., Okręglicka, M. and Gajda, W. (2020) "Technical, Information and Innovation Risks of Industry 4.0 in Small and Medium-Sized Enterprises-Case of Slovakia and Poland", *Journal of Business Economics and Management*, Vol 21(5), pp 1269-1284.
Snihur, Y. and Wiklund, J. (2019) "Searching for Innovation: Product, Process, and Business Model Innovations and Search Behavior in Established Firms", *Long Range Planning*, Vol. 52(3), pp 305-325.
Taber, K.S. (2018) "The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education", *Research in Science Education*, Vol 48, pp 1273-1296.
Teece, D.J. (2018) "Business Models and Dynamic Capabilities", *Long Range Planning*, Vol 51, No. 1, pp. 40-49.
Wang, M.C., Chen, P.C., and Fang, S.C. (2018), "A critical view of knowledge networks and innovation performance: The mediation role of firms' knowledge integration capability, *Journal of Business Research*, Vol. 88, pp. 222-233.
Zahra, S.A. and Nielsen, A.P. (2002) "Sources of Capabilities, Integration and Technology Commercialization", *Strategic Management Journal*, Vol 23, No. 5, pp 377-98.
Zahra, S.A., Ireland, R.D. and Hitt, M.A. (2000) "International Expansion by New Venture Firms: International Diversity, Mode of Market Entry, Technological Learning, and Performance*", Academy of Management Journal*, Vol 43, No. 5, pp 925-950.
Zahra, S.A., Neubaum, D.O. and Hayton, J. (2020) "What Do We Know About Knowledge Integration: Fusing Micro-and Macro-Organizational Perspectives", *Academy of Management Annals*, Vol 14, No. 1, pp 160-194.
Zhao, Y. and Wang, X. (2020) "Organisational unlearning, relearning and strategic flexibility: From the perspective of updating routines and knowledge", *Technology Analysis & Strategic Management*, Vol. 32(11), pp. 1251-1263.

The Relationships Between National Intellectual Capital and Foreign Direct Investment

Te-Yi Lin[1] and Yeh-Yun Carol Lin[2]
[1]Department of Business Management, Tatung University, Taipei, Taiwan.
[2]Department of Business Administration, National Chengchi University, Taipei, Taiwan.
tylin@gm.ttu.edu.tw
yehyunln@nccu.edu.tw

Abstract: Foreign direct investment (FDI) has a significant influence on economic development, productivity and competitiveness in host countries. Policymakers are eager to attract FDI. With the importance of the knowledge economy, intellectual capital becomes a critical determinant of FDI location choice. Thus, the study tries to understand the relationships between national intellectual capital (NIC) and FDI in host countries and to compare the differences between developed countries and developing countries. The study hypothesizes that each component of NIC (human capital, market capital, process capital, renewal capital and financial capital) is positively related to FDI. Moreover, in developed countries, human capital and renewal capital has more influence on FDI while in developing countries, market capital and process capital have more influence on FDI. The study uses data from United Nations Conference on Trade and Development (UNCTAD) and Taiwan Intellectual Capital Research Center (TICRC). Because of data availability, the sample needs to be both included in the database of UNCTAD and TICRC during 2001 to 2018. The final sample consists of 59 countries which extends over the five continents. The study proceeds by using panel data, pooling 56 countries for the period from 2001 to 2019 after the Hausman test to determine whether there are fixed effects or random effects. A generalized least square (GLS) model is used to test the hypotheses with country-year data for FDI analysis. The results confirm that each dimension of NIC is positively related to inward FDI, indicating to the importance of NIC to attract inward FDI. In addition, national market capital, national process capital and national renewal capital have more influence on inward FDI in developing countries than in developed countries. Conclusions and practical suggestions are also provided.

Keywords: National intellectual capital. Foreign direct investment. Developed countries. Developing countries

1. Introduction

For two decades, the global growth in foreign direct investment (FDI) has been remarkable (Villaaverde and Maza, 2015). Given FDI´s significant impact on the host country's economic development and competitiveness, it has become a critical element of the economic strategies practiced by most countries (Villaverde and Maza, 2015). Determining the direction and destination of FDI has become a prominent research topic. Several frameworks and theories have been proposed to explain the determinants of FDI locations such as Product Life Cycle (Vernon, 1966), Internalization theory (Buckley & Casson, 1976), Ownership-Location-Internalization paradigm (Dunning, 1980), and institutional approach (North, 1990; Scott, 1995), etc., Based on Kim and Aguilera (2015), two perspectives exist on FDI activities: the economic tradition and institutional perspectives Among these several perspectives or theories, perspective of intellectual capital is neglected.

With the emergence of the knowledge economy, intellectual capital and intangible assets have been recognized as basic sources of wealth and national competitiveness (Lee, Lin and Lin, 2017). National intellectual capital (NIC) is important for creating national productivity and competitiveness (Edvinsson and Bounfour, 2004). It also facilitates economic growth, human development, and quality of life (Lin and Edvinsson, 2011; Lee, Lin and Lin, 2017). Foreign direct investment, which could influence the economy of a nation may be also influenced by the domestic intellectual capital.

Based on the OLI paradigm and institutional approach with the recognized importance of NIC, this study attempts to identify the determinants of FDI location choices from the perspective of NIC. The present study explores the national-level determinants of FDI based on NIC to understand which NIC component will attract FDI to the host country.Therefore, the research question is whether NIC in the host country attracts FDI. We hypothesize that all dimensions of NIC are positively related to FDI in host countries, although each dimension would facilitate FDI through different mechanisms. We hope that this study will provide a reference for policymakers facing fierce global competition. This study had two research questions: 1. Does the NIC in the host country help attract FDI? 2. Does each NIC component have different impacts on FDI in developing and developed countries? The study not only provides theoretical contributions to IB literature and intellectual capital literature by combining NIC and FDI together and finding the relationship between these two concepts

but also provide practical suggestions to policy makers in developing and developed countries by comparing the different effects of NIC in these two types of countries.

2. Literature review

2.1 Locational determinants of FDI location choice

Following Kim and Aguilera (2015), two perspectives exist on FDI activities: the economic tradition and institutional perspectives. The underlying assumption of the economic tradition perspective is that an MNC is eager to maximize returns on its rent-yielding proprietary assets in an imperfect world market (Kim and Aguilera, 2015). Extending internalization theory, the OLI paradigm proposes that MNC's location decisions are intertwined by the ownership, internalization, and location advantages of the host country (Dunning, 1980). According to the OLI paradigm, there are four major motives for FDI: market seeking, natural resource seeking, efficiency seeking, and strategic asset seeking. Market-seeking FDI aims to penetrate host countries' local markets. Natural resource-seeking FDI seeks and secures natural resources such as raw materials. Efficiency-seeking FDI attempts to pursue increasing efficiency, and it goes where the costs of production are lower. Strategic asset-seeking FDI focuses on attaining created assets such as technology, organizational abilities, and market information (Wadhwa and Reddy, 2011).

Another perspective comes from institutional theory. With the rising prominence of emerging economies, the integration of economic and sociological variants has made institutional theory one of the most robust topics in FDI research (Xu and Shenkar, 2002). There are two concepts in the institutional perspective: institutional quality and distance. Institutional theory argues that a nation's institutional framework influences its internal transactions, and thus, affects firm profitability (Khanna and Rivkin, 2001). Superior institutional quality in a country makes FDI more attractive, reduces investment risk, and facilitates processes involved in doing business (Uddin et al., 2019).

2.2 National intellectual capital

National intellectual capital can be divided into five subcategories: human, market, process, renewal, and financial capital (Bontis, 2004; Lee, Lin and Lin, 2017). Human capital represents the knowledge, expertise, competencies, skills, intuition, wisdom, and ability of individuals in the country to achieve national tasks and goals, as well as national cultural values (Bontis, 2004; Lin and Edvinsson, 2011). Market capital refers to the assets in a nation's relationship with international markets (Lin and Edvinsson, 2011) and the capability to provide a desirable, competitive solution to its international clients' needs (Bontis, 2004). As a type of social intelligence in national intra/interrelationships, market capital entails legal relations, market mechanisms, and social networks (Lee, Lin and Lin, 2017). Process capital is the non-human reservoir of knowledge embodied in a nation's technological, information, and communication systems (Bontis, 2004) as well as the cooperation and flow of knowledge requiring structural intellectual assets (Lin and Edvinsson, 2011). Process capital is embedded in a country's science and technology, information, and communication systems that can be made tangible and materialized (Lee, Lin and Lin, 2017). Renewal capital refers to a nation's future intellectual wealth (Bontis, 2004). It is a nation's capability to increase its competitive advantage in future markets (Lin and Edvinsson, 2011). As a country's ability to create, sustain, and develop competitive strength, renewal capital includes investment in novel and innovative entrepreneurial activities (Lee, Lin and Lin, 2017). Financial capital is the financial capability of a nation and indicates its current national wealth (Lee, Lin and Lin, 2017). Financial capital refers to the ability to invest in other forms of capital and to build a foundation for the future.

2.3 Hypothesis development

The relationship between national human capital and FDI has mostly been studied for all NIC dimensions. Human capital is recognized as a significant factor in inward FDI (Villaverde and Maza, 2014). By upgrading the skill level of the workforce, enhanced human resource development makes the investment environment attractive to foreign investors and increases incoming FDI (Majeed and Ahmad, 2008). Thus:
Hypothesis 1: National human capital is positively related to the country's inward FDI.

A desirable environment for international clients is an open culture, a global mindset, and tolerance of diversity (Lee, Lin and Lin, 2017). These factors imply a friendly and welcoming environment for MNCs, help to decrease the liabilities of foreignness, and increase host country attractiveness for MNC investment. Market capital also refers to investment and achievements in foreign relations as well as the social intelligence created by elements such as laws, market institutions, and social networks (Bontis, 2004). A higher level of market capital represents

stronger and more complete social institutions, such as corporate taxes and transparency, all of which decrease the liability of foreignness and facilitate FDI. Thus,
Hypothesis 2: National market capital is positively related to the country's inward FDI.

Process capital refers to organizational processes, activities, and related infrastructure for the creation, sharing, transmission, and dissemination of knowledge to contribute to individual knowledge worker productivity. National process capital can be seen as a country´s infrastructure and institutions that create, share, store, transfer, and disseminate knowledge. From the perspective of institutional theory, which posits that the quality of institutions influences the location of FDI, countries with higher levels of process capital are more likely to become the destination of FDI because of their strong institutions. Thus,
Hypothesis 3: National process capital is positively related to the country's inward FDI.

Renewal capital is defined as a nation's future intellectual wealth and contains capabilities and actual investments in renewal and development to sustain competitive advantages (Bontis, 2004). All of these have drawn the interest of MNCs expanding abroad for resource exploration purposes or strategic asset seeking. Additionally, MNCs from developing countries are more prone to investing abroad for strategic asset-seeking motivations (Li, Li and Shapiro, 2012). They are more likely to be attracted to countries with abundant renewal capital, because of their high level of strategic assets. Thus,
Hypothesis 4: National renewal capital is positively related to the country's inward FDI.

Financial capital refers to a country's financial wealth. A higher level of financial capital represents greater national wealth and purchasing power. According to traditional economics, MNCs tend to be attracted by foreign market size with the motive of market-seeking. Past research provides much evidence about the impact of market seeking and factor endowment, such as the host country´s market size (Emudainohwo, Boateng, Brahma and Ngwu, 2018). Thus,
Hypothesis 5: National Financial capital is positively related to the country's inward FDI.

Most advanced strategic assets and sophisticated customer knowledge are concentrated in developed countries (Dunning, 2006). Thus, developed countries have more strategic assets in terms of human capital and renewel capital. Due to the high quality of human and renewal capital that developed countries usually possess, MNCs are likely to invest in developed countries to seek strategic assets, rather than efficiency- or natural resource-seeking. Makino et al. (2002) propose that newly industrialized economic firms are more likely to invest in developed countries when they seek strategic assets in a host country. Hence, national human capital and renewed capital, which can be viewed as strategic assets in the host country, are especially important for attracting FDI in developed countries. Thus:
Hypothesis 6: National human capital has more influence on FDI in developed countries compared to developing countries.
Hypothesis 7: National renewal capital has more influence on FDI in developed countries compared to developing countries.

MNCs invest in developing countries because of cheap labor and abundant natural resources (Majeed and Ahmand, 2009). The motives for FDI in developing countries tend to be natural resource-seeking or efficiency-seeking. In addition to abundant natural resources and cheap labor, developing countries also share common characteristics, such as poor infrastructure, corruption at all government levels, political instability, government inefficiency, government intervention, and a lack of good governance (https://en.wikipedia.org/wiki/Developing_country). These characteristics not only increase FDI risk, but also increase its transaction costs in developing countries. Thus, MNCs are more likely to invest in host countries with a complete infrastructure, economic openness and freedom. Research also finds that weak infrastructure deters MNCs from investing in developing countries; therefore, developing countries are improving their infrastructure bases to attract FDI (Saini and Singhania, 2018). Hence, national market capital and national process capital, which refer to friendly relationships with international clients and the infrastructure in host countries, are more likely to attract FDI in developing countries. Thus,
Hypothesis 8: National market capital has more influence on FDI in developing countries compared to developed countries.
Hypothesis 9: National process capital has more influence on FDI in developing countries compared to developed countries.

3. Methodology

To examine the hypotheses, this study uses data from the United Nations Conference on Trade and Developmen (UNCTAD) and Taiwan Intellectual Capital Research Center (TICRC) at National Chengchi University, which have been used in several studies (Kostova, Beugelsdijk, Scott, Kunist, Chua., and Essen, 2019; Ståhle, Ståhle and Lin, 2015; Yoo and Reimann, 2017). The advantage of the databases is the wide coverage of FDI flows between country pairs and country-level variables. The study collected data on independent, dependent, and control variables from the two databases. Due to data availability, the sample needs to be included in both the UNCTAD and TICRC databases from 2001 to 2018. The final sample consisted of 59 countries that extend over five continents. This study follows Yoo and Reimann (2017), based on the United Nations classification, to classify developing and developed countries.

The independent variables in this study are the five NIC dimensions: national human capital, national market capital, national process capital, national renewal capital, and national financial capital. Following Ståhle, Ståhle, and Lin (2015), this study measures each capital type using 12 indicators, except for financial capital. Financial capital was measured by gross domestic product per capita (PPP). The TICRC collected panel data from 2001 to 2018 for 59 countries from the World Competitiveness Yearbook and other databases. The period of analysis is 2001-2018 for FDI data, with the independent and control variables lagged by one year.

The dependent variable in this study is the annual inward FDI flow in a specific country, measured in US dollars and obtained from the UNCTAD database. As with Kottaridi, Louloudi and Karkalakos (2019), this study employs the logarithm of FDI inflows to mitigate the effects of skewness on the data.

This study incorporates the log values of population and GDP growth to control for host country market size (Bailey and Li, 2015; Kottaridi, Louloudi and Karkalakos, 2019; Yoo and Reimann, 2017) as well as the ratio of ore and metal exports to the GDP of the host country (Ma, Xu, Zeng and Wang, 2020) to control for the motive of natural resource seeking.

This study uses ordinary least squares (OLS) regression models to test the hypotheses with country-year panel data, pooling 59 countries for the period from 2001 to 2018 after the Hausman test to determine whether there are fixed or random effects. To create interaction terms, the independent variables were mean-centered to avoid multicollinearity (Aiken and West, 1991).

Table 1: Descriptive table

	Mean	**S.D.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
FDI inflow	9.07	1.53								
Population	9.93	1.67	0.49**							
GDP growh	3.22	10.66	0.04	0.07*						
Ores and metals exporting	7.05	10.66	-0.08*	-0.05	0.04					
Human capital	6.71	0.91	0.09**	-0.46**	-0.30**	-0.15**				
Market capital	5.51	1.11	0.27**	-0.40**	0.02	-0.09**	0.57**			
Process capital	6.53	1.24	0.18**	-0.45**	-0.24**	-0.12**	0.83**	0.80**		
Renewal capital	3.95	1.55	0.27**	-0.26**	-0.18**	-0.20**	0.83**	0.74**	0.87**	
Financial capital	8.61	0.63	0.16**	-0.52**	-0.18**	-0.22**	0.68**	0.65**	0.81**	0.66**

Table 2: Regression model of direct effects

	1	**2**	**3**	**4**	**5**	**6**	**7**
Constant	4.77*** (18.87)	-2.22*** (-4.20)	-1.53*** (-4.50)	-2.01*** (-4.92)	1.81*** (6.47)	-12.60*** (-16.26)	-12.57*** (-13.85)
Ln Population	0.44*** (17.82)	0.62*** (24.28)	0.65*** (29.69)	0.67*** (27.79)	0.55*** (24.26)	0.77*** (31.54)	0.81*** (32.07)
GDP growth	-0.02 (-0.49)	0.06*** (4.39)	-0.02† (-1.87)	0.05*** (4.14)	0.03** (2.62)	0.03** (3.00)	0.00 (0.21)
Ores and metals exporting	-0.02* (-2.54)	0.00 (0.22)	-0.00 (-0.17)	0.00*** (0.22)	0.00 (0.93)	0.01*** (3.94)	0.01*** (4.06)
Human capital		0.73*** (14.64)					0.38*** (4.86)

	1	2	3	4	5	6	7
Market capital			0.76*** (23.05)				0.69*** (12.29)
Process capital				0.66*** (19.52)			-0.43*** (-5.19)
Renewal capital					0.44*** (17.34)		-0.05 (-0.96)
Financial Capital						1.61*** (23.22)	1.19*** (12.57)
Adjusted R^2	0.28	0.41	0.54	0.48	0.45	0.54	0.61
F value	19.62***	32.57***	53.08***	43.36***	38.18***	53.60***	61.53***
Max VIF	<2	<2	<2	<2	<2	<2	11.24
t-statistics are in parenthesis; †,*, **, *** Significant at the 0.1, 0.05, 0.01, 0.001							

4. Empirical results

Table 1 shows the descriptive statistics and correlation matrix of control variables, the five dimensions of NIC and the dependent variable, FDI inflow. Table 2 presents the results of OLS regression where FDI inflow is the dependent variable. Model 1 includes only control variables in the regression model, and thus preliminarily tests the effect of control variables on FDI inflow. H1, proposing that national human capital will be positively related to inward FDI, is supported (β=0.734, p<0.001), with an adjusted R2 of 0.412 in Model 2. In Model 3, market capital is positive and significant at the 0.1 percent level (β=0.763, p<0.001)and adjusted R2 is 0.536, thus supporting H2. H3 arguing that national process capital is positively related to inward FDI is supported with β=0.659, p<0.001, and an overall adjusted R2 of 0.484 in Model 4. H4 suggesting that national renewal capital will be positively related to inward FDI is supported in Model 5 with β=0.435, p<0.001. H5 proposing that national financial capital will be positively related to inward FDI is also strongly supported in Model 6 (β=1.606, p<0.001, adjusted R2 =0.538).

Table 3: Regression model of moderating effects

	1	2	3	4
Constant	2.80*** (10.20)	-1.30 (-1.42)	2.22*** (8.60)	3.43*** (13.33)
Ln Population	0.62*** (23.51)	0.69*** (10.89)	0.69*** (27.30)	0.56*** (22.44)
GDP growth	0.05*** (3.85)	0.03*** (3.53)	0.04** (3.07)	0.03* (2.28)
Ores and metals exporting	0.00 (0.29)	0.01* (2.07)	0.00 (0.20)	0.01 (1.45)
Country type	-0.23* (-2.35)	0.50* (2.25)	-0.34*** (-3.82)	-0.07 (-0.79)
Human capital	0.78*** (13.74)			
Market capital		0.48*** (8.21)		
Process capital			0.72*** (19.73)	
Renewal capital				0.46*** (16.81)
HC*Country	-0.21† (-1.95)			
MC*Country		-0.49*** (-4.27)		
PC*Country			-0.360*** (-5.03)	
RC*Country				-0.15* (-2.57)
Adjusted R^2	0.416	0.45	0.50	0.45***
F value	30.497***	31.68***	42.96***	35.46
Max VIF	<2	<2	<2	<2
t-statistics are in parenthesis; †,*, **, *** Significant at the 0.1, 0.05, 0.01, 0.001				

Table 3 shows the moderation effects of each national intellectual capital dimension on inward FDI and tests H6 to H9. H6 suggests that the positive relationship between human capital and inward FDI will be stronger in developed countries than in developing countries. This hypothesis is not supported (β=-0.212, p<0.1), with an adjusted R2 of 0.416 in Model 1. The coefficient is negative but not significant, indicating that human capital may not have significantly different effects on inward FDI in developing countries and developed countries. H7 argues that the positive relationship between renewal capital and inward FDI will be stronger in developed countries than in developing countries. This hypothesis is not supported because the coefficient for the interaction of renewal capital and inward FDI is significant but negative(β=-0.148, p<0.05) in Model 4. H8 predicts that market capital and inward FDI will be stronger in developing countries than in developed countries. This hypothesis is supported (β=-0.492, p<0.001), with an adjusted R2 of 0.452 in Model 2. H9 states that the positive links between process capital and inward FDI will be stronger in developing countries than in developed countries. This hypothesis is supported by the interaction coefficient in Model 3 which is negative and significant (β=-0.359, p<0.001) with an adjusted R2 of 0.504 in Table 3.

5. Discussion and conclusion

5.1 Discussion

The empirical results indicate that human, market, process, and financial capital are all positively related to inward FDI. Not surprisingly, human capital has always been considered a crucial factor in attracting FDI (Kottaridi, Louloudi and Karkalakos, 2019) and our results emphasizes the importance of human capital. Additionally, human capital has a similar influence on inward FDI in both developed and developing countries. Human capital thus plays a crucial role in attracting inward FDI in all countries, and policymakers should emphasize increasing human capital.

Market and process capital have a positive influence on inward FDI. The results confirm the outcomes of several studies that argue that institutions attract inward FDI (such as, Sabir, Rafique and Abbas 2019; Abbas and El Mosallamy, 2016; Saini and Singhania,2018). Moreover, market capital and process capital have more influence on inward FDI in developing countries than in developed countries. MNCs invest in developing countries mostly for large markets and natural resources rather than strategic assets (Saini and Singhania,2018; Majeed and Ahmand, 2008). Compared to developed countries, developing countries with higher market and process capital tend to attract more attention and inward FDI. Therefore, it is important for developing countries to improve these two dimensions of the NIC to gain more inward FDI.

Renewal capital positively influences inward FDI. Interestingly, renewed capital has a greater influence on inward FDI in developing countries than in developed countries. Financial capital also has a positive relationship with inward FDI after controlling for the effects of population and economic growth. MNCs prefer to invest in destinations with large markets and higher potential growth (Li et al., 2018). Countries aiming to gain more inward FDI should increase their GDP and GDP per capita, which represent their national purchasing power.

5.2 Conclusion

This study finds that every dimension of intellectual capital has a positive influence on attracting FDI. Countries aiming to attract more inward FDI should focus on increasing the level of NIC. In addition, developing countries are not only preferred locations for MNC investment, but also have more advantages in increasing national intellectual capital to attract inward FDI. A higher level of NIC has more influence and draws more inward FDI in developing countries than in developed ones. Thus, policymakers in developing countries should emphasize increasing the level of national intellectual capital to attract the attention of MNCs and inward FDI.

This study has limitations that nevertheless provide for follow-up research in certain key directions. First, the measurement of NIC remains inconclusive, and several measurement models have been proposed. Further research should use other measures to capture NIC´s different dimensions. Second, we attempted to reveal the different impacts of each NIC dimension on FDI. There are still some other possible impacts that need to be revealed. Future research should examine the relationship between each dimension and FDI.

References

Abbas, S., and El Mosallamy, D. (2016). “Determinants of FDI Flows to Developing Countries: An Empirical Study on the MENA Region”, Journal of Finance and Economics, Vol. 4, No.1, pp 30-38.

Aiken, L. S., & West, S. G. (1991). Testing and interpreting interactions in multiple regression, Sage, London.

Bailey N. and Li, S. (2015). “Cross-national Distance and FDI: The Moderating Role of Host Country Local Demand”, Journal of International Management, Vol.21, No.4, pp 267-276.
Bontis, N. (2004). “National Intellectual Capital Index: A United Nations initiative for the Arab region”, Journal of Intellectual Capital, Vol.5, No.1, pp 13-39.
Dunning, J. H. (1980). “Toward an Eclectic Theory of International Production: Some Empirical Tests”, Journal of International Business Studies, Vol.11, No.1, pp 9-31.
Dunning, J. H. (2006). “Towards a New Paradigm of Development: Implications for the Determinants of International Business Activity”, Transnational Corporations, Vol.15, No.1, pp 173-227
Edvinsson, L., and Bounfour, A. (2004). “Assessing National and Regional Value Creation”, Measuring Business Excellence, Vol.8, No.1, pp 55-61.
Emudainohwo, O. B., Boateng, A., Brahma, S., and Ngwu, F. (2018).” Analysis of Government Policies, Institutions, and Inward Foreign Direct Investment: Evidence from sub-Saharan Africa”, Thunderbird International Business Review, Vol.60, No.4, pp 523-534.
Khanna, T., and Rivkin, J. W. (2001). “Estimating the Performance Effects of Business Groups in Emerging Markets”, Strategic Management Journal, Vol.22, No.1, pp 45-74.
Kim, J. U., and Aguilera, R.V. (2016). “Foreign Location Choice: Review and Extensions”, International Journal of Management Reviews, Vol.18, No.2, pp 133-159.
Kostova, T., Beugelsdijk, S., Scott, W. R., Kunst, V. E., Chua, C. H., and Essen, M. (2019). “The Construct of Institutional Distance through the Lens of Different Institutional Perspectives: Review, Analysis and Recommendations”, Journal of International Business Studies, Vol.51, No.4, pp 467-497.
Kottaridi, C., Louloudi, K., and Karkalakos, S. (2019). “Human Capital, Skills and Competencies: Varying Effects on Inward FDI in the EU Context”, International Business Review, Vol.28, No.2, pp 375-390.
Lee, I. C., Lin, C. Y. Y., and Lin, T. Y. (2017). “The Creation of National Intellectual Capital from the Perspective of Hofstede’s National Culture”, Journal of Intellectual Capital, Vol.18, No.4, pp 807-831.
Li, J., Li, Y., and Shapiro, D. (2012). “Knowledge Seeking and Outward FDI of Emerging Market Firms: the Moderating Effect of Inward FDI”, Global Strategy Journal, Vol.2, No.4, pp 277-295.
Lin, C. Y. Y., and Edvinsson, L. (2011). National intellectual capital: A comparison of 40 countries. Springer Science and Business Media.
Ma S, Xu X, Zeng Z, Wang L. (2020). “Chinese Industrial Outward FDI Location Choice in ASEAN Countries”, Sustainability, Vol.12, No.2, pp 674
Majeed, M. T., and Ahmand, E. (2008) “Human Capital Development and FDI in Developing Countries”, Journal of Economic Cooperation, Vol.29, No.3, pp 79-104.
Majeed, M. T., and Ahmad, E. (2009). “An Analysis of Host Country Characteristics that Determine FDI in Developing Countries: Recent Panel Data Evidence”, Lahore Journal of Economics, Vol.14, No.2, pp 71-96
Makino, S., Lau, C. M., and Yeh, R. S. (2002). “Asset-exploitation versus Asset-seeking: Implications for Location Choice of Foreign Direct Investment from Newly Industrialized Economies”, Journal of international business studies, Vol.33, No.3, pp 403-421.
Sabir, S., Rafique, A., and Abbas, K. (2019). “Institutions and FDI: Evidence from Developed and Developing Countries”, Financial Innovation, Vol.5, No.1, pp 1-20.
Saini, N. and Singhania, M. (2018). “Determinants of FDI in Developed and Developing Countries: A Quantitative Analysis using GMM”, Journal of Economic Studies, Vol.45, No.2, pp 348-382.
Stahle, P., Stahle, S. and Lin, C.Y.Y. (2015) “Intangibles and National Economic Wealth: A New Perspective on How They are Linked”, Journal of Intellectual capital, Vol.16, No.1, pp 20-57.
Uddin, M., Chowdhury, A., Zafar, S., Shafique, S., and Liu, J. (2019). “Institutional Determinants of Inward FDI: Evidence from Pakistan”, International Business Review, Vol.28, No.2, pp 344-358.
Villaverde, J., and Maza, A. (2015). “The Determinants of Inward Foreign Direct Investment: Evidence from the European Regions”, International Business Review, Vol.24, No.2, pp 209-223.
Wadha, K., and Reddy, S. (2011). “Foreign Direct Investment into Developing Asian Countries: The Role of Market Seeking, Resource Seeking and Efficiency Seeking Factors”, International Journal of Business and Management, Vol.6, No.11, pp 219-226.
Xu, D., and Shenkar, O. (2002). “Institutional Distance and the Multinational Enterprise”, Academy of Management Review, Vol. 27, No.4, pp 608-618.
Yoo, D., and Reimann, F. (2017). “Internationalization of Developing Country Firms into Developed Countries: The Role of Host Country Knowledge-based Assets and IPR Protection in FDI Location Choice”, Journal of International Management, Vol.23, No.3, pp 242-254.

Knowledge Management Challenges in Start-up Companies in China's Great Bay Area

Gang Liu[1], Sabetzadeh Farzad[2], Lengxin Lora Liu[3] and Yixiao Zhao[1]
[1]Business School, Shenzhen Technology University, China
[2]City University of Macau, China
[3]Cheung Kong Graduate School of Business, China
Liugang3@sztu.edu.cn; gang.liu@connect.polyu.hk
farzad@cityu.mo
loraliu1218@hotmail.com
z19926437046@126.com

Abstract: China's Great Bay Area covers Hong Kong S.A.R, Macau S.A.R, Shenzhen, and many other cities in Guangdong Province and is one of China's most economically prosperous areas. Thousands of people start their businesses in this area every year. It is a well-known belief that knowledge management can help business success; however, start-up companies may face many issues in applying knowledge management to achieve their success. Therefore, this study examines the challenges and problems of knowledge management implementation in start-up companies in this region. Conducting a series of semi-structured interviews with owners of start-up companies, this study tries to find several challenges of these companies, such as a lack of knowledge management systems and expertise in the domain. To the best of our knowledge, this is the first study investigating the knowledge management challenges of start-up companies in China's Great Bay Area. It also provides significant managerial implications that can help these companies to embark on the knowledge management journey successfully.

Keywords: knowledge management practices, entrepreneurship, start-up company, small-medium size enterprises

1. Introduction

China's Great Bay Area, which encompasses two special administrative regions of Hong Kong S.A.R, Macau S.A.R, and several important cities and areas such as Shenzhen and Guangzhou in the Guandong Province, is one of China's most economically prosperous areas. It applies regional advantages of Hong Kong S.A.R, Macau S.A.R, and Shenzhen to facilitate the development of other cities in this area. As one of the most economically developed areas globally, millions of entrepreneurs started their businesses in this region in the 1980s, when China initiated an open-door policy. Some have now become leading companies in their industries, such as Huawei, Tencent, and DJI. Table 1 shows the GDP and number of SMEs in China's Great Bay Area.

Table 1: GDP and number of SMEs in China's Great Bay Area

Cities of China's Great Bay Area	GDP 2021(100 million yuan)	Number of SMEs as of 2021
Hong Kong S.A.R,	23748.98	1,375,172
Shenzhen,	30664.85	2,410,484
Macau S.A.R,	1929.27	81,060
Zhuhai,	3881.75	303,482*
Foshan,	12156.54	961,392*
Dongguan,	10855.35	1,144,800*
Zhongshan,	3566.17	215,694
Jiangmen,	3601.28	627,848*
Huizhou,	4977.36	265,387
Zhaoqing,	2649.99	283,663

One of the ever-present concerns is that SMEs are fragile and face many challenges because of their characteristics (Durst & Edvardsson, 2012). The latest Covid-19 pandemic, by and large, has manifested such fragility. The way to survive in an increasingly uncertain environment is a vital issue for many entrepreneurs. It is widely believed that knowledge management (KM) can help an organization to be successful (Inkinen, 2016), and KM is vital for start-up companies to identify their business strategy and success (Chaston, 2012). However, the KM practices of start-up companies remain poorly understood, despite some studies have been carried out on this topic.

It can be found that some studies have investigated KM of new SMEs (Cerchione et al., 2016), KM and entrepreneurs (Maalaoui et al., 2020; Paoloni et al., 2020), or KM and entrepreneurial activities. For example, Li et al. (2020) reported that dynamic capabilities partially mediate the relationship between KM practices and entrepreneurial performance. Similarly, Shuja et al. (2020) found that KM can improve fintech start-ups' dynamic capabilities. In addition, Cardoni et al. (2018) found that the entrepreneur, acting as a knowledge broker, plays a significant role in the knowledge transfer process. Yasir et al. (2017) also argued that if people's entrepreneurial intentions for entrepreneurial behavior are more robust, their entrepreneurial knowledge can contribute more to entrepreneurial activity.

So far, the earlier scholarly works have neglected the challenges and difficulties of SMEs, especially start-up companies in terms of KM implementation. It raises a significant question about the challenges and difficulties of the start-up companies in China's Great Bay Area. How to help these start-up companies in China's Great Bay Area to embark on KM and obtain competitive advantages through KM becomes a critical issue in the context of Covid-19 prevalence. Thus, this study aims to first outline the challenges and problems of the start-up companies regarding KM initiatives, especially in China's Great Bay Area; second, this study is looking to provide some managerial implications for start-up companies to initiate their KM journey.

After introducing this study's objectives and research gaps, a research method is presented in section two. Section three shows findings and section four provides practical implications for these start-ups. Finally, this study concludes with limitations and future directions.

2. Research methods

We adopted a deliberate sampling technique (Patton,1990) to ensure that the selected research objects are start-up companies in China's Great Bay Area. This research adopted a semi-structured interview approach as this method allows interviewers to explore deep insights from interviewees (Saunders et al., 2000). After conducting 15 interviews with the founders or chief executives (CEOs) of these companies , we conducted a deep content analysis (Duriau et al., 2016) to identify the challenges of KM implementation in these organizations. Then, managerial implications are proposed for these start-up companies to embark on KM.

3. Findings and discussion

3.1 Lack of knowledge about KM

Most of the interviewers understand the importance of knowledge in today's business development. Still, more than half of them (8) know little about KM, while others know KM differently. It is not easy for them to take advantage of KM to enhance companies' competitive advantages due to these top executives' lack of understanding of KM. For example, they seldom demonstrate KM leadership styles, so they cannot be considered the role model for KM practitioners. Their subordinates either have the chance to imitate their superior's behavior to facilitate KM for their daily work.

On the other hand, two companies' CEOs fully understand KM and are receptive to KM. Nevertheless, in one case, the CEO of CubeNest (a wireless charger provider), Mr. Zhang, mentioned: "I always support knowledge sharing activities; for example, we even informally discuss our product research and development ideas during lunch. I try to provide an open speech environment to motivate innovations".

3.2 Misperception of KM

Many individuals or SMEs are vaguely familiar with the concept when defining KM. Not only because the KM term may sound new to them, but more importantly, those who claim to know about it are talking about information management (IM). Being misjudged as IM has created new obstacles in adopting KM as they may find it as an outdated topic to pursue or event for the long run.

3.3 Lack of resources

Start-up companies are always SMEs lacking resources, such as funds, talents, and time. Some of the examined companies considered that their priority is development and growth. They have to invest such limited resources in more critical tasks rather than just focus and allocate them to KM. They also thought that KM is a more advanced managerial practice that does not match their current status. As one interviewer said," In the next step when we have enough funds, we will consider expanding the company and carrying out KM".

On the other hand, among these 15 companies, only one company's R&D director is a KM expert with a master's degree in KM. There are no professional KM experts in these companies, bringing more difficulties to KM implementation. In addition, Mr. Zhang mentioned that "As we are a small company, everyone is extremely busy. It's challenging for us to initiate KM".

3.4 Lack of formal procedures

The start-ups are so new that their business procedures are simple and not well established yet, especially for KM. Based on our survey, none of the companies has managed their knowledge at the strategic level. Their KM strategies are not clear. Consequently, they failed to take good advantage of knowledge assets in their companies, and KM did not well support their business. The start-ups also face a higher turnover rate because employees feel unsafe in these companies, which makes these companies even harder to retain and use human capital.

3.5 Fragmented human resource management practices

Most start-ups provide training programs to their employees. Still, few encourage KM activities, such as knowledge sharing through other human resource management (HRM) practices, such as visible or invisible rewards to their employees. For example, knowledge-sharing behavior is not encouraged and rewarded. KM activities, such as knowledge sharing, are not indicators of employees' performance appraisal.

3.6 Lack of KM system

The start-ups highly depend on social instant messaging tools, such as WeChat, and WhatsApp to communicate. They don't have a KM system to support knowledge codification and personalization, which brings high risks of knowledge loss.

4. KM initiative recommendations for start-ups

Although start-ups have many challenges in initiating KM, there is still a way to embark on the KM journey to be successful. First, management teams should be aware of KM and support KM activities (Gang Liu et al., 2022) to foster a knowledge-friendly organizational culture in which knowledge sharing, learning, innovation, mutual trust, and collaboration are highly valued (Liu et al., 2021). Building a knowledge-friendly organizational culture and demonstrating KM leadership (Liu et al., 2018) don't need much monetary investment. Such practices are easier for start-ups because the number of employees is small.

Second, it is also feasible for these new companies to start knowledge-based HRM. Besides training programs, they can provide a bonus to motivate employees for KM activities, such as knowledge sharing and creation. It is also necessary to include KM activities as individual performance appraisal indicators. Third, the companies should apply information technology (IT) to facilitate KM activities. Instant messaging tools can be used for implicit knowledge sharing and free IT platforms, e.g., google drive, can be used for explicit knowledge storage and sharing. Finally, executive teams of start-ups should manage the company's intangible assets at the strategic level (Gang Liu et al., 2020) that established KM strategies can support business strategies (G. Liu et al., 2020).

5. Conclusion

This study analyzed the challenges regarding KM implementation of start-ups in China's Great Bay Area and provided applicable guidelines for these start-ups to initiate KM. Besides significant managerial implications for practitioners, several limitations deserve further investigation. First, as the primary stage of this project, this study only interviewed 15 start-ups. The generalisability of the findings may be limited. Second, the proposed recommendations are based on the work of Liu (2021) without considering the specificity of the start-ups. Therefore, for the second phase of this study, an extensive survey will be carried out. Quasi-experiment for KM initiatives will be conducted to examine the impacts of KM on the success of start-ups. Future research also can explore the implications of background characteristics of the CEOs of these start-ups on KM implementation intention and their company performance by using upper echelons theory (Hambrick & Mason, 1984). It is also interesting to know the KM implementation challenges of start-ups in other countries because KM is also different in various national contexts (G. Liu et al., 2022).

Acknowledgments

The authors appreciate the students from the City University of Macau and the interviewees for completing this study.

References

Cardoni, A., Dumay, J., Palmaccio, M., & Celenza, D. (2018). Knowledge transfer in a start-up craft brewery. Business Process Management Journal, 25(1), 219-243. https://doi.org/10.1108/bpmj-07-2017-0205

Cerchione, R., Esposito, E., & Spadaro, M. R. (2016). A literature review on knowledge management in SMEs. Knowledge Management Research and Practice, 14(2), 169-177. https://doi.org/10.1057/kmrp.2015.12

Chaston, I. (2012). Entrepreneurship and knowledge management in small service-sector firms. The Service Industries Journal, 32(6), 845-860. https://doi.org/10.1080/02642069.2011.559224

Duriau, V. J., Reger, R. K., & Pfarrer, M. D. (2007). A content analysis of the content analysis literature in organization studies: Research themes, data sources, and methodological refinements. Organizational Research Methods, 10(1), 5-34.

Durst, S., & Edvardsson, I. R. (2012). Knowledge management in SMEs: A literature review. Journal of Knowledge Management, 16(6), 879-903. https://doi.org/10.1108/13673271211276173

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. The Academy of Management Review, 9(2), 193-206.

Inkinen, H. (2016). Review of empirical research on knowledge management practices and firm performance. Journal of Knowledge Management, 20(2), 230-257. https://doi.org/10.1108/JKM-09-2015-0336

Maalaoui, A., Le Loarne-Lemaire, S., & Razgallah, M. (2020). Does knowledge management explain the poor growth of social enterprises? Key insights from a systematic literature review on knowledge management and social entrepreneurship. Journal of Knowledge Management, 24(7), 1513-1532. https://doi.org/10.1108/jkm-11-2019-0603

Liu, G., Kianto, A., & Tsui, E. (2020). A comprehensive analysis of the importance of intellectual capital elements to support contemporary developments in Chinese firms. In P. O. de Pablos & L. Edvinsson (Eds.), Intellectual Capital in the Digital Economy (pp. 62-73). Routledge.

Liu, G., Tsui, E., & Kianto, A. (2018, 6 – 7 September). The myth of the presence of chief knowledge officers [Paper presentation]. 19th European Conference on Knowledge Management, Padua, Italy.

Liu, G., Tsui, E., & Kianto, A. (2020, 2–4 December). A meta-analysis study on the relationship between strategic KM and firm performance [Paper presentation]. 21st European Conference on Knowledge Management, Coventry, UK.

Liu, G., Tsui, E., & Kianto, A. (2021). Knowledge-friendly organisational culture and performance: A meta-analysis. Journal of Business Research, 134, 738-753. https://doi.org/10.1016/j.jbusres.2021.05.048

Liu, G., Tsui, E., & Kianto, A. (2022). Revealing deeper relationships between knowledge management leadership and organisational performance: A meta-analytic study. Knowledge Management Research & Practice, 20(2), 251-265. https://doi.org/10.1080/14778238.2021.1970492

Liu, G., Tsui, E., & Kianto, A. (2022). How knowledge management differs across national cultures: A systematic literature review. In J. Chen & I. Nonaka (Eds.), The Routledge Companion to Knowledge Management. 211-235, Routledge. https://doi.org/ DOI: 10.4324/9781003112150-17

Paoloni, M., Coluccia, D., Fontana, S., & Solimene, S. (2020). Knowledge management, intellectual capital and entrepreneurship: A structured literature review. Journal of Knowledge Management, 24(8), 1797-1818. https://doi.org/10.1108/JKM-01-2020-0052

Patton, M.Q. (1990). Qualitative Evaluation and Research Methods, 2nd ed. Sage

Saunders MN, Lewis P and Thornhill A. (2000) Research Methods for Business Students. Pearson Education Limited.

Shuja, A., Yazdani, N., & Shuja, A. (2020). Investigating Resilience and Performance of Emergent Financial Technology Startups Endorsed by Knowledge Management. Journal of Independent Studies & Research: Management & Social Sciences & Economics. 18 (1), 1-13. https://doi.org/10.31384/jisrmsse/2020.18.1.1

A Knowledge Management Model for Internal Auditing

Duc Nghia Mai and Hoang To Loan Nguyen
School of Accounting, University of Economics Ho Chi Minh City (UEH), Ho Chi Minh City, Viet Nam
ducnghia@ueh.edu.vn
loannht@ueh.edu.vn

Abstract: Internal audit is crucial to improve the effectiveness and efficiency of internal controls, governance, and risk management processes in organizations. For an internal audit organization, to benefit from the knowledge of its staff, it is vital to identify the knowledge that is needed to complete quality and efficient internal audits. Knowledge management is a system that is concerned with using to the best advantage knowledge and experience. In internal auditing, knowledge management is increasingly recognized as a tool to effectively manage not only the knowledge of individuals, but also the collective knowledge in the organization. Research on internal audit has appeared since the 1980s and brought many benefits to internal audit activities, but these studies have not explained how knowledge is created during an internal audit. To address the research gap, this study looks into how knowledge is managed in an internal audit process. The applied methodology is to conduct qualitative case study research by using in-depth interviews, observations, and documentary analysis in the internal audit field. Findings from empirical analysis of the case together with the literature review provide useful insights to construct a potential model of knowledge management in internal audit. During an internal audit process, there are three key elements including data, information, and knowledge that internal auditors need to consider. Data is a series of separate observations, measurements, or events in the audited company. Information is the organized data that has been arranged with relevance and purpose for better comprehension of the internal activities. The knowledge generated and applied by internal auditors can be thought of as a collection of specific and broad information sets and experience in similar audit situations. The process of knowledge management in internal audit involves four sub-processes: collecting data, analyzing data to get information, synthesizing information to create knowledge, and improving knowledge by putting knowledge into practice. The research findings imply that the process of internal auditing requires internal auditors to apply not only analysis capacities but also empirical experience in their work. In the internal audit, it requires collaboration from within the auditing organization and from the auditee's sources to enable a valuable outcome for all involved.

Keywords: knowledge management, internal audit, internal control

1. Introduction

Internal auditing is an assurance and consulting activity purported to add value and improve an organization's operations (IIA, 2017). In the model of three lines by IIA (Figure 1), internal audit function serves as the third line of defense in an organization.

Specifically, internal audit function is crucial to improve the effectiveness and efficiency of internal controls, governance, and risk management processes in organizations. For example, Sarbanes – Oxley Act (SOX) in the US require executive boards to issue a report on their internal control systems annually and in order to discharge this obligation, the boards rely on the internal audit function. Section 303A.07 of listing rules on New York Stock Exchange demand all listed firms conduct their internal audit function. In other countries, there are compulsory requirements of internal audit activities for listed or big companies such as in Malaysia in year 2008, Singapore 2012, India 2014 and Vietnam 2019. The importance of internal audit function has been increasingly reported. For a successful activity of internal audit, it is vital to identify the knowledge that is needed to complete quality and efficient internal audit job. Knowledge of internal auditors plays a big role in these duties.

Research on internal audit has appeared since the 1980s and brought many benefits to internal audit activities, however, these studies have not explained how knowledge is created during an internal audit. For example, Messier and Schneider (1988) found that external auditors ranked internal auditors' competence as the most crucial component, followed by their objectivity and work when evaluating the internal audit function.

Mihret and Yismaw (2007) evidenced that internal audit effectiveness is influenced by both internal audit quality and management support meanwhile Arena and Azzone (2007) found the effects of the ratio of internal auditors over employees and the audit committee's involvement in internal audit engagements. In addition, Ma'ayan and Carmeli (2016) proved that the skills, resources, and behaviors of internal auditors support audit learning and assist audited units in improving their efficiency, and effectiveness meanwhile Endaya and Hanefah (2018)

showed that characteristics of internal auditors, the performance of internal audit function and support of other organization members directly affected the effectiveness of internal audit job.

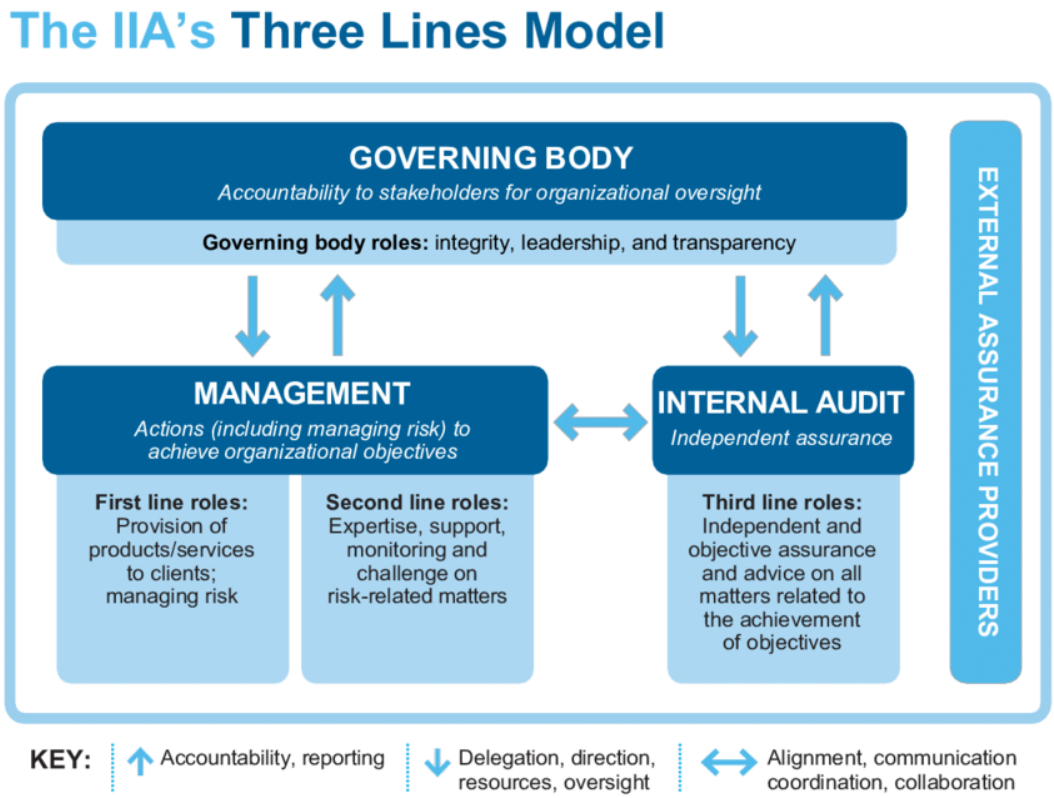


Figure 1: IIA's Three Lines Model *(Source: IIA, 2020)*

Knowledge management (KM) is a system that is concerned with using to the best advantage knowledge and experience. Currently, KM is being discussed as an emerging topic of theoretical development and practical application (Ragab and Arisha, 2013; Pawitra et al., 2019; Duh et al., 2020). In the area of internal auditing, knowledge management is increasingly recognized as a tool to effectively manage not only the knowledge of individuals, but also the collective knowledge in the organization.

However, there are few empirical studies on the relationship between KM and internal audit. Most of the research tried to find out what factors affected the quality of internal audit jobs rather than focusing on how KM has been applied in that internal engagement. For instance, Mihret and Yismaw (2007), Arena and Azzone (2007) found the roles of management support, audit committee's involvement or ratio of internal auditors over employees affecting the internal audit jobs. To address the research gap, this study looks into how knowledge is managed in an internal audit engagement.

2. Literature Review

2.1 Internal audit theory

External audit area has got more attentions from researchers than internal audit (Gendron and Bedard, 2006). However, the external audit practice has not met the expectation of stakeholders in society which is often called the audit expectation gap. The role of internal audits becomes bold as a way of compensating for the inherent weakness of external audits. There is no consensus on the theory of internal audit. Traditionally, internal audit function is viewed as a component of audit committees or corporate governance mechanism. However, when considering the role of internal audits in real life, it seems to have the best relations to agency theory (Adams, 1994) and behavioral theory.

In a context of agency theory, an agency relationship (between the principal and agent) exists when one party (the internal auditor) is obligated to act on behalf of and in the best interests of the other (audit committees or top management) (Jensen and Meckling, 1976). Internal auditors as agents may have different incentives to be biased in their audit conclusions which audit committees or top management depend on. On papers, internal

auditors are assumed to conduct their internal audit job in professional and due care manners. However, there is always a limitation in any conducted activity. For example, lack of training or competence or even negligence of internal auditors could impair the best interests of principals. Meanwhile salaries, and other related expenses of internal audit function (IAF) can be seen as agency costs. With the above discussion, it is clear that there is a reasonable demand to make internal audit activity more effective and efficient for the best interest of audit committees or top management or ultimate interest of whole company. Sarens et al. (2011) found evidence of monitoring role of IAF in corporate governance mechanism and a substitution effect between IAF and independent members of board.

A book named *A Behavioral Theory of the Firm* by Cyert and March (1963) ignited the development of subsequent behavioral theories in different area such as management, political science, psychology, and economics. The essence of behavioral theory stated that an organization is made up of various individuals and groups (stakeholders), each with its own set of objectives and requirements. These objectives may conflict with one another and with the organization's overall objectives. As a result, activities of people and organizations are not always rational as expected although behavioral theory mostly concerned with rationality, searches for problems, solutions and standard operating procedures (Argote and Greve, 2007). Knechel (2000) elaborated that changes of auditing process to more subjective, and risk-based approaches emphasized the role of judgment placed on individual auditors when making audit decisions. As a part of organization, decisions of internal auditors can be affected by many factors such as the amount and timing of information they have, their knowledge, preferences and judgement on the audited subjects. For instance, Brown-Liburd et al. (2015) found behavioral implications of Big Data on auditors. Specifically, information overload, pattern recognition and ambiguity are challenges to individual auditor during the course of information processing and finally affected the audit decision making. Moreover, Sarens et al. (2015) proved the relative magnitude of the IAF is also influenced by a supportive control environment.

In summary, internal audit activities relate to the context of agency theory (internal auditors as agents in agency relationships) and behavioral theory (works of internal audit are affected by many factors inside and outside an organization that internal auditors serve).

2.2 Knowledge management theory

In essence, knowledge management (KM) can be understood as necessary activities to make the best use of knowledge resources. DIKW (data–information–knowledge–wisdom hierarchy) also called the *Knowledge Hierarchy* is a model originally proposed by Ackoff in 1989. It has been widely used in knowledge management literature. Based on the DIKW model, KM can be viewed as a process that transforms data into information, and then into knowledge (see Figure 2).

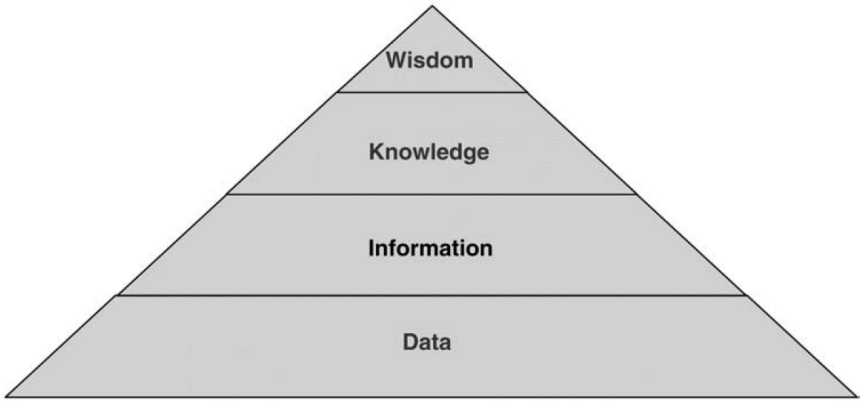


Figure 2: DIKW model (Source: Rowley, 2007)

According to the figure above, data is the entry level of DIKW model and it is the product of observation. Data itself cannot work until it is processed into useable or relevant forms. Information is inferred from data and accommodated in statements on who, what, when and how. Information systems are tools to process, store and retrieve information. Meanwhile, kknowledge referred to know-how, and it turns information into instructions. More importantly, knowledge can be achieved by instructions or experiences. In other words,

knowledge can transfer from one individual to another. And the last, wisdom is the highest level of DIKW model and it is possible to enhance the effective use of knowledge. Wisdom adds value and requires judgment. Thus, the ethical and aesthetic values are unique and personal to individuals.

Characteristics of each level in DIKW model can be explained in more detail in the Figure 3 as follows:

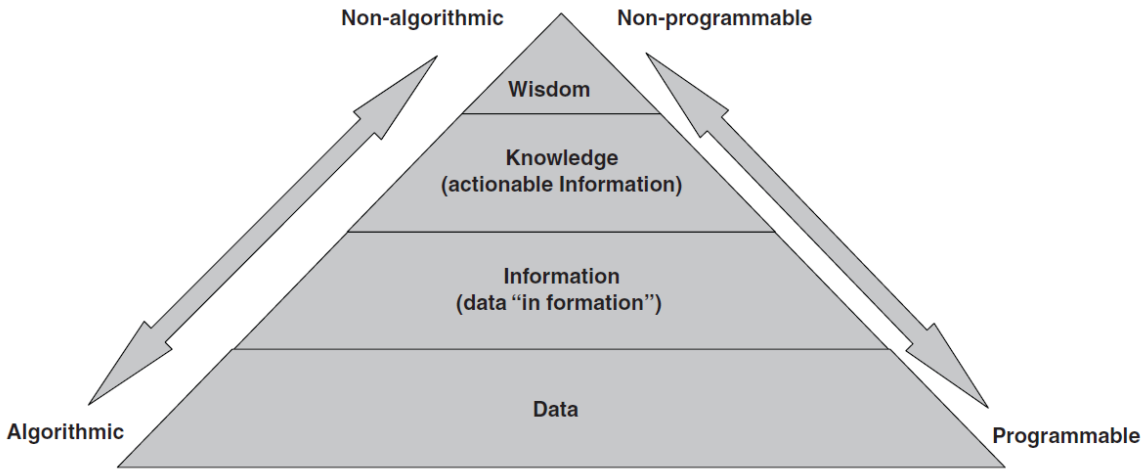


Figure 3: Data, Information and Knowledge *(Source: Awad and Ghaziri, 2004)*

Other authors provided deeper analysis or elaborated further on the work of Ackoff such as Jashapara (2004) or Bellinger et al. (2004), Nguyen et al. (2015), and Nguyen (2021). For example, Jashapara (2004) labeled knowledge level as "actionable information" and suggested that better decision making was a result of actionable information. Equally, Bellinger et al. (2004) emphasized that with the ethical aspect of wisdom, computers cannot process wisdom, thus, wisdom is unique to human beings. Moreover, Nguyen et al. (2015) proposed a framework of knowledge management in external auditing to emphasize the knowledge process in external auditing. Nguyen (2021) also described a wisdom-based model for external auditing. More importantly, Pawitra et al. (2019) indicated that knowledge has played a significant role in the judgments of auditors and implied enhancing knowledge of auditors resulted in better audit judgments.

These above studies imply many theoretical aspects for knowledge management research in internal audit.

2.3 Knowledge management in internal audit

Internal audit function is a knowledge intensive practice because it requires deep understanding of audited units. To achieve the mission of adding values and improving an organization's operations, internal auditors must have insightful knowledge to provide assurance and advices on different aspects of operations. Auditors with better audit knowledge could result in better audit conclusions because they could make more appropriate judgments (Knechel et al., 2013). Furthermore, Duh et al. (2020) evidenced that sharing of knowledge within audit firms increased both audit quality and audit efficiency. However, knowledge management in internal audit appears to be a neglected area of research. There are some possible reasons for this state. The first one relates to internal characteristics of an internal audit job. In any organization, internal audit department (function) is an independent unit of all the remaining. No one knows exactly how knowledge of internal auditors is created, shared, stored or enriched. Thus, aactivities of internal audit department (training, coaching, work procedure setting…) have been quite isolated from the rest of an organization. The second reason is that scope and objectives of internal audit engagement are so diversified depending on intention of audit committee or top management at each organization.

In current literature, there are some studies on KM in external audit. For example, Nelson (2009) evidenced that expert knowledge and judgment of auditors played significant roles in planning an audit engagement meanwhile Rogers et al. (2017) found that knowledge transfer is vital for improving auditor professional skepticism and, as a result, the accuracy of auditor judgments. Thus, KM in internal audits still needs a lot of research works to explore the way KM can affect the effectiveness and efficiency of internal audit engagements.

3. Research Methodology

In order to address the above research gap in internal audit studies, this research aims to explain the empirical internal audit process by using the viewpoint of knowledge management. The conducted major research question is "how has an internal audit process been performed in practice by a company?". To answer the major research question, we employed a qualitative study to examine the process of internal audit in practice.

The data were collected by interviewing five practicing internal auditors who have long-term experience in the areas of internal auditing, such as working in internal audit departments, performing internal audit projects, consulting for internal audit activities, and so on. All the five interviewees are internal audit managers who have around five to ten years of working experience in the field. The interviews were semi-structured to verify the nature of the research phenomenon. We conducted both face-to-face interviews and online interviews through Zoom video meetings.

To analyze the data collected, interview transcripts were recorded and coded to find out the answer for the major research question. The interview transcripts were analyzed through four steps and supported by MAXQDA 12 software. At first, all the transcripts were thoroughly read as a whole to find out impressive words, actions or processes. Then, all the relevant words, actions and processes were labeled or coded. Next, the important codes were sorted into categories by connecting together based on their meanings. Finally, emerging associated concepts or relationships were identified to describe the tentative framework.

4. Research findings

An internal audit usually is conducted by the company's internal audit department or an outside service provider who could be an external audit team. The interview findings identify that an empirical internal audit process has been performed through four sub-processes including *planning, fieldwork, reporting*, and *following up.* In order to conduct an internal audit engagement, each of the sub-processes has its own specific purposes. They have a logical sequence and findings of a prior sub-process is used to perform a later one.

4.1 Collecting general data in planning for an internal audit

The first sub-process of an internal audit is planning phase. Normally, there are two types of planning in internal audit that include annual planning and engagement planning.

- *Annual plan* is an overall plan for all internal audit activities of the fiscal year. It usually is early prepared from the end of the prior year. In the annual plan, based on the scopes of the businesses and numbers of current internal auditors, the internal audit department has to identify the total internal audit engagements needed to be conducted in the next fiscal year.
- *Engagement plan* relates to specific engagement of internal audit. Each engagement plan is defined by a particular objective of internal audit activities. For example, during an interview with an audit manager, he described that: "*internal audit could be conducted for personal loans, secured or unsecured loan activities, operational audit of branches, and so on*". In accordance with the risk assessments of the internal audit department and the directions of the board of directors, engagement plans are selected.

In the planning phase, the internal audit team aims to obtain background information about the specific audit engagement. The overall data of the audit engagement shall be collected. For instance, if the internal audit is a compliance audit, the applicable laws and regulations, relevant policies, and control procedures will be obtained. In more detail, another internal audit manager explained that "*if the audit relates to personal loans, all relevant information of the loan activities will be collected, such as loan contract, loan agreements, debt-age rating of the loan, debt payment status, list of collateral assets (if any) and so on*".

After collecting all the necessary data, the audit team will analyze the preliminary data to assess the risk. Each audit engagement has a risk assessment in order to determine which areas with higher risks should be focused on in the audit. According to the results of the risk assessment, the audit manager prepares the audit schedule, allocate the audit staffs, arrange to meet the client and design the audit program.

4.2 Analyzing data in fieldwork to discover audit findings as meaningful information

The audit fieldwork is the second phase of an internal audit engagement when the allocated internal audit team visit their client's offices to conduct the prepared internal audit plans. Usually, the audit team starts the audit

by arranging a kick-off meeting with the clients to discuss the audit scope and the audit schedule. In this meeting, the audit clients could share their thoughts and concerns about the audit engagement.

During audit fieldwork, the audit team members collect more empirical data about the engagement. For example, an internal audit manager highlighted that *"they can interview their clients about business activities, have site-observations, obtain internal documents, review documents, and perform audit tests*". The major purpose of the fieldwork is to examine the problems in internal control activities, for example accounting errors, control weaknesses, asset misappropriations, or fraudulent operations. For instance, an interviewee described that "*during the audit fieldwork of an internal audit for a personal loan, the in-charged audit team discovers that the loan object is inappropriate and the loan interest rate is improper in accordance with the company's regulations*". In other cases, internal auditors could find the secured assets have disappeared or downgraded the status of those assets.

4.3 Generating knowledge by interactions to build action plan

Reporting is the third phase of an internal audit process. After collecting all the relevant information from the fieldwork, the internal audit team summarizes all their findings, and proposes a tentative action plan. Then, the internal audit team arranges a meeting to announce the results of the audit findings with the client. In the meeting, all the audit findings, client feedbacks, suggestions, and discussions are recorded in minutes.

- Next, based on the results of the meeting, a preliminary internal audit report is drafted. There are some adjustments during the meeting, the content of the preliminary report may be different from the content of the early audit findings.
- Later, the preliminary report is reviewed by the head of the internal audit department or the manager of the internal audit team. From there, the main auditor (in the IA team) will make an official report and send it to the Board of Directors and Supervisory Board. The Board of Directors and the Supervisory Board will then give opinions and agree on the issues in the official report and then send it to the relevant departments. The result of the report is an action plan that is suggested in the preliminary report.

4.4 Putting action plan into practice to revise action plan

After the reporting, the follow-up is a critical step to consider whether the action plan is performed appropriately or not. For example, an internal audit manager stated that *"the following-up sub-process is important and meaningful for future improvement. Usually, internal auditors consider the implementation of action plan and revise it if necessary."*

In more detail, a follow up sub-process aims to attain these objectives:

- To ensure the proposed audit findings have been corrected, follow-up is performed after one month to one year of the internal audit. The follow-up phase possibly includes some procedures audit fieldwork, such as reviewing new processes or testing documents.
- According to the recommendations of the official report, each department or branch will implement the recommendation of the action plan. Usually, there is an auditor who keeps track of the issues that need to be followed up for an internal audit engagement.
- The follow-up activities have specific deadlines. When the deadlines are over, the follow-up auditor will send a report on the follow-up results to the head of internal audit department to see if the problem is clear.

5. Potential framework and discussions

According to the research findings, this study proposes a potential framework to explain an empirical internal audit process as follows:

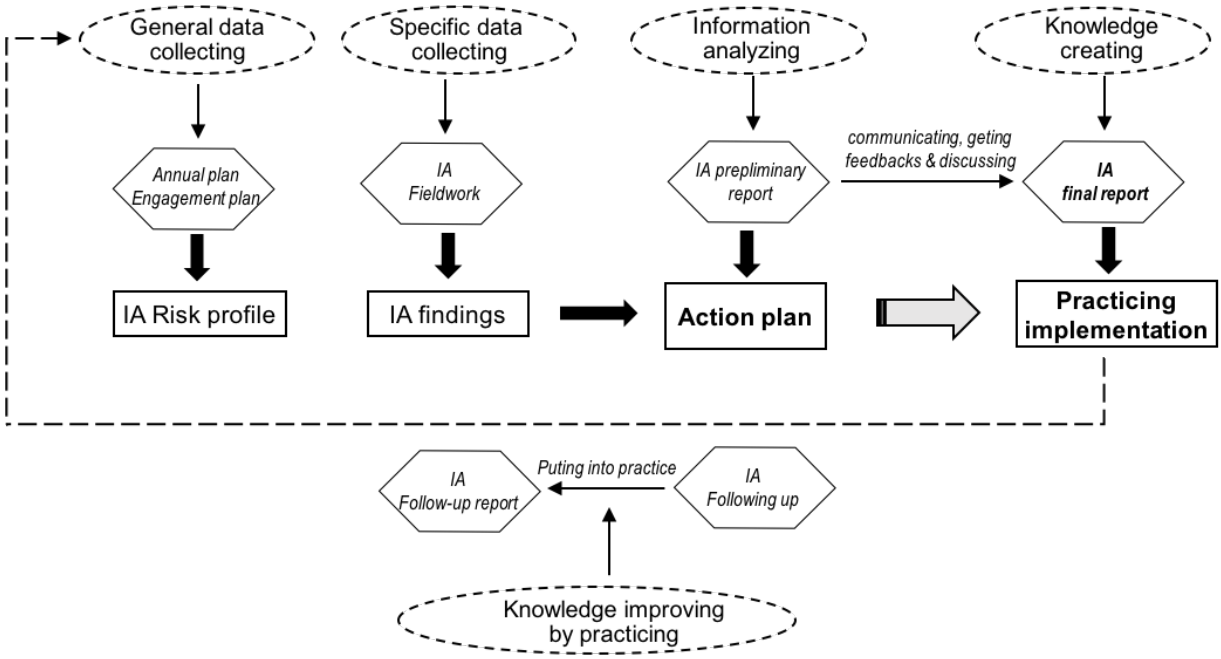


Figure 4: Knowledge Management Process in Internal Audit

The research findings from the interviews, coding results and literature implications suggest us to build a potential theoretical framework of knowledge management in internal audit as presented in Figure 4. Using the knowledge management viewpoint, the framework explains how an empirical internal audit is performed by internal audit team.

The framework, including five steps, describes how: data of internal audit is collected, information is created by analyzing to examine audit findings, knowledge is generated by communications in form of an action plan, and knowledge is revised by putting it into practice.

- The first step of an internal audit starts by collecting general data such as scopes of the businesses, internal audit objectives, number of current internal auditors to prepare an overall plan.
- Then, when the objectives of all internal audit engagements are clearly defined, the in-charged internal auditor for particular engagements continues collecting necessary data for their engagement. In this step, the data is more specific and relevant to the being audited engagement such as background information, relevant policies, internal controls, risk profiles and so on. In the first two steps, data is collected as a series of separate observations, measurements, or events in the audited company.
- In the third phase, all the above data is analyzed to create new findings of the internal audit engagement. This phase aims to create new information from the collected empirical data. Newly created information involves all discovered issues in the internal audit such as accounting errors, control weaknesses, asset misappropriations, or fraudulent operations. In this analyzing step, information is organized and arranged with relevance and purposes for examining new audit findings.
- Next, new information needs to be communicated with the audited company. Through the process of communicating, getting feedback and negotiating about the audit findings, details of potential actions are decided. In this phase, knowledge is generated in form of a final action plan for the internal audit engagement.
- Finally, the action plan is put into practice to justify and revise the action plan if necessary. This phase relates to following-up activities when final action plan is conducted in real life context.

During the above internal audit process, individual auditors contribute their knowledge to build the action plan for particular audit findings. In reality, the interviewed auditors said that they did not be aware of KM application but they did understand that they must use their knowledge and experience to develop the action plan. Then, after each audit engagement, they can memorize that experience and applied to a similar situation in the next audit job. In other words, their understanding and experience have been enriched after each engagement. However, the kind of knowledge that individual auditor learnt can be classified as tacit knowledge because it

has been done on individual base with different extents. The collaboration inside and outside the auditing department created explicit knowledge that all auditors can learn collectively.

The research findings imply that the process of internal auditing required internal auditors to apply not only analysis capacities but also empirical experience in their work. In the internal audit, it requires collaboration from within the auditing organization and from the auditee's sources to enable a valuable outcome for all involved.

6. Conclusions, limitations and suggestions for future research

The paper sought to answer the main research question by proposing the model of knowledge management in internal audit based on an empirical case study. This model possibly sheds more light on the way KM has been created and managed in the area of internal audit. The research findings imply that the process of internal auditing required internal auditors to apply not only knowledge but also professional judgments in their work. In addition, for a success of an internal audit engagement, it requires collaboration from within the auditing department and from the auditee's sources to enable a valuable outcome for all involved.

For practical contributions, this paper recognized the importance of KM in each internal audit activity and it implies the need of formalization of KM in internal audit operation that require the attention of senior management or Supervisory Board.

The numbers of interviews used in this paper are still limited and thus the conclusions could be challenged by other research with larger sample sizes. In addition, all of the internal auditors in this paper have been working in one country (Vietnam) and in the financial service industry, so there could be a concern of geographical area and the business sector.

Future research can be conducted at a larger scale or specialized in each sector such as banking, production or retailing to explore in more depth the way KM has been applied in internal audit activities.

References

Ackoff, R.L. (1989), "From Data to Wisdom", *Journal of Applied Systems Analysis*, Vol. 16, No. 1, pp. 3-9.

Adams, M.B. (1994), "Agency Theory and the Internal Audit", *Managerial Auditing Journal*, Vol. 9 No. 8, pp. 8-12. https://doi.org/10.1108/02686909410071133

Arena, M. and Azzone, G. (2007), "Internal Audit Departments: Adoption and Characteristics in Italian Companies", *International Journal of Auditing,* Vol. 11, No. 2, pp. 91-114.

Argote, L., and Greve, H.R. (2007), "A Behavioral Theory of the Firm: 40 Years and Counting: Introduction and Impact", *Organization Science*, Vol. 18, No. 3, pp. 337–349. http://www.jstor.org/stable/25146105

Awad, E.M and Ghaziri, H.M (2004), *Knowledge Management*, Pearson Education International, Upper Saddle River, NJ.

Bellinger, G., Castro, D., and Mills, A. (2004), "Data, information, knowledge, and wisdom". Available at: https://www.systems-thinking.org/dikw/dikw.htm (accessed March 2022).

Brown-Liburd, Helen & Issa, Hussein & Lombardi, Danielle. (2015). Behavioral Implications of Big Data's Impact on Audit Judgment and Decision Making and Future Research Directions. *Accounting Horizons*. 29. 150119134654004. 10.2308/acch-51023.

Cyert, R.M., and March, J.G. (1963), *A behavioral theory of the firm*, Vol. 2, No. 4, pp. 169-187.

Endaya, K. and Hanefah, M. (2018), "Internal Audit Effectiveness: An Approach Proposition to Develop the Theoretical Framework", *Research Journal of Finance and Accounting*, Vol. 4, No. 10, pp. 92-102.

Duh, Rong-Ruey and Knechel, Warren Robert and Lin, Ching-Chieh, The Effects of Audit Firms' Knowledge Sharing on Audit Quality and Efficiency (2020). Auditing: A Journal of Practice & Theory, 39(2), 51-79. https://doi.org/10.2308/ajpt-52597, The University of Auckland Business School Research Paper Series, Available at SSRN: https://ssrn.com/abstract=4029188

Gendron, Y. and Bedard, J. (2006), "On the Constitution of Audit Committee Effectiveness", *Accounting, Organizations and Society,* Vol. 31, No. 3, pp. 211-239.

Institute of Internal Auditors (IIA), (2017) Available at: https://global.theiia.org/about/about-internal-auditing/pages/about-internal-auditing.aspx

Jashapara, A. (2004), *Knowledge management: An integrated approach*, Pearson Education.

Jensen, M.C. and Meckling, W.H. (1976), "Theory of the firm: Managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, Vol. 3, pp. 305-360.

Knechel, W. Robert; Behavioral Research in Auditing and Its Impact on Audit Education. Issues in Accounting Education 1 November 2000; 15 (4): 695–712. doi: https://doi.org/10.2308/iace.2000.15.4.695

Knechel, Warren Robert and Krishnan, Gopal and Pevzner, Mikhail and Bhaskar, Lori Shefchik and Velury, Uma, Audit Quality: Insights from the Academic Literature (January 1, 2013). *Auditing: A Journal of Practice & Theory*, 32(1), February 2013, Available at SSRN: https://ssrn.com/abstract=2040754 or http://dx.doi.org/10.2139/ssrn.2040754.

Ma'ayan, Y. and Carmeli, A. (2016), "Internal Audits as a Source of Ethical Behavior, Efficiency, and Effectiveness in Work Units", *Journal Business Ethics,* Vol. 137, pp. 347–363. https://doi.org/10.1007/s10551-015-2561-0

Messier, W.F. and Schneider, A. (1988), "A Hierarchical Approach to the External Auditor's Evaluation of the Internal Auditing Function", *Contemporary Accounting Research,* Vol. 4, No. 2, pp. 337-353.

Mihret, D.G. and Yismaw, A.W. (2007), "Internal Audit Effectiveness: An Ethiopian Public Sector Case Study", *Managerial Auditing Journal,* Vol. 22, No. 5, pp. 470-484.

Nelson, M.W. (2009), "A Model and Literature Review of Professional Skepticism in Auditing", *Auditing: A Journal of Practice and Theory,* Vol. 28, No. 2, pp. 1-34, Johnson School Research Paper Series No. 02-2011, Available at SSRN: https://ssrn.com/abstract=1735435

Nguyen, H.T.L., Umemoto, K., Kohda, Y., and Blake, J. (2015, September), "Knowledge management in auditing: a case study in Vietnam", In the proceedings of European Conference on Knowledge Management (ECKM) (p. 571). Academic Conferences International Limited.

Nguyen, H.T.L. (2021), "A conceptual framework for wisdom-based decision-making process in audit profession", *Library Hi Tech*.

Pawitra, D. A. K., & Suhartini, D. (2019). The influence of individual behavioral aspects toward audit judgment: the mediating role of self-efficacy. Journal of Economics, Business, & Accountancy Ventura, 22(2), 264-273.

Ragab, M. and Arisha, A. (2013) "Knowledge Management and Measurement: A Critical Review", Journal of Knowledge Management, Vol. 17, No. 6, pp. 873-901.

Rodgers, W., Mubako, G., & Hall, L.L. (2017). Knowledge management: The effect of knowledge transfer on professional skepticism in audit engagement planning. *Comput. Hum. Behav*., 70, 564-574.

Rowley, J.E. (2007), "The Wisdom Hierarchy: Representations of the DIKW Hierarchy", *Journal of information science*, Vol. 33, No. 2, pp. 163-180.

Sarens, G. and Abdolmohammadi, M.J. (2011), Monitoring Effects of the Internal Audit Function: Agency Theory versus other Explanatory Variables. *International Journal of Auditing*, 15: 1-20. https://doi.org/10.1111/j.1099-1123.2010.00419.x

Factors Influencing Transfer of Learning in the ICT Sector. A Conceptual Framework

Margaret Mangion
Edward de Bono Institute for Creative Thinking and Innovation
margaret.mangion@um.edu.mt

Abstract: Learning takes place constantly, including in workplace settings. Exploring which factors may facilitate or hinder the transfer of learning in the workplace may have implications on organisational performance. Following a review of the extant literature exploring factors that impact situated learning, and bi the Situated Learning Transfer Model emerged as a potential tool that may make learning processes more explicit. A qualitative approach using semi-structured interviews with 40 respondents from two ICT companies was used to collect data that would operationalise the Situated Learning Transfer Model. Deductive analysis using four overarching themes categories: (i) respondents' perception of workplace learning, (ii) factors affecting transfer of situated learning at an organisational level will be noted, (iii) individual level in relation to how factors affecting the transfer of situated learning, and (iv) transfer climate was conducted. The findings support the Situated Learning Transfer model and indicate that the workplace is a rich, contextual environment where learning can take place. Factors that affect situated learning may be observed at the organisational and individual level with the support of an adequate transfer climate. The workplace provides a social context where individuals interact and learn from each other. This study focuses on this type of learning that takes place in situ. This paper is a first attempt to operationalise the Situated Learning Transfer Model which gives prominence to learning taking place at the organizational level and at the individual level within the work environment. There is considerable scope for situated learning to be placed at a strategic level to gain leverage and enhance organizational performance.

Keywords: situated learning, learning transfer, workplace learning

1. Introduction

Learning takes place constantly (Tracey et al. 1995) and it is highly contextual and situated within the communities where it evolves through the interactions of members ((Vygotsky, 1962). It may be natural to assume that this happens at the workplace too Eraut (2004) with individuals learning from one another on the job (Brown and Duguid, 1991; Lave and Wenger, 1991). This instigates curiosity about how situational 'cues' (Roullier and Goldstein, 1993) may encourage individuals to apply new learning. In their study, Chiaburu and Marinova (2005), found that the application of new skills was positively correlated with organisational support. All organisations can be learning organisations, however, how individuals learn, the pace and the cost can be differentiated (Mai, 1996). A comparison between the engagement in situations where formal learning is imparted and informal learning situations occur led by Berg and Chyung (2008) found that there are aspects that impinge on the extent of informal learning and its transfer like personality, the work environment, relationship with colleagues and also physical proximity to co-workers.

For firms to improve their effectiveness, learning needs to be at the heart of their operations (Grugulis and Stoyanova, 2005). Informal learning opportunities including situated learning are often overlooked especially when the learning is not deliberate. Informal learning, may be considered important, as researchers see it as a key determinant of organisational success since it takes place in daily working situations (Tjepkema, 2002) without having any clear goals a priori.

2. Workplace learning

For some time now, there has been growing consensus that instability in the modern working environment has become a key ingredient that challenges organisations constantly (Argyris and Schon, 1978) leading to VUCA circumstances. In this view, the importance of treating learning as an ongoing process becomes increasingly emphasised. The unstable conditions in which many businesses now operate add a tangible context to justify the need to leverage internal knowledge that resides within employees.

The workplace offers various learning opportunities (Davies and Easterby-Smith, 1984). Often the learner is unaware of the process of learning itself especially when learning takes place incidentally (Marsick and Watkins, 2001). Workplace learning has also been criticised as 'unstructured', an affirmation that Billet, (2001) discounts, claiming that norms, values and common practices themselves provide a structure for learning experiences. Marsick and Volpe (1999:4) on the other hand claim that the value of informal learning is due to it being

'predominantly unstructured, experiential and non-institutional'. The cultural and structural characteristics of the organisation may therefore shape the 'learning landscape' and affect the effectiveness of the application of informal learning. Lave, (1990) refers to structure as the 'learning curriculum', emphasising the difference from a 'teaching curriculum', as learning takes place in a social context through engagement and co-participation in real activities with other members of the workplace community. In this research the curriculum refers to the structure of learning opportunities in situated instances. Gherardi et al (1998) introduce the concept of the 'situated curriculum' which is embedded in the habits and traditions of the community. The focus of this study lies in the value of the often-neglected aspects of the transfer of informal learning within the workplace under situated conditions. The 'situated curriculum' (Gherardi et al., 1998) could emerge as an important factor in the process of the transfer of such learning.

2.1 Learning in the workplace

Models of informal learning abound in the literature. Researchers explored how learning is manifested from different points of view in an effort to improve the success rate of these instances. When moving away from formal structures, a predominance of learning from experience can be observed in the literature (Boud and Walker, 1990; Davies and Easterby-Smith, 1984; Kolb, 1984) particularly due to the unstructured nature of learning events that take place in the workplace. Experiential learning has been documented as happenings emerging from specific events or stages that contribute to a process within which the acquisition of knowledge takes place (Kolb, 1984; Mc Call, Lombardo and Morrison, 1988). These events provide adequate grounds from which 'lessons' are learned as the learner engages with the experience from one stage to the next. Exploring distinct stages of (i) concrete experience, (ii) reflective observation, (iii) abstract conceptualisation, and finally (iv) active experimentation, Kolb's experiential learning model in particular instils an element of reflexivity between one stage and the next leading the individual from experience to actual implementation of concepts learned thus potentially facilitating transfer of knowledge acquired under situated conditions. Keeping experience at the heart of the learning process, Davies and Easterby-Smith (1984) spoke to 60 managers about their professional development. It emerged that the subjects learned more when elements of novelty were presented under the guise of challenges or new experiences. The need to change and shift perspectives provided learning instances while leading to professional development. Looking at experience from the point of view of how learning influences career success Hoeksema, van de Vliert and Williams (1997) found that depth of learning is an important factor. They suggested customised development programmes in order to maximise the learning potential. In a collaboration with van der Sluis and Williams, Hoeksama (2002) proceeded to develop an instrument to measure the quality of managerial learning on the job based on four types of work experience that offer opportunities for learning at the individual level. Influenced by Meggison (1996), the authors also looked at learning behaviour that explores how individuals engage with different learning opportunities that they come across at the workplace. Emergent learning which happens spontaneously and planned learning as identified by Megginson (1996) complemented the learning behaviours identified by Hoeksama et al. (2002) in the development of their study.

It must be noted that so far, the models explored are primarily centred around the experience of the individual from a learning opportunity. In their work Nonaka and Takeuchi (1995), first distinguish between two types of knowledge, tacit predominantly difficult to articulate and subjective and explicit, that which is more objective. They go on to elaborate on the theory of organisational knowledge creation assuming that tacit and explicit knowledge interact. The model moves from tacit to explicit knowledge through an interplay of activities, starting with socialisation supporting claims that we learn in social contexts (Vygotsky, 1962). From tacit to explicit knowledge the model moves to externalisation by articulating the tacit knowledge acquired through socialisation into concepts. Remaining in the same mode of knowledge creation combination of knowledge is proposed. This takes place through the organising of the concepts involving explicit knowledge. Closing the process is the internalisation of knowledge which takes the individual forward by embedding the knowledge making it tacit. The authors refer to this phase as the learning by doing stage. It may be noted that this exhaustive model takes a different approach to the ones previously mentioned since it incorporates the build up of how knowledge evolves within the individual while acknowledging the relevance of the social aspect.

2.2 Issues with transfer from workplace learning

Vermeulen (2002) referred to issues of transfer from formal learning interventions claiming that the opportunities to apply new knowledge are not easy to find since organisations might not be flexible enough to allow the time and resources needed to facilitate transfer. Greeno et al (1993) made explicit reference to transfer in situated contexts. Acknowledging the challenges of transfer in such conditions they claimed that if

events are to be transferred, the learning needs to take place in a form that remains constant across situational changes or else allow flexibility and transfer as needed. Workplace characteristics, namely the work environment and contextual characteristics such as the nature of the task and the learning experience, need to be taken into consideration when planning for transfer (Belling et al., 2004). The study focused mainly on experiential learning while concerns related to the transfer of what is learned from a learning opportunity have not been given explicit attention. For the purpose of the current study, the term learning transfer is used interchangeably with the term application referring to application of newly learnt material to workplace situations.

3. Theoretical contribution

With the exception of the models proposed by Hoeksama et al. (2002) and Megginson (1996), most models of experiential learning mentioned imply reference to the acquisition of knowledge that takes place mainly informally, perhaps incidentally (Marsick and Watkins, 2001). Located at the heart of organisations and in social practices, situated learning is highly contextual embedded in experiences made by individuals while interacting together (Lave and Wenger, 1991). Involving knowledge building, it adds relevance to situations that provide learning opportunities McLellan (1996). This paper aims to propose advances on previous studies through the Situated Learning Transfer Model (Fig. 1).

3.1 The Situated Learning Transfer Model

The different components of the model represent factors that possibly impact instances of learning transfer. These instances could take place in communities of practice (Lave and Wenger, 1991) through incidental learning (Marsick and Watkins, 2001) and other events where knowledge is presented to individuals. Ultimately, the model is mobilised through an empirical investigation aiming to confirm factors that facilitate or inhibit transfer of learning. Being aware of these factors, could facilitate the design of processes and tools that enhance transfer of learning in situated conditions reflecting Billet's claim that "learning in any environment will be more or less transferable, depending on the quality of the learning processes experienced" (2001:21).

The proposed model looks at learning broadly in terms of formal and informal instances, assuming that in firms there is normally a combination of both. Often, employees bring with them a level of knowledge that they carry around by default. This knowledge could be in the form of certifications or other educational achievements, formally acquired. Know-how from previous workplaces or mere observations and the acquisition of knowledge from experience also flow into the organisation while individuals build a repertoire of tacit knowledge available in the firm (Smith, 2000). Both formal and informal learning are brought together in the model being proposed as the constituents of the individuals' personal knowledge. Various established models of experiential learning fail to acknowledge this dichotomy of personal knowledge explicitly.

Organisational level effect focuses on factors related to factual occurrences in the organisation as well as abstract facets. Strategies and policies and business goals represent the factual aspects of the organisational level effect. Lim & Johnson (2002) acknowledge the element of 'planning for future use' in their work which is highly relevant in the proposed model. On the other hand, work environment and supervisor/peer support and/or sanction are two factors that address concepts not necessarily related to black on white situations, but in many ways still affect the level of transfer of learning at the workplace and the dissemination of new knowledge. Work environment as a factor can be highly valuable as it is broad enough to consider varying issues. A work environment where communication is valued could prove to be a critical factor for the transfer of learning. The variables identified by Lim and Johnson (2002), such as 'supervisor's interest and involvement', 'planning for future use', and 'difficulty to apply due to organisational problems', were considered in terms of high or low levels of transfer. The concept of Fuller and Unwin's (2003) expansive learning and restrictive learning are also considered within the work environment which is aimed to extract information on the atmosphere at the workplace vis-à-vis the transfer of situated learning, as finding elements promoting an expansive culture is considered critical when highlighting factors affecting the transfer of learning.

The model also features a section dedicated to the individual level effect. This presents another area that appears to be missing form existing models of experiential learning since processes are viewed as relatively automatically without considering ancillary factors. Billet (2001) explored the interdependence of the social practice of work within the workplace and how individual roles come into play. Lave (1996) addresses the issue of multiple differences in how learners shape and use what they know. The proposed model refers to this as imported know-how, made up of cumulative experience that each employee brings to the organisation. The

individuals' know-how accumulated over the years through different experiences could be imported and used in the organisation as is or it may be adapted as a result of creative processes involving creative cognition. Different methods of problem solving or levels of mastering new techniques could potentially be shared at the workplace and advantage could be gained out of such experiences. The personality characteristics of individuals also make a valid ingredient that could potentially influence how and when learning is applied at the workplace (Billet, 2001). Self-efficacy is seen by Kirwan and Birchall (2006) as another major component linked to personality characteristics.

Finally, the proposed model looks at transfer climate. This is the medium that can motivate individuals to transfer new learning into the organisation. This presents a further element that misses explicit reference in existing models of experiential learning that primarily view learning as a process without exploring the external factors that may impinge on the success rate if the same process. It must be noted that transfer climate can also be positive thus facilitating the application of newly learned material or negative thus placing constraints on the process. Instances of poor transfer climates, risk making the work environment as non-conducive for the application of new learning. Brinkerhoff and Montesino (1995) reported lower levels of transfer where the supervisor had fewer interventions with workers, thus not providing a conducive learning transfer climate.

To summarise, building on previous work by established scholars, the Situated Learning Transfer Model aims develop a clearer understanding of the factors that may influence the application of situated and learning in the workplace through contextual elements at individual and organisational levels. model assumes that the criteria mentioned above influence the transfer climate within the organisation.

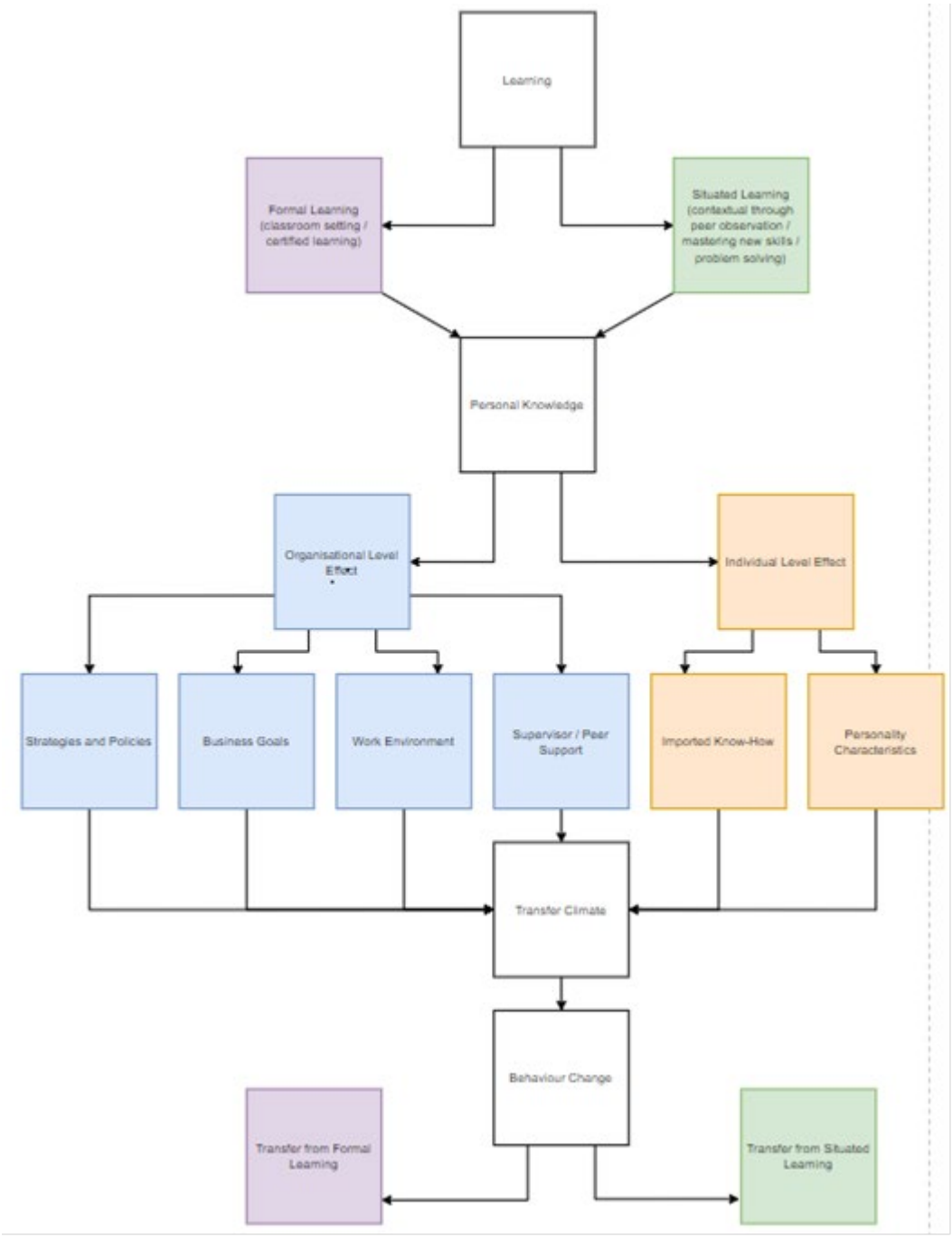


Figure 1. Situated Learning Transfer Model

4. The current study.

To validate the factors identified in the Situated Learning Transfer Model, a deductive study was designed to explore the following research questions:

1. How do factors at the organisational-level influence transfer of knowledge in organisations?
2. How do factors at the individual-level influence transfer of knowledge in organisations?
3. Which factors emerge as determinants of the transfer climate that may facilitate transfer from situated learning in organisations?

5. Method

5.1 Research Design

Adopting a deductive approach, a qualitative design was identified as suitable this study since it provides the opportunity to explore data in more depth and detail. Interviews offer features that enable the researcher to

engage with the process of data collection by taking note of non-verbal responses and through the possibility to clarify any misunderstandings instantly (Patton, 1990). More specifically, semi-structured interviews were conducted. This method gives the possibility of a degree of standardization through the interviewing phase while maintaining the possibility to collect data rich in insights, opinions, values and feelings (May, 2001).

5.2 Participants

Two ICT organisations located in Malta (EU) took part in this study. Established in 1996, both research organizations have considerable experience in the field of ICT solutions. Both organisations were founded in the same year and experienced the same economic and social conditions presented on the island. Both organisations fall under the SME category since they both employ less than 250 individuals each.

The sample comprised of 40 participants; 32 males and 8 females with an age range between 18 and 55 years. The participants occupied different roles within the research organisations. This permitted a cross-sectional view of the concepts being explored. Purposive sampling was used to identify two organisations working in the ICT Sector in Malta (EU).

All the relevant ethical principles have been adhered to. To preserve the identity of respondents all responses were pseudonymised.

Table 1 presents the categories of the participants that took part in the study.

Table 1: Categories of respondents

Role	Number of Respondents
Managing Director	2
Manager	6
Team Member	22
Ancillary departments*	10

*Ancillary departments: human resources, marketing, secretarial pool

6. Data Analysis

Semi-structured interviews were conducted with the aim to elicit as much information and detail as possible. Each interview lasted approximately 60 minutes. Directed content analysis (Hsieh and Shannon, 2005) was deemed to be an appropriate method to breakdown the data collected since it is in line with a theory building approach since the current research aims to fill gaps in the existing literature. Directed content analysis was carried out using overarching themes, and themes identified in the Situated Learning Transfer Model as a template. Codes and categories emerging from the data were also used. After transcribing all the data from the semi-structured interviews, the transcript was read multiple times for familiarisation while highlighting instances in the text that stood out as representing the pre-set overarching themes and themes identified in the model. This was followed by allocating codes to the highlighted areas in the transcripts as appropriate. Any recurring themes that emerged that were not explicitly formulated in the model where given a new name. Themes are not fixed. As abstract constructs, they emerge during the research process, (Denzin & Lincoln, 2003) even in deductive approaches. It must be noted that trustworthiness in qualitative research is a way in which researchers make their work noticeable (Lincoln & Guba, 1985). In the current study this was achieved through a reflexive process involving the questioning and reviewing of the process undertaken during the analysis. The entire process was carried out manually.

7. Findings

Through the use of directed content analysis, the aim was to extract evidence from the transcripts to confirm or refute the Situated Learning Transfer Model. Table 2 highlights examples of the overarching themes and themes from the model, together with codes and categories that were identified from the text. A description of the key findings from the study ensues.

7.1 Perception of workplace learning.

Participants used action-oriented vocabulary to express their perceptions of workplace learning and its transfer. The most recurring action words used when referring to learning included: '/share/ or /sharing/, /observation/ or /observing/. Concepts of learning in a social context thus adding to the situativity of the nature of learning in

the workplace were also noted. Instances of situated learning and its transfer were linked to the possibility of having opportunities for trial and error and problem-solving situations on the job.

7.2 Factors affecting transfer of situated learning at the organisational level

This section presents findings related to factors that influence the transfer or situated learning at the organisational level.

7.2.1 Support for learning.

Support emerged as a critical factor. Support through appreciation seems to be valued by employees and is indicative of learning-supportive culture. Feedback is also perceived as an important element of support in view of setting learning opportunities. The lack of support emerged as an important factor impinging on the willingness to apply new learning.

7.2.2 Opportunities for transfer.

Finding opportunities to transfer techniques learned appeared to be a valued feature of situated learning for participants. Responses indicated that project-based tasks brought about openings where individuals could explore and practice their abilities.

Participants referred to the workload and time pressures as limitations that inhibit them from transferring new learning.

7.2.3 The work environment

The work environment provides a multitude of contextual factors that impinge on the possibility of transfer of new learning to the workplace. The social aspect in an environment conducive to learning and the application of what is learned stood out in the elicited responses. Suggesting a work environment in which employees feel valued and confident, responses referred to a 'learning-supportive culture' where an interplay between values, practices and assumptions takes place.

Although most responses provided positive feedback about the work environment, elements of a restrictive learning culture, also emerged. In a particular interview a narrow scope for learning within the job was noticed.

Table 2: Sample themes, codes and categories

Overarching Theme: Learning in the workplace		
Theme: Perceptions of learning from the point of view of respondents.	Code: Sharing	Category: Promoting insight
"...because colleagues will share with you their knowledge and work methodologies", "…sharing of ideas and points of view might help in learning new skills etc.		
	Code: Observation	Category: Promoting insight
"…you can also learn by observing because you will be seeing different people's working methods…"		
	Code: Practice	Category: Promoting insight
Reading about it didn't help me much as actually getting my hands dirty and coding the actual application."		
Overarching Theme: Factors affecting transfer of situated learning at an organisational level		
Theme: The work environment as a learning site	Code: Opportunities	Category: Opportunities to Apply Learning
"…new ideas that are encouraged is the type of code used (and the format with which is written (as long as the code is well documented)) and prioritising issues. Projects are given to us and it is up to us to prioritise them as long as we finish before the deadlines."		
Theme: Support for learning	Code: Instances	Category: Supervisor Support

Overarching Theme: Learning in the workplace		
"I feel that I am always learning something here. I get appreciation on the good things and also criticism which is also appreciated to help you improve your skills."		
Theme: Opportunities to Apply Learning in the Organisation	Code: Opportunity	Category: Experimentation
"…By giving you jobs which aren't of a normal routine or putting you in a situation where you have to use a new approach, like implementing new technology or a new methodology."		
Theme: Opportunities to Apply Learning in the Organisation	Code: Time	Category: Workload
"It (new learning) can't be because the implementation at work is very hard. It's ok to learn but finding the right time to use what is learnt is difficult."		
Overarching Theme: Factors affecting transfer of situated learning at an individual level		
Theme: Imported know-how	Code: Awareness	Category: Skills
"I think that I mostly brought around knowledge about programming, which is a pity given that I have much more knowledge in many other subjects other than computer areas."		
Theme: Sharing of ideas	Code: Interpersonal skills	Category: Individual characteristics
"If the person is shy or has a low self-worth, then his idea will not go far"		
Theme: Personality characteristics	Code: Perception	Category: Individual characteristics
"Being too pushy or too subdued might both fail to successfully implement new ideas. One needs a balance between confidence and diplomacy."		
Theme: Willingness to contribute	Code: Time	Category: Cohesion
"At times when I find a problem, or maybe hear others talking about a problem, I don't always feel like sharing that information. If I tell others, at times it would take much longer to complete the job."		
Overarching Theme: Transfer Climate		
Theme:	Code: Networks	Category: Support
"My colleagues suppor***t*** me by asking questions and offering suggestions."		
Theme:	Code: Culture	Category: Attitude
"Management need to develop a 'can-do' culture but at the same time allow for mistakes to happen and resources (money, time, etc) to be consumed during learning."		
Theme: Communication	Code: Network	Category: Feedback
"We communicate to give feedback all the time. This feedback can be good or not so good. It usually leads to discussions on how we can improve."		

Most responses outlined a positive attitude from management indicating that the allocation of responsibility to staff could foster a conducive environment for learning at the workplace, thus potentially laying the foundations for the successful transfer of situated learning.

7.2.4 Opportunities to Apply Situated Learning.

Participants indicated an empowering mode of work organisation that is conducive to the application of learning. Interviews led to the understanding that 'the opportunity for use' also arises through 'empowerment' or by leaving individuals to come up with their own solutions.

The workplace environment has the potential to undermine as well as support the transfer process. Organisational deterrents for learning and its transfer include lack of time because of job pressures and responsibilities.

7.3 Factors affecting transfer of situated learning at the individual level

This section focuses on the role of the individual in relation to transfer of situated learning.

7.3.1 Imported know-how

Participants were asked to think of what type of know-how they believe to have brought to the firms when they joined. In a broad sense, however, participants tended to make a clear distinction between core technical skills required for the job and soft skills, and they were more inclined to respond in terms of technical skills perhaps due to the nature of their roles in the ICT sector.

7.3.2 Personality characteristics

Previous research hinted at the role of individual agency and personality in the learning and transfer process. The findings confirmed that personality characteristics and their impact on human agency could influence the transfer of learning at the workplace. Participants recognized that in order to implement new knowledge certain qualities were necessary. Although participants appeared to think that "certain personality types", referring to staff members who do not like change, may not openly enjoy learning, positive personality characteristics most frequently used were: /drivers/, /being positive/, /believing/, /risk takers/, /persistence/, /ability to find and use the right channels/, and /trust/ respectively. The responses imply that an outgoing personality and a positive attitude are perceived to be desired personality attributes to implement changes as a result of new learning.

On the basis of these findings one may suggest that the impact of personality characteristics on the application of new learning needs to be recognized so that effective systems are designed to facilitate transfer. Individual personality is seen to be a powerful 'niche' that could be exploited to understand and enhance the transfer of situated learning and its transfer.

7.4 Transfer Climate

Findings from the current study indicate that something akin to a transfer-supporting climate existed in both research organisations. Responses indicate that the climate established in the work environment can support or hinder the transfer of learning. Some responses suggest, that the nature and quality of existing working relationships could also play an important role in the generation and implementation of new learning. A high level of mutual support between co-workers also became apparent. Support networks, facilitative working relationships and constructive feedback arrangements, emerged as potential catalyst for the implementation of new learning.

The findings also show evidence indicating that the climate at the workplace contained aspects that were not so conducive to the of learning transfer. The attitude of managers was seen to be central to the extent of which the workplace provides opportunities to transfer situated learning. The following section explores how communication can be seen as another contextual influence on learning transfer.

8. Discussion

Building on existing experiential learning models (Boud and Walker, 1990; Kolb, 1984; Hoeksama et al, 2011; Megginson, 1996), the current paper sought to identify and confirm a model that identified factors that may influence the transfer of learning. Identified as appropriate to explore theory (Creswell, 2007), a deductive approach was used to analyse the data. Overall, the proposed model has been confirmed through the emerging findings which in turn appear to support previous literature. Instances of incidental learning (Marsik and Watkins, 2001) as well as aspects mentioned in other models including the experiential learning model by Kolb (1984) were observed. Moreover, when looked at globally, the findings also show support for SECI model (Nonaka and Takeuchi 1995) through the interaction with knowledge in the form of a journey that starts with socialisation on the job that eventually leads to the internalisation of concepts. The findings also indicate support for findings by Lim and Johnson, (2002) at the organisational level with direct references made to supervisor support and the search for opportunities for future use. At the individual level, support for work by Kirwan and Birchall (2006) was evident through the descriptions in relation to personality characteristics implying the manifestation of self-efficacy when seeking opportunities to apply new knowledge. Moreover, the individual differences in how learners interpret and choose to apply what they learn clearly reflects the work by Lave

(1996). All these elements appear to impinge on the intent to transfer new knowledge by creating the transfer climate. The findings from the study indicate that there is scope for a learning curriculum (Gherardi et al., 1998) in the workplace to stimulate and enhance learning under situated conditions while raising awareness about the opportunities to transfer the acquired knowledge to daily activities.

Initially, conceptualised as relevant, 'strategies and policies' and 'business goals' within the organisational level effect elements were made redundant since participants did not relate to them nor referred to them during the semi-structured interviews. They only appeared under the disguise of a sense of urgency in the business rather than as a potential learning tool. The data therefore suggests the need for revisions to the model. Confirmatory studies are required to further support the proposed model of situated learning transfer.

9. Limitations

In trying to operationalise the conceptual model, a small-scale study was carried out. Although using a qualitative approach one finds out more about the perceptions of participants, the numbers tend to be small leading to limited scope for generalisation. Moreover, the focus on one sector (IT) is another limitation since behaviour in other sectors may differ.

The study points to new directions for the development of fresh research. It must be noted that although the model was supported by the findings, it can still be considered as parsimonious since dynamics external to the research organisations were not considered in this study. Market forces could provide extensive possibilities for situated learning and its application at the workplace in order to ensure organisational survival.

References

Argyris, C., and Schon, D. (1978) *Organisational learning: A theory of action perspective*. Reading, Mass: Addison Wesley.

Belling, R., James, K. and Ladkin, D. (2004), "Back to the workplace: How organisations can improve their support for management learning and development", *Journal of Management Development*, Vol. 23 No. 3, pp. 234-255.

Berg, S.A. and Chyung, S.Y. (2008) "Factors that influence informal learning in the workplace", *The Journal of Workplace Learning*, Vol.20 No.4, pp 229-244.

Billet, S. 2001: *Learning in the workplace: Strategies for effective practice*. Allen and Unwin Sydney.

Boud, D. & Walker, D. (1990) Making the most of experience. *Studies in Continuing Education*. Vol. 2, No. 2 pp 61-80.

Brinkerhoff, R. O., and Montesino, M. U. (1995) "Partnerships for training transfer: Lessons from a corporate study", *Human Resource Development Quarterly*, Vol. 6 No. 3, pp 263–269.

Brown, J.S. and Duguid, P. (1991) "Organizational learning and communities of practice: toward a unified view of working, learning and innovation". *Organization Science* 2 No.1, pp 40–57.

Cambridge University Press.

Chiaburu, D. S. and Marinova, S. V. (2005) "What predicts skill transfer? An exploratory study of goal orientation, training self-efficacy and organisational supports", *International Journal of Training and Development* Vol.9 pp 110-123.

Creswell, J. W. (2007) *Qualitative inquiry & research design: choosing among five approaches* (3rd ed.). Sage.

Davies, J., & Easterby-Smith, M. (1984) "Learning and developing from managerial work experiences", *Journal of Management Studies*, No.21, pp 169-183.

Denzin, N.K., and Lincoln, Y. (eds) (2003) *Collecting and interpreting qualitative materials*. Sage Publications Inc.

Eraut, M. (2004) *Informal learning in the workplace*. Studies in Continuing Education, 26 No.2, pp 247-273.

Fuller, A. and Unwin, L. (2003) "Learning apprentices in the contemporary UK workplace: Creating and managing expansive and restrictive participation", *Journal of Education and Work.* Vol. 16 No.4, pp 407-426.

Gherardi S., Nicolini D., and Odella F., (1998) "Toward a social understanding of how people learn in organisations", *Management Learning*, Vol. 29 pp 273-97.

Greeno, J. G. (1998) "The situativity of knowing, learning and research". *American Psychologist*, Vol.53 No.1, 5-26.

Grugulis, I. and Stoyanova, D. (2005) Skill and performance. *Paper presented at the International Labour Process Conference*, 21st – 23rd March 2005, University of Strathclyde.

Hoeksema, L., van de Vliert, E, and Williams, R. (1997) "The interplay between learning strategy and organizational structure in predicting career success", *International Journal of Human Resource Management*, Vol. 8 No3, pp 307-327,

Hsieh, H.F. and Shannon, S.E. (2005)" Three approaches to qualitative content analysis", *Qualitative Health Research* 15 No.9 pp 1277–1288

Kirwan, C. and Birchall, D (2006) "Transfer of learning from management development programmes", *International Journal of Training and Development*, Vol.10, No. 4, pp 252 - 268

Kolb, D. (1984) *Experiential learning: experience as the source of learning and development.* New Jersey: Prentice Hall.

Lave, J. (1990) *The culture of acquisition and the practice of understanding*, in Stigler, J.W., Shweder, R.A., Herdt, G. (Eds.), *Cultural Psychology*, Cambridge University Press, Cambridge, pp 259-86.

Lave, J. (1996) Teaching, as learning, in practice, *Mind, culture, and activity,* Vol. 3, No. 3, pp 149-164.

Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge:

Lim, D.H. and Johnson, S.D. (2002) "Trainee perceptions of factors that influence learning transfer". *International Journal of Training and Development* Vol 6. No.1, pp36 – 48

Lincoln, Y., and Guba, E. G. (1985) *Naturalistic inquiry*. Newbury Park, CA: Sage.

Mai, R. (1996) *Learning partnerships. How leading American companies implement organizational learning*. Chicago, III, Irwin

Marsick, V.J. and Watkins, K.E. (2001) "Informal and incidental learning", *New Directions for Adult and Continuing Education*, No.89, pp 25-34.

Marsick, V.J., and Volpe, M. (1999) "The Nature and Need for Informal Learning", *Advances in Developing Human Resources, 1*, pp 1 - 9.

May, T. (2001) *Social research. Issues, methods and process*. Open University Press.

McCall, M. W., Lombardo, M. M., & Morrison, A. M. (1988) *The lessons of experience: How successful executives develop on the job*. New York, NY: Free Press.

McLellan, H. (1996) *Situated Learning Perspectives; Educational Technology*. New York, NY, USA.

Megginson, D. (1996) "Planned and Emergent Learning", *Management Learning*, Vol. 27, No.4, pp 411–28.

Nonaka, I. and Takeuchi, H. (1995) *The knowledge creating company. How Japanese companies create the dynamics of innovation*. OUP USA; 7th Edition

Patton, M.Q. (1990). *Qualitative evaluation and research methods*. Sage Publications Inc.

Rouillier, J.Z., Goldstein, I.L. (1993) "The relationship between organizational transfer climate and positive transfer of training", *Human Resource Development Quarterly*. Vol 4, pp. 377-390

Tjepkema, S. (2002) *The learning infrastructure of self-managing work teams*. Enschede: Twente University Press

Tracey, J.B., Tannenbaum, S.I., and Kavanaugh, M.J. (1995) "Applying trained skills on the job: The importance of the work environment", *Journal of Applied Psychology.* Vol. 80, pp 239 – 252.

van der Sluis,L. , Williams, R. and Hoeksema, L. (2002) "Measuring the quality of managerial learning on the job", *The International Journal of Human Resource Management*, Vol. 13 No. 8, 1266-1278

Vermeulen, R.C.M. (2002) "Narrowing the transfer gap: the advantages of 'as if' situations in training". *Journal of European Industrial Training* Vol. 26, No. 8, 336- 374.

Vygotsky, L.S. (1962) Thought and Language. Cambridge, MA: MIT Press. (Original work published in 1934)

Workplace Learning. A Proposed Typology to Facilitate Transfer from Situated Learning

Margaret Mangion
Edward de Bono Institute for Creative Thinking and Innovation
margaret.mangion@um.edu.mt

Abstract: Learning is a phenomenon that takes place constantly. It is envisaged that capitalizing on its effects to possibly enhance performance is a desirable outcome for organisations. Following the introduction of the Situated Learning Transfer Model, and a review of the relevant literature, a new typology emerged. One of the primary aims of the proposed typology is to make informal learning visible and arguably more transferable. This could possibly be a step to support transfer from situated learning to the workplace. The typology identifies the contextual factors that can potentially enhance or inhibit transfer from situated learning. To date, research in the area of learning focused mainly on formal learning. The proposed typology could make a valid contribution to research, policy and practice through its focus on informal learning. It must be noted that transfer of learning climate is heavily embedded and, to a large extent, implicit in the typology through different elements that constitute the workplace environment directly and indirectly. The typology may pave the way for new opportunities to capitalize on learning through the consideration of three main factors, namely, instances of learning, organisational enhancers of transfer from situated learning, and contextual elements. Through the proposed typology it is hoped that this theory building exercise can help fellow researchers to pursue their projects in further understanding learning and its management in organisations. Further research is required to refine and test the typology.

Keywords: typology, informal learning, situated transfer, organisations

1. Introduction

Learning takes place all the time in different contexts (Tracey et al. 1995). It is therefore not surprising that the workplace may also present a rich environment where learning can take place (Eraut, 2004) with informal learning being acknowledged as an important catalyst for development in organisations (de Laat, and Schreurs, 2013). Forrester and McTigue (2004) acknowledge that workplace learning has different meanings that feature under different guises including apprenticeships and professional education. For the purposes of this paper, wprkplace learning is understood to refer to the acquisition of knowledge in the workplace. In their work Stern and Sommerland (1999:1) claimed that workplace learning acquired visibility and saliency because it "sits at the juncture of new thinking concerning the nature of learning about the modern enterprise in a global economy". This notion instigated an investigation in how learning in situ could be exploited to inform and benefit organisations. Cognizant that situated learning provides opportunities to create meaning from real life events and activities in our daily living (Stein, 1998) the Situated Learning Transfer Model (SLT) was outlined in a separate paper aiming to explore the factors that influence the transfer of learning in situated conditions in the workplace. In this paper first, an outline of the SLT model is provided. Secondly the typology for workplace learning will be presented.

2. Background

Searching the extant body of literature, it is understood that situated learning through its spontaneity takes place in workplace environments too (Billett, 2001, Eraut, 2000). Studies show that there is a link between workplace learning and growth through professional development when engaging with the work context (Lave, 2012). Jacobs and Park (2009) define workplace learning as a process where individuals engage with learning opportunities both formal and informal to gain new skills to support on the job practices. This differs from situated learning which takes the form of informal acquisition through social activities. Through the practice of situated learning, knowledge is constructed in situ through social interaction with fellow individuals and also within the organizational context (McLellan, 1996). More specifically, Lave and Wenger (1991) stated that learning takes place while contextually engaging with situations involving communities of practice. Taking this background into consideration, one may deduce that learning on the job could equate with professional development since know-how is acquired through situated learning.

Echoing work by Lave and Wenger, Boud and Hager (2012) argue that the process involves active participation through which knowledge is located, constructed and improved through routine activities. Marsick and Volpe (1999:4) state that the value of informal learning is 'predominantly experiential and non-institutional' while Billet, (2001) claims that norms, values and common practices themselves provide a structure for workplace

learning experiences. Vieweing learning as situated. Raz and Fadlon (2005) state that meaning is embedded and highly contextualised while the knowledge that is transmitted is not entirely 'objective'. It follows that in such a social context, knowledge could therefore be imbued with influences from the social environment, habits and the community where it is taking place. This is supported by a claim made by Edmondson (1999) stating that knowledge is embedded in interactions and shared beliefs.

The cultural and structural characteristics of the organisation may shape the 'learning landscape' and impact the effectiveness of the application of situated learning. Lave, (1990) refers to structure as the 'learning curriculum', emphasising the difference from a teaching curriculum, as learning takes place in a social context through engagement and co-participation in real activities with other members of the workplace community. Gherardi et al (1998) introduce the concept of the 'situated curriculum' which is embedded in the habits and traditions of the community. Although best practice methods regarding what conditions 'prompt access and utilisation for learning' are yet to be fully understood (Marsick, 1994:28), much research has been conducted with the aim of exploiting and utilizing better the knowledge residing and created in organisations. Processes and routines within the organisation could provide fertile grounds for situated learning that individuals unknowingly tap into.

2.1 The Situated Learning Transfer Model

The SLT model (Fig.1) builds on existing models primarily on Boud and Walker (1990 and Holton (1996). The different components of the model represent factors that may have on instances of learning transfer. Transfer refers to the application of acquired knowledge to real life situations defined by Rijdt et al. (2013) as the generalization of application of skills and knowledge acquired to the workplace. Identifying in which area(s) of the firm the learning resides and finding out how to make this learning transferable is the ultimate aim of the model and the proposed typology. Notwithstanding the name 'situated learning transfer model', it must be noted that the learning addressed is not solely directed to situated instances. Constructs within the model, like 'supervisor support' and 'knowledge brought into the organisation', could also be applied to formal learning situations. The situated learning transfer model sees learning at its starting point. It may be argued that the level of awareness of this process can strongly impinge on the extent of usefulness to the organization.

A qualitative study with forty respondents from two ICT organisations was carried out to assess the emergent findings against the different constructs identified in the SLT model. In an attempt to clarify the emerging factors that shape the way transfer of situated learning takes place at the workplace, the research findings are summarized below in graphic representation (Fig. 2). From right to left the model shows three concentric circles symbolizing three key areas in the research also found in the situated learning transfer model. The outermost circle contains organisation-level effect factors that emerged out of the findings. The factors' positioning does not refer to their importance in the model. As will be seen further down, 'strategies and business goals' did not emerge as significantly as initially anticipated. The middle circle represents the 'transfer climate', or rather the invisible effects that influence the implementation of learning. The inner most circle represents the individual-level effect factors that emerged, mainly referring to personality characteristics and imported know-how. To the left of the model another section represents actions where situated learning can take place. These emerging actions can present an opportunity to give situated learning at the workplace some structure that could increase awareness and potential success.

The findings are primarily divided into the following key areas, namely respondents' perception of learning which can be considered an innovative inclusion when compared to other research such as Lim and Johnson (2002). The positive perception of the value of learning appeared to support Cheng and Ho (1998), although their research focused on formal learning through training. Following the situated learning transfer model, the other sections describe the organisational level effect, other individual level effect factors besides the individuals' perception of learning in the transfer of the situated learning equation.

The illustration is based on the central conclusion that, to understand how situated learning can be transferred/implemented, we first need to clarify and delineate the various factors that condition the occurrence of that learning within workplace settings. More specifically, the illustration highlights the findings which suggest that situated learning at the workplaces studied emerges primarily from informal situations or day-to-day happenings in working environments, and that various contextual factors impact on this process. More specifically, observations, meetings, evaluation sessions, information sharing and problem solving were the key learning situations identified by respondents. It appeared that findings on the elements of sharing and

observation confirmed the social and situated aspect of learning in research by Fuller and Unwin (2003) and Lave and Wenger (1991).

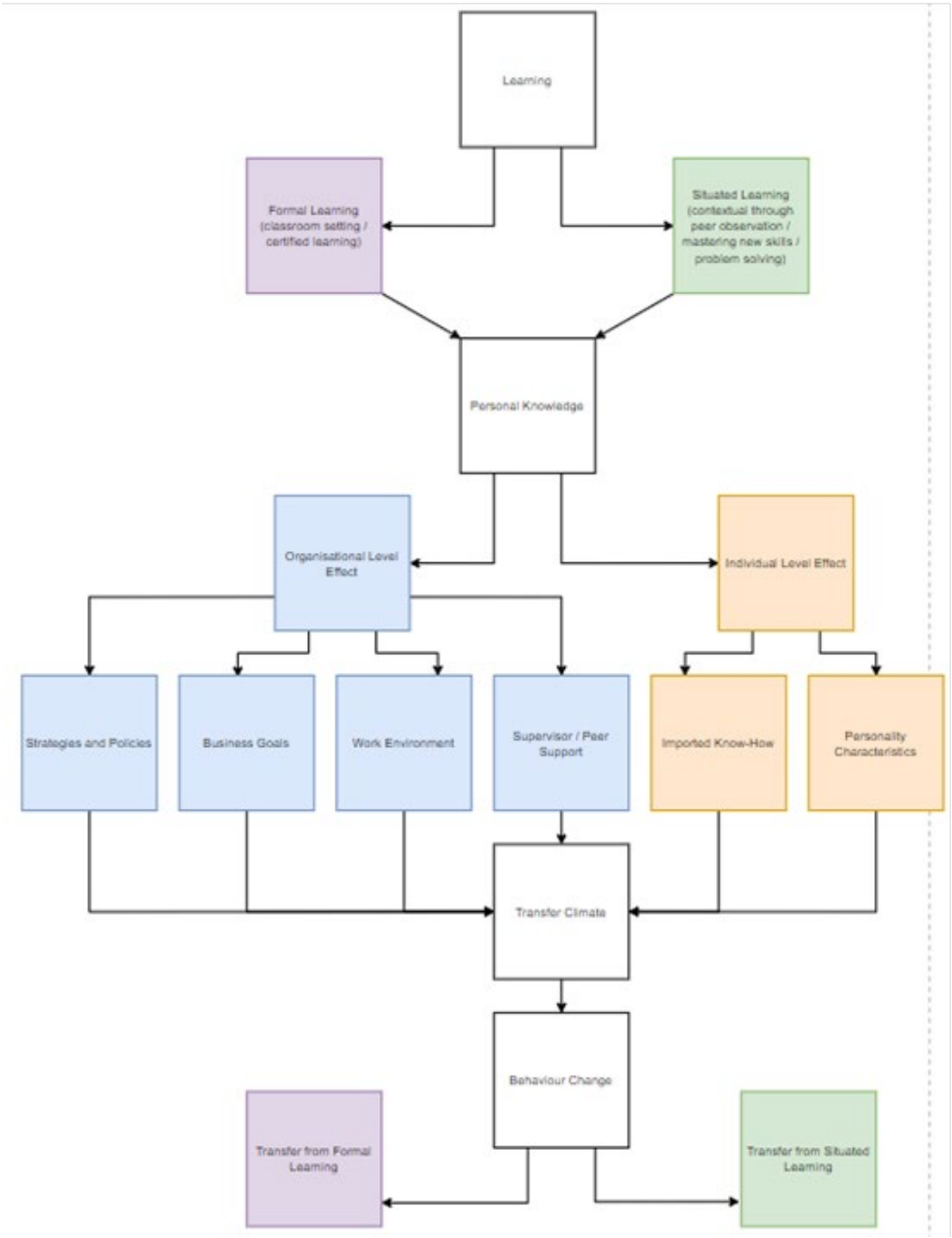


Figure 1: Situated Learning Transfer Model

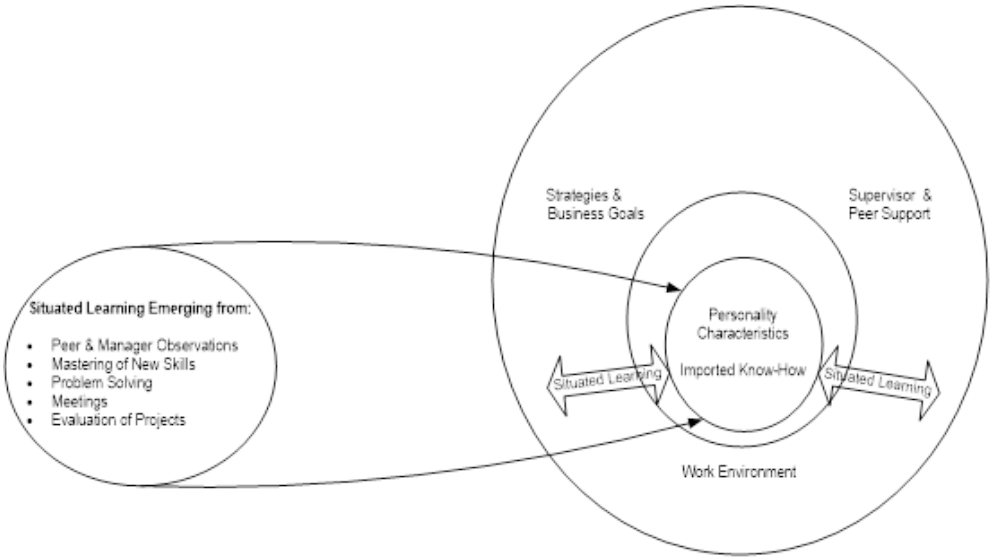


Figure 2: Graphic representation of the factors conditioning situated learning and its transfer

3. Typology Development

Typologies may be used as foundations in theory building (Ahlquist and Breunig, 2012), while theory is used by scholars to illustrate new contributions and describe advances in different fields (Colquitt, and Zapata-Phelan, 2007). This paper aims to build a typology of situated learning in the workplace. Nind and Lewthwaite (2019:468) state that "[A] typology is a classification of practice that distils complex data". In their attempt to build 'good' typologies that bear both academic and practical significance in the area of innovation studies, O'Raghallaigh, et al. (2010) suggest four steps to follow when creating typologies. Step 1 involves the limitation of the domain of the typology. Step 2 requires scholars to identify and define concepts while step 3 relates to the explanation of relationships between the different concepts. Finally, in step 4, scholars should offer potential predictions of how elements of the typology might interact.

In the current paper, the steps by O'Raghallaigh, et al. (2010) could be loosely followed since they offer clear explanations of what should take place at each step. Firstly, the domain of the typology is identified as learning in the workplace. More specifically, this topology addresses learning through a situated form. The identification of constructs was also relatively straightforward since the typology was designed based on the findings of a study proposing the SLT model. Step 3 involves the explain of the relationships between the different concepts.

This explanation along with potential predictions that should be offered in step 4 are outlined following the definition of the different concepts in the typology offered below.

Formal learning only offers the acquisition of knowledge in a small part. Situated learning through its contextualized form encourages the constant co-creation of knowledge and offers a variety of learning opportunities. The VUCA (Hadar et al. 2020) world we are currently experiencing with its volatile, uncertain, complex and ambiguous challenges dictates the need to adapt to new situations in an ever-changing workplace. Implementing an approach where learning is considered to be a part of the individual's development while acknowledging opportunities of where and when it happens can be considered critical in the current context.

The findings from the study mentioned above indicated that an effective environment for the transfer of learning is one where employees are encouraged and enabled to reflect on learning episodes that would otherwise remain invisible and ignored.

With the potential of contributing to research, policy and practice through its focus on informal, incidental learning, the typology is divided into three focal categories; organizational enhancers of transfer from situated learning, instances where situated learning takes place, and contextual elements that may influence the degree of transfer. The proposed typology, was inspired by a number of elements surrounding situated learning and learning at the workplace in general. These aspects were drawn from research findings and other workplace learning literature as observed in the literature review.

Table 1: A Typology of Factors Impacting Upon Situated Learning Transfer.

Organizational Enhancers (activities that may facilitate transfer from situated learning)	**Instances of Situated Learning (activities that provide opportunities for engagement with learning opportunities)**	**Contextual Elements (tacit activities and events that may influence the opportunities to transfer situated learning)**
Learning Strategy	Formal and Informal Meetings	Supervisor Support
Organisational Goal Setting	Feedback from clients	Peer Support
Individual Goal Setting	Internal Feedback (supervisor & Peers)	Workload
Coaching/Mentoring	Project Based Learning – organisation, process and evaluation	Opportunity to Use
Promotion of Reflective Thinking	Observation of others	Autonomy
Sharing of information	Problem Solving	Organisational attitude towards learning

3.1 Organisational Enhancers for Situated Transfer of Learning

Organizational enhancers that may facilitate transfer from situated learning, could be manifested through activities that could be explicitly intertwined with daily routines on the job with the aim to increase the application of new learning. The enhancers in the typology represent the activities that could be promoted within the organisation to create the need for learning and structure. They may overlap with other sections in the typology wherein the 'curriculum' and the contextual element take place. Coaching and mentoring could be interpreted to overlap with supervisor support. There are distinctive differences between coaching and mentoring and mere supervisor support, mainly stemming from the requirement of former methods to mentor and to give constructive feedback. The organisational enhancers for the situated transfer of learning are delineated below.

Learning Strategy: This term refers to learning that employees are expected to go through during their life time with the organisation. A mindful exercise that explicitly identifies processes and activities could be beneficial both for the organization and for the individual.

Organisational Goal Setting: Creating an awareness and sharing of the vision and goals of the organization could motivate employees to engage more by being more aware of situated learning instances and its transference.

Individual Goal Setting: Clear communication and understanding of processes is critical. Identifying knowledge gaps could arguably make situated learning more explicit and promote mindful activities.

Coaching and Mentoring: Good practices should be shared. Coaching and mentoring may help new entrants to engage with their role within the organisation.

Promotion of Reflective Thinking: The ability to look back and assess may provide opportunities for further improvement thus creating a learning environment.

Sharing of information: Initiatives like Quality Circles could initiate new dialogues that promote learning instances.

3.2 Instances where situated learning takes place

Instances of situated learning highlight some areas where learning opportunities could reside in a situated environment.

Formal and Informal Meetings: These settings could provide space for deliberate thinking about learning processes in the workplace.

Feedback from Clients: Feedback is an invaluable source of knowledge. It may help organisations to reassess processes to fine tune and improve effectiveness.

Internal Feedback: Making the space and time to discuss could make organisations more mindful of their modus operandi. Safe environments where employees can share feedback could provide excellent learning experiences.

Project Based Learning: Providing new experiences, new opportunities perhaps on rotation with different members of staff through projects may be a motivating source of gaining know-how.

Observation of Others: Modelling of good practices could instill desired behavioural patterns.

Problem Solving: Deliberate effort to explore organisational issues could be supported with know-how from different departments. Combinatorial efforts leading to novel solutions could result in new learning.

Each one of these instances contains essentials of communication, feedback and organisational skills. Using these essentials each instance can provide the possibility for tacit learning of new material. The final element of the typology concerns the contextual elements of situated transfer of learning.

3.3 Contextual Elements

In the proposed typology, contextual elements refer to work situations embedded in the organisation that arise out of day-to-day activities at the workplace.

Supervisor Support: Instances in which the supervisor or manager presents scope for learning at the workplace. Support can encourage explicit reflection on what has been learnt, therefore making such learning more amenable to transfer.

Peer Support: Peers in the workplace can be an important learning resource, through observation, problem solving and sharing of ideas. Space to share practices could enhance support and facilitate transfer of situated learning.

Workload: Pressure and stress created by the workload could hinder learning opportunities. The role of this factor in the typology is considerable even if the workload could be a subjective factor to assess.

Opportunity to Use: Creating situations where learned skills may be applied could enhance the value of situated learning.

Autonomy: High levels of autonomy could prompt of situated learning. The respondents clearly felt that, when working autonomously, they needed to learn how to prioritise, make decisions and get feedback. This appears to be one of the more crucial factors in creating a climate for the transfer of learning.

*Organisational attitude towards learning***:** Setting up an appropriate organisational attitude, like being positive and willing to share information may facilitate transfer from situated learning.

It is hoped that through its simplicity, this typology can provide the basis for situated learning and its transfer in the workplace. Failure to acknowledge the often tacit learning opportunities presented at the workplace could potentially damage the organisational memory of the firm and create work intensification through work related stress.

The function of the contextual elements in the typology is to highlight the situational areas that could potentially be further exploited to enhance the learning culture and application of new learning. The proposed typology covers broad areas that related to the employee experience in the workplace. The relationships between the different concepts offered may vary according to the work environment and personal characteristics of the employee, co-workers and supervisor. In a VUCA world the dynamics would constantly shift due to the need to adapt to different circumstances, however, one could predict that a linear relationship between the three core concepts, namely organizational enhancers that may facilitate transfer from situated learning, instances of situated learning and contextual elements is not realistic due to changing conditions in the work environment. Notwithstanding this, if these elements are brought to the awareness of the key players, the employee, co-workers and supervisors, then the possibilities for transfer from situated conditions are predicted to increase.

4. Further Research

The typology may indicate similarity in concept to the organisational knowledge creation theory outlined by Nonaka and Takeuchi (1995). This parallel between transfer/application and creation of organisational knowledge gives the study a further innovative aspect and contribution to existing literature. Nonaka and

Takeuchi (1995) are predominantly preoccupied with the process of knowledge creation through the generation of a spiral that appears to have a snowball effect though its progression. The knowledge, starting in the individual, spirals to become explicit also goes through the motions of socialisation and combination. Similarities can now be outlined in the 'use' of definitions for operational terms like 'organisational knowledge creation'.

Two other parallel can be drawn to Nonaka and Takeuchi (1995) referring to value creation and the provision of a new outlook on knowledge and learning in organisations. As a contribution to current literature, the typology is hoped to address a gap in the literature while also bearing practical relevance in view of the use of informal learning at the workplace.

Any conclusions and outcomes arising from the proposed typology must be considered within the context of the limitations of the research on which it was built. The most significant element is the focus on situated learning and the transfer process within the workplace. The suggested typology could inspire in depth research which could also further validate or refine the SLT model. Hager (2003) suggests that most of our understanding of learning behaviours continues to be based on assumptions stemming out of formal learning settings. It is hoped that the study will instigate further research into pedagogical issues pertaining to the area of transfer of learning at the workplace. Further qualitative research needs to take place with a focus on the situativity of workplace learning, taking into consideration learning behaviours and social elements surrounding tacit processes operating at individual and organisational levels.

Further research is needed both at organisational and individual levels. However, it would be interesting to find more research investigating the interplay between the organisation and the individual and how that plays on the transfer of learning at the workplace. A third element to this dimension could potentially include the external environment and how it affects the organisation through pressures on the supply chain and economic issues instigated by the VUCA world. More specifically, research is needed in areas that regard the contextual elements of learning and how different agents affect learning environments.

Through the elements identified in the typology, a link is noted between the overall organizational vision and goals, communication, and the readiness for learning in the organisation. It would be interesting to investigate how reflective thinking could shape the organizational vision and goals and how the interplay of these elements could influence outcomes at the level of instances of situated learning and also the contextual elements that surround these instances therefore an interplay between the three main elements of the typology. This could result in a dynamic model that may ultimately support the mapping of organizational practices that may lead to more emphasis on situated learning and its transfer to the workplace. A workplace curriculum that may instigate a growth mindset could foster organizational readiness and provide the ability to adapt to changing circumstances.

5. Conclusion

Workplaces are dynamic entities that are susceptible to the changes in and around them providing ecosystems where many opportunities for situated learning occur. However, such opportunities are not always recognised by individuals. Similarly, the ways in which that situated learning can be applied are little understood and rarely explicitly used. In conclusion, situated learning at the workplace is a crucial but still often neglected phenomenon that holds important elements for organisational memory and overall performance of the firm. The unspoken issues stemming from identified factors that appeared to impinge on the transfer of situated learning have inspired the typology to enhance workplace learning transfer. Finally, it is concluded that specific learning instances need to be further enhanced through mechanisms that can help to make explicit, and to codify the tacit knowledge available, though the social context that is the workplace. Only when such situated learning is better understood, and rendered more visible can we begin to make it more transferable.

References

Ahlquist, J.S., and Breunig, C. (2012) "Model-based Clustering and Typologies in the Social Sciences", *Political Analysis, 20*, pp92 - 112.

Billet, S. (2001) *Learning in the workplace: Strategies for effective practice*. Allen and Unwin Sydney.

Billett, S. (2001) "Learning through work: Workplace affordances and individual engagement", *Journal of Workplace Learning*, 13 (5), pp209 - 214

Boud, D., and Hager, P. (2012) "Re-thinking continuing professional development through changing metaphors and location in professional practices", *Studies in Continuing Education*, 34 (1), pp17-30,

Boud, D., and Walker, D. (1990) "Making the most of experience". *Studies in Continuing Education*. 2 No.2 pp 61-80.
Cheng, W.L., and Ho, C.K. (2001) "A review of transfer of training studies in the past decade", *Personnel Review*, Vol. 30 No.1, 2001, pp 102- 118
Colquitt, J.A. and Zapata-Phelan, C.P. (2007) "Trends in theory building and theory testing: A five-decade study of the Academy of Management Journal," *Academy of Management Journal,* Vol. 50, p. 1281
de Laat, M., and Schreurs, B. (2013) "Visualizing Informal Professional Development Networks: Building a Case for Learning Analytics in the Workplace". *American Behavioral Scientist*, Vol. *57* No.10, pp 1421–1438.
Edmondson, A.C. (1999) "Psychological safety and learning behaviour in Work Teams", *Administrative Science Quarterly*, 44, No. 2. pp 350-383
Eraut, M. (2000) "Non-formal learning and tacit knowledge in professional work", *British Journal of Educational Psychology*, 70, pp 113-136
Eraut, M. (2004) *Informal learning in the workplace*. Studies in Continuing Education, 26(2), pp.247-273.
Forrester, K. and Mc Tigue, P. (2004) *Dimensions of Adult Learning: Adult Education and Training in a Global Era*. In Foley (ed), Routledge.
Fuller, A. and Unwin, L. (2003) "Learning apprentices in the contemporary UK workplace: Creating and managing expansive and restrictive participation", *Journal of Education and Work,* Vol. 16, No. 4, pp 407-426(20).
Gherardi S., Nicolini D., and Odella F., (1998) "Toward a social understanding of how people learn in organisations", *Management Learning*. Vol.29, pp 273-97.
Hadar, L. L., Ergas, O., Alpert, B., and Ariav, T. (2020) "Rethinking teacher education in a VUCA world: student teachers' social-emotional competencies during the Covid-19 crisis", *European Journal of Teacher Education*, Vol.*43* No.4, pp 573 – 586.
Holton, E.F. (1996) "The flawed four level evaluation model". *Human Resources Development Quarterly.* Vol. 7, pp 5-21
Jacobs, R. L. and Park, Y. (2009) "A Proposed Conceptual Framework of Workplace Learning: Implications for Theory Development and Research in Human Resource Development", *Human Resource Development Review*, 8(2), pp. 133–150.
Lave, J, Wenger, E (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press
Lave, J. (2012) "Changing practice". *Mind, Culture, and Activity*, *19*(2), pp 156-171.
Lim, D.H. and Johnson, S.D. (2002) "Trainee perceptions of factors that influence learning transfer". *International Journal of Training and Development* 6:1 pp36 – 48
Marsick, V. J. (ed.) (1987) *Learning in the workplace*, Croom Helm.
Marsick, V. J. and Volpe, M. (1999) "*The nature of and need for informal learning. Advances in developing human resources*: *Informal learning on the job",* Academy of Human Resources Development, Netherland, 1999, 1-9.
McLellan, H. (1996) Situated Learning Perspectives; Educational Technology: New York, NY, USA.
Nind, M., and Lewthwaite, S. (2019) "A conceptual-empirical typology of social science research methods pedagogy", *Research Papers in Education, 35*, pp 467 - 487.
Nonaka, I. and Takeuchi, H. (1995) *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press, New York.
O'Raghallaigh, P., Sammon, D. and Murphy, C. (2010). *Theory-building using Typologies - A Worked Example of Building a Typology of Knowledge Activities for Innovation*. In A. Respício, F. Adam, G. E. Phillips-Wren, C. Teixeira and J. Telhada (eds.), *DSS* pp. 371-382, IOS Press.
Raz, A.E. and Fadlon, J. (2006) Learning managerial culture, workplace culture and situated curricula in organizational. *Organization Studies* Vol. 27, No. 2, pp 165 - 182
Rijdt, C.D., Stes, A., Vleuten, C.P., and Dochy, F. (2013) "Influencing variables and moderators of transfer of learning to the workplace within the area of staff development in higher education: Research review" *Educational Research Review, 8*, pp 48-74.
Stein, D. (1998) *Situated learning in adult education.* [online], https://www.ericdigests.org/1998-3/adult-education.html
Stern, A. and Sommerlad, E. (1999) *Workplace learning, culture and performance*, Institute of personnel and Development, London. UK.
Tracey, J.B., Tannenbaum, S.I., and Kavanaugh, M.J. (1995) "Applying trained skills on the job: The importance of the work environment", *Journal of Applied Psychology.* Vol. 80, pp 239 – 252.

Digital Human Resources Management HUB: Exploring their Importance as Learning Space

Dora Martins
CEOS.PP, ISCAP, P.PORTO and GOVCOPP, University of Aveiro, Portugal
doramartins@iscap.ipp.pt

Abstract: The focus of this empirical study is to explore the importance of creating a HUB specialized in digital human resources management (HRM). Digital Hubs are collaborative networks that aim to stimulate the adoption of advanced digital technologies that promote interaction between different agents for emerging ideas, tools, and for digital networking. Furthermore, a HUB could provide an overview of digital skills and learning strategies to improve these skills to work in a digital society. The main objective of this research is to explore the role of HRH practitioners as agents of creating, acquiring and diffusing knowledge about digital HRM issues. Thus, this study intends to know several stakeholders' opinions about the importance of the creation of a collaborative platform to manage sourcing, information, and knowledge. It uses qualitative analysis to collect information based on an exploratory study using a focus group with a group of stakeholders (HRM professors, students, and practitioners) with an interest in the topic, through a collective semi-structured interview. The results show that it is important to create a digital HUB to enhance the use of advanced technology in the development of HRM and to facilitate the digital transformation of the different HRM stakeholders. As main activities to develop, the ones identified are: (1) to create a digital room to improve the learning of HRM students related with tools such as chatbots and avatars; (2) to do regular HRM talks to promote the sharing of new knowledge regarding digital innovations; (3) to define digital HRM working groups to create new knowledge; (4) to develop HRM entrepreneurship projects as well as (5) research projects related to digital issues; and (6) to share a digital HRM Library. We conclude by reflecting the importance of HRM digital transformation and also encourage higher education institutions to become shared and open digital learning spaces. The conclusion provides suggestions for opportunities for future research.

Keywords: Digital HRM, Digital HUB, Knowledge sharing, Acquisition of knowledge, Learning spaces, Higher education institutions

1. Introduction

Digital transformation has affected people, business, and education organisations, fostering new opportunities as well as challenges specifically in higher education institutions. Thus, digital transformation is the ability of an organisation to "adapt, respond, and position itself for success in the face of rapid technology evolution" (Guinan, Parise & Langowitz, 2019, p. 717).

Several scholars have analysed the impact of digital transformation on academic and practical organisations (Giones & Brem, 2017; Rippa & Secundo, 2019; Tekic & Koroteev, 2019). For instance, digital transformation can be related with various technological tools such as big data, artificial intelligence (AI), 4.0 machines, 3D printers and social media networks (Bresciani et al., 2021), digital platforms (Linzalone, Schiuma & Ammirato, 2020) and digital learning (Bygstad et al., 2022). However, as knowledge is the dominant production factor (Cardoni et al., 2019), universities become the main stakeholder in the creation and the transfer of knowledge, as well as in the selection of the kind of involvement practical stakeholders can have on this knowledge management (KM) (Lombardi et al., 2019; Trequattrini et al., 2018; Ramaswamy & Ozcan, 2018). Thus, the industry 4.0 revolution has impacted several areas and functions, including HR. As referred by Sengupta et al. (2021, p. 10169), "traditionally viewed as a support function that delivered employee services, HR function is now leading the digital transformation giving competitive advantage to the organisations worldwide. This transition is rapid to respond to the industry requirements and with a positive impact on the organisational performance through the optimization of its functions".

The objective of this paper is to research the importance of the creation of a digital HRM HUB in a public higher education institution specialized in HRM.

The methodology selected to answer our research questions is Yin's case study (Yin, 2014). Furthermore, the case study used semi-structured interviews with a focus group which included three different stakeholders (HR professors; students and practitioners). We adopt Rippa and Secundo's framework (Rippe & Secundo, 2019) to identify the motivations (Why), the stakeholders (Who), the activities (What), and the process (How) related with the creation of a digital HRM HUB.

The case study research provides, on the one hand, theoretical and practical insights for academic organisations implementing digital Hubs, involving specialized stakeholders, activities, and their processes (Kang et al., 2021) and, on the other hand, it contributes to the understanding of how a digital platform can foster the digital transformation on academic and professional HR environments.

The following sections present the literature review related to digital transformation on HRM functions and digital Hubs (section 2), followed by the description of the methodology (section 3). Section 4 presents the main results of the study, and section 5 underlines some conclusions.

2. Literature Review

Increasingly, organisations are relying on innovative technologies to manage their operations and business, requiring a repositioning of HRM leaders (Abdussamad et al., in press; Sengupta et al., 2021) and a dynamic reinvention of the scope of HRM on a global scale (Vrontis et al., 2022). The use of advanced technology, a consequence of digital transformation, is enabling not only more transparency and objectivity, but also efficiency and effectiveness gains in the different HR processes through the use of AI-based mobile digital tools (Ogbeibu et al., 2021; Pan et al., 2022; Sengupta et al., 2021; Suseno et al., 2022; Vrontis et al., 2022). Previous literature (e.g., Giudice et al., 2022; Jaiswal, Arun & Varma, 2022; Seeck & Diehl, 2016) underlines the importance that AI is assuming in reshaping work and various HR tasks, by enabling not only a source of innovation, but, above all, the positive effect on labour productivity and the consequent increase in organisational performance. On the one hand, with digital transformation HRM managers have new responsibilities, such as responding to increased competition for globally mobile talents or adapting rapid technological advances in the HR process (Fındıklı & Bayarçeli, 2015). In line with this perspective, Seeck and Diehl (2016) suggest that HRM can create an enabling environment for technological innovation through improvements and changes in working conditions. To this end, learning digitalisation skills needs more investment in order to enhance the impact of HRM on organisational KM. On the other hand, digital transformation has triggered a need for a web-based HRM, known as electronic HRM (e-HRM) (Fındıklı & Bayarçeli, 2015; Vrontis et al., 2022) or "smart" HRM (Ogbeibu et al., 2021), defined as the digital revolution in HRM tasks, which are executed in a manner that somewhat depends on AI, cloud computing, big data, and automation (Ogbeibu et al., 2021). This recent e-HRM system brings several benefits to organisations as they allow the reduction of spatial and temporal barriers enabling HR professionals to play a more active role as strategy builders, more efficient and effective organisational support decisions (Zhou et al., 2021), and cost reduction and service quality improvement (Sengupta et al., 2021), thus contributing to an effective organisational knowledge management (Fındıklı & Bayarçeli, 2015). Therefore, these technologies not only have brought new vocabulary to the HRM discourse, but they are changing the HRM profession (Vrontis et al., 2022). On the one hand, we are witnessing radical changes in HRM practices (Fındıklı & Bayarçeli, 2015), such as e-HR Planning, hiring HR (recruitment and selection), developing HR (training and development, career management), rewarding HR (performance evaluation, compensation, and benefits), protecting HR (health and safety, employee relations/legal issues). Furthermore, there are other functions such as team management, KM, employer branding, employee engagement, overtime optimization, reduced staff turnover, quality of work life, support mobility, talent management, onboarding, and employee engagement, which have recently entered into its digitalization phase (Pan et al., 2022; Sengupta et al., 2021). On the other hand, digital tools make it possible to intensify digital relations between the various teams in different departments that, while working independently and autonomously, can exchange creative ideas for business models' transformation, driving innovation processes and stimulating value creation (Ogbeibu et al., 2021). Thus, as referred to in recent studies (Giudice et al., 2022; Jaiswal et al., 2022; Ogbeibu et al., 2021) there will be a continuous increase in demand for new skill sets including intuitive intelligence (for complex, chaotic and context-specific tasks) and empathetic intelligence (for tasks requiring high levels of emotions and empathy) to remain employable and competitive. If, on the one hand, it is true that e-HRM supported on AI requires the mastery of skills to work with AI (Suseno et al., 2022), it is also true that HR professionals need to develop skills to use these technologies for the benefit of companies and employees, i.e., skills that improve the quality of HR decisions (Vrontis et al., 2022).

With the Covid-19 pandemic, millions of students, professors, and professionals started to use various digital tools, leading to the emergence of new learning experiences, both in the education system and in the labour market, which requires more, and often, new digital skills. Thus, higher education is a central venue for the creation of new knowledge to support the digital transformation of education, research, and practical knowledge. Furthermore, digital knowledge enables new learning forms, visualization of information, data, and

ideas with tools to explore information, develop digital sources, and implement pedagogical innovations to promote an effective digital learning space (Bygstad et al., 2022). Furthermore, and as referred by Bygstad et al. (2022), higher education should be a digital learning space where students learn in physical, hybrid and digital spaces, which often interact. Furthermore, digital learning spaces should support collaborative learning which opens up new possibilities, such as closer co-operation with businesses and other communities.

3. Methodology

To answer the research questions, this study is a simple case study (Yin, 2014). The case study method is suitable when "a how or why questions are being asked about a contemporary set of events over which the investigation has little or no control" (Yin, 2014, p.14).

3.1 The case study context

We choose a single case study proposing a pilot experience of a digital HRM HUB by a public higher education institution in the North of Portugal. This institution integrates bachelor and master courses in the field of business sciences, including a bachelor and a master in HRM.

Studying this digital HRM HUB becomes important because it is being created by a public higher education institution to accelerate the digital transformation in HRM, in the academic and in the work subsystem. The aim of data collection is related to understanding the digital transformation in HRM, more specifically, how digitalisation can improve the creation of theoretical and practical HRM knowledge and its dissemination among its various stakeholders.

3.2 Data collection and analysis

Data were collected in three groups using semi-structured interviews with professors, HRM undergraduate and master's students, as well as HR practitioners (directors or managers), using an intensive qualitative research approach (Ragin & Amoroso, 2019), where participants received open questions. Because the theme is external to the life of the group, the authors selected focus groups over the individual interview. Each participant reflected from an intellectual, technical, and professional point of view only to originate new ideas (Mucchielli, 1974).

For the research, we used Rippa and Secundo's framework (2019) to identify the motivations (Why), the stakeholders (Who), the activities (What), and the process (How) that justify the creation of this digital HRM HUB.

We carried out online interviews using the Zoom platform and, after a previous contact by mobile phone or email, explaining the digital HRM HUB concept and the objectives of their participation in this study.

After obtaining confirmation of their interest to participate, we organised a date for an online meeting. The interview guide includes four main questions:

- Why is the higher education institution motivated to create a digital HRM HUB?
- Who are the stakeholders that should be involved in the creation of the digital HRM HUB?
- Which activities should be included in the digital HRM HUB?
- How should the dissemination of knowledge between the different stakeholders occur?

The data were gathered between September 2021 and January 2022. The average length of each meeting was of seventy-five minutes. In total, there were 6 meetings (2 with HR professors, 2 with HR undergraduates, 1 with HR students enrolled in the master's degree and 1 with HR practitioners (with manager or director positions)). In total, we involved over 150 participants related to 3 HR groups of stakeholders.

Data analysis followed three phases (Strauss & Corbin, 1990): (1) open coding, to identify the concepts and their properties to generate codes; (2) axial coding, to develop and to organise categories according to the relationship between the codes; and (3) selective coding to integrate the categories.

4. Results

This section presents the main results related to the creation and development of a HUB to share knowledge about digital HRM.

4.1 The Why perspective

A relevant dimension in the creation of a digital HRM HUB is the motivations that justify its existence. The motivations identified by the three groups of participants are diverse. In general, all participants emphasise that the existence of an HUB will help accelerate the digital transformation in digital HRM. Professors, in particular, considered it relevant to create a HUB that covers all areas of HRM intervention – individual, organisational, and societal, as "only this way will we be enhancing all areas of professional possibilities, and equalising our intervention in the different areas of HRM" (professors). Wanting the digital transformation to be the most complete and as comprehensive as possible, the mission of this HUB has to frame all areas of work that use digital HRM, so "the object of intervention should be diversified, with a mission oriented to respond to the interests of a professional, who works with individual or organisational management, who is responsible for defining employment, labour market and HR policies in national or international contexts" (professors). Another motivation behind the creation of this HUB is the need to innovate using advanced technological resources, benefiting from government support to update the teaching, and learning methods (professors). This group of professors also emphasises that this HUB could strengthen the institutional image of HRM education and "benefit the institution in terms of more candidates in the future and bring greater educational effectiveness in terms of student employability when they have digitalisation skills, which is still very scarce in comparison with the increasingly growing demand" (professors). From the perspective of the HRM professionals, this digital HUB will help accelerate the digital transformation of organisations and HRM agents. One of the HRM practitioners in the organisational environment underlines that "the creation of a digital HUB will increase the efficiency of resources and the effectiveness of the results in the different activities and processes of the day-to-day HRM of organisations" (practitioners). This argument was reinforced with the idea that "the adoption of more technologically developed resources in the execution of HRM tasks will allow us to become more strategic players, with a more adequate response to younger generations expectations, as they tend to favour a more digital performance and feel more attracted by more innovative work environments. Therefore, if we want the best people working with us, we have to modernise, we have to digitalise" (practitioners).

Being a HUB associated with a higher education institution that teaches HRM undergraduate and master's degrees, this HUB will contribute to the growth of the institution's reputation in the labour market by mobilizing the knowledge that is created, both academically and professionally, and that is disseminated in the community. This way, "we can be recognised as an educational institution aligned with the skills required by the current labour market, reinforcing our leadership in the North of Portugal regarding HRM education" (professors). The adoption of technologies is important to facilitate knowledge transfer between HR knowledge ecosystems, "keeping the academy and labour market ecosystems close through the co-creation, dissemination and acquisition of knowledge and skills that, sooner or later, we will all have to apply within the scope of our functions" (practitioners). Students, in turn, consider that this HR digital HUB may facilitate their entry into the labour market, especially in organisations that are more digitally proficient, considering that this HUB "allows us to find out which companies are technologically more advanced in the area of HRM" or by complementing the knowledge acquired in the classroom with knowledge disseminated by HRM professionals. One of the students emphasises: "this HUB allows us to contact and learn from those who are already in the field and (understand) how they are using technological resources to manage people and HRM processes" (students). Furthermore, the students believe that this HUB will enhance the image of HRM, not only in the demands for more innovative skills, but also in the ability to develop more complex activities. Additionally, they claim that it may also improve the average salary of the professional; "maybe we will no longer be associated with a pencil and paper degree; and people will perceive HRM as important or even more important than an engineer or students who study technology, and we may even have better salaries when we enter the labour market, as having mastery of more digital tools for our HRM role gives us a greater competitive advantage when applying for a position in organisations that are more digitally aware!" (students). HRM professionals refer that the HUB can allow them to acquire knowledge capable of developing new skills that will help them to make the digital transformation they are now embarking on by trial and error or with help from professionals. This is because these are very costly changes for those who have considered HRM digital transformation a priority. As one of the practitioners underlines, "we have already thought about it; I have already talked to other HR managers, but when we ask for quotes, we give up because it is very expensive to use companies specialized in digital transformation. We are doing some digitalisation in our HRM processes, but these are still far from what is desirable because the knowledge is still reduced". Another practitioner adds, "we already have something done! With the help of our IT department, we already have a smart HRM APP, but it still has many limitations, despite it speeding up many HRM tasks". Innovation is the common motivation for all stakeholders; either creating new HRM activities or innovating existing ones. The group of professors underlines that "we are very interested in the creation of this

HUB as this will give us the opportunity to be recognized as a digital teaching institution in HR, preparing our current and future students for the real needs of the market, that is increasingly digital. Therefore, this HUB can innovate our institution's HRM education, an area that is critical in the training offer of the institution".

4.2 The Who perspective

Another of the questions underlying the creation of the HR digital HUB is related to who should be involved in the creation of this HUB so that it is perceived as an added value for future adherent members. All groups were unanimous in identifying a heterogeneous group of stakeholders, although it is a critical requirement to possess know-how in digital HRM. In the professors' group, four professors had greater sensitivity to digital transformation in HRM. One stated, "I think my participation might be important because I have been researching in the field of HRM 4.0". Experience in the development of digital tools in international research teams was also a valued requirement. Another professor stated, "I believe that the previous experience of the colleague in the project who developed several tools using virtual reality and augmented reality may be useful in this HUB, and they can now be readjusted for HRM core processes". Several HR practitioners in IT companies were invited to join the HUB given their proximity to digital transformation processes. Professionals linked to companies that are developing technologically advanced resources in the HRM area, namely using chatbots or HRM avatars, were also invited. On the one hand, the students, despite arguing that a greater cultural diversity of HRM experiences could be enriching, they believe that there is a need, initially, to "focus more on the participation of members who are already working in more technologically advanced environments to encourage others who are still less oriented towards the digitalisation of the role HRM assumes"(students). On the other hand, one of the CEOs of a company that develops an HRM support APP reinforces this by stating: "I am very interested in helping create this HUB by providing know-how and technological resources that can be used in demonstrations for HRM professionals who want to implement digital transformation in the organisations where they work, as well as case-studies to be used in practical work to complement classroom learning with your students" (practitioners). Of the 10 professionals interviewed, all showed interest in joining the HUB start-up team, providing the different digital resources they are currently using in their organisations. One of the practitioners refers that "we have been developing several micro training courses using virtual reality and gamification that may be interesting to share in the HUB, and even improve the resources that have been already developed with the feedback of the adherent members" or, "in terms of recruitment and selection, we have a very competent team in the development of resources with advanced technology. We have already created, in the company, an avatar that provides an important support in the selection of candidates and a chatbot that we use in the recruitment and selection processes with a high number of candidates". Other stakeholders will intervene mainly in the design of the image and in providing IT support in the creation and development of the HUB, explaining that "we are available to help. Our design department can create the image of the HUB, design the webpage, and edit various resources that are selected to share on the HUB" (practitioners).

4.3 The What perspective

One of the points explored in the focus group with the different stakeholders was related to the relevant activities and resources for the creation and promotion of knowledge of the HUB, proposed by the researcher, who is also responsible for the creation of this HUB.

According to participants, it is desirable to have differentiating activities to capture the diversity of interests of the members linked to the three dimensions of human resources management – individual, organisational, and societal. In an initial phase, there are 6 dissemination of knowledge activities planned to facilitate digital transformation in the HRM area:

1. *Digital HR Talks.* Through these talks, emerging themes of digital HRM in the context of work will be debated. The stakeholders recognise this activity as one of the most relevant and capable of attracting the adhesion of members, given the diversity of topics that can be shared. "In an initial phase of the HUB this may be the activity that mobilises more participants considering the collective debate of innovative topics within the scope of digital transformation" (professors).
2. *Digital Room* dedicated exclusively to HRM students and researchers. It includes several digital resources provided by partners in order to promote a digitalisation culture in HRM at work. This activity will be very useful for students to complement their learning, as they will be given the possibility to access digital resources that partner companies can share. "Our company is available to serve as a practical example in training-related knowledge, being able to make explanatory and demonstrative videos of the training using virtual reality" (practitioners). This is an activity that will attract the adhesion of students

considering the innovation of learning because "for us, it will be very useful to know apps and virtual assistants to support HRM because, when we get to the labour market, it is almost certain there will be these assistants to support our functions"(students).

3. *Research Projects in Digital HRM*. This activity is for researchers interested in deepening the study of HRM in the context of work, and may benefit from the administrative support of funding structures and the establishment of partnerships in national or international projects. This activity generated a lot of enthusiasm because it gives the possibility for master students to conduct research with empirical analysis of pioneer organisational partners in digital transformation; "for those who wish to research in the digital transformation area, we are available to be case studies, considering our know-how in digitalisation" (practitioners). For professors "this activity will support the achievement of more innovative research projects giving the opportunity to access funding, through applications to digital transformation incentive programmes, considering the strategic importance that digitalisation assumes for funding agencies, as well as the possibility for master students to develop pioneering research in the area of digital transformation".
4. *Digital HRM Entrepreneurship Projects*. This activity is for professionals interested in deepening the study of HRM in a work context and may benefit from the administrative support of funding structures and the establishment of partnerships in national and/or international projects. For some practitioners, "developing new digital tools will be fundamental to help the digital transformation to be effective and may attract investment from business angels who believe in our ideas because they are of practical application and even subject to patenting".
5. *Thematic Work Groups*. This activity will aggregate members in restricted forums according to the interest in participating in the debate or development of working tools aimed at HRM in the workplace. It allows the creation of restricted groups, with a call for members who are effectively interested in deepening their knowledge on a specific theme or tool, considering that "in groups specialized in specific HR processes, it is always easier to debate and deepen our knowledge" (practitioners). This is an argument reinforced by another practitioner who supports the creation of specific work groups since, "together with other professionals of the same sector and with a similar organisational reality, I can benefit from peer knowledge and experiences, giving me guarantees of the return on the investment I may make".
6. *Digital HRM Library*. Through this library it will be possible to offer a diversity of digital resources in the different areas of HRM, either by consulting, uploading, or downloading resources suitable for improving specific knowledge. As a professor mentions, "some of these resources can be created in the classroom by our students, others can be shared because they are open access, available on websites or in social networks. Our role is to ensure that, on a weekly basis, we do research and share links that may be of interest to all members and that can help upskill and re-skill the digitisation of the stakeholders linked to the digital HRM area".

4.4 The How perspective

A part of the questions asked in the focus groups sought to understanding the procedural implementation of the HUB in order to provide knowledge that is creative and able to mobilise professionals with experience and knowledge in digital transformation in HRM and who can be mentors to other professionals and students interested in proceeding with digital transformation in HRM.

The knowledge will be disseminated through a platform fully managed by one of the professional stakeholders of this HUB, accessible either by personal computer or smartphone. Another stakeholder will be in charge of managing the image and providing the HUB's IT support, creating alerts of new events or of whenever new resources are introduced or updated. There will be a team to support the dissemination of the different activities, with personalised alerts and invitations according to the areas of interest of the adhering members. For the students, "this HUB allows us to be up to date about the activities that are planned, and we only sign up if we are interested in the topic. There are topics that may not be of interest now, but if they become available in the digital library, we can consult them at any time" (students). Furthermore, according to the students, "it is important to develop a platform that is user-friendly and with an appealing design to increase participation and interest in the shared knowledge". Through this HUB, companies can have access to different activities, knowledge resources or business tools in order to involve numerous users who can be suppliers, customers or participants in diverse knowledge and information. As referred by one professor, "the use of a digital platform is essential to manage HRM's big data of knowledge in collaboration with diverse stakeholders". Moreover, students consider that "the HUB is important to manage our career's opportunities to fast access to innovations

of digital contents and to obtain help for different needs" (students). For HRM practitioners, the HUB "is an important channel to share knowledge aligned to the digital period of development and became an essential tool for carrying out digital HRM activities" (practitioners).

5. Conclusions

The Covid-19 pandemic has accelerated digital transformation in higher education. In this study, we explore the possibility of creating infrastructures to support digital transformation in learning, in the interaction between education subsystems and work organisations, highlighting the shared role that the different stakeholders could take to develop a digital learning space that, on the one hand, benefits students' qualifications and their development of digitalization skills in e-HRM, and, on the other hand, develops digitalization skills in professors and HR professionals. This study, although exploratory, seeks to underline the main strengths that a digital HRM HUB may bring as a shared solution for the acquisition and development of new forms of knowledge, including new actors outside the academic institution, such as HRM practitioners and organisations who could reinforce the network and the sharing of digital sources.

The results demonstrate that all stakeholders acknowledge the relevance of this HUB in being able to encompass all processes capable of enabling digital transformations in HRM. However, motivations vary among participants. On the one hand, professors believe this HUB is an opportunity to attract new students. On the other hand, students see benefits regarding their future professional opportunities. Finally, professionals recognise that the HUB may foster digital transformations in their own HRM processes. Thus, although the activities proposed were regarded as relevant, priorities vary among stakeholders. Professors essentially value digital HR talks and research projects in the field of digital HRM; students emphasise the relevance of the digital room and digital HRM library and profissionals consider digital HRM entrepreneurship projects and thematic work groups essential.

This study has some limitations, the main one being related to the generalisation of the results, which should be viewed with restraint, since this is a case study, which is a small sample within a public higher education institution. In future research, it would be interesting to extend the study to other higher education institutions that also have HRM degrees and analyse the role of Digital HRM in knowledge management.

We are confident that the present study has provided a roadmap for future research and practical implications related to HRM digital transformation and also encourage higher education institutions to become shared and open digital learning spaces, which promote the successful implementation of a digital approach to HRM.

Acknowledgements

"This work was financially supported by the research unit on Governance, Competitiveness, and Public Policy (UIDB/04058/2020) + (UIDP/04058/2020), funded by national funds through FCT - Fundação para a Ciência e a Tecnologia."

References

Abdussamad, Z., Agyei, I.T., Döngül, E.S., Abdussamad, J., Raj; R. and Effendy, F. (in press) "Impact of Internet of Things (IOT) on Human Resource Management: A review", *Materials Today: Proceedings*, [online], https://doi.org/10.1016/j.matpr.2021.11.247

Bresciani, S., Huarng, K.H., Malhotra, A. and Ferraris, A. (2021) "Digital Transformation as a Springboard for Product, Process and Business Model Innovation", *Journal of Business Research*, Vol 128, pp 204-210, [online], https://doi.org/10.1016/j.jbusres.2021.02.003

Bygstad, B., Ovrelid, E., Ludvigsen, S. and Daehlen, M. (2022) "From Dual Digitalization to Digital Learning Space: Exploring the Digital Transformation of Higher Education", *Computers & Education*, Vol 182, No 104463, [online], https://doi.org/10.1016/j.compedu.2022.104463

Cardoni, A., Dumay, J., Palmaccio, M. and Celenza, D. (2019) "Knowledge Transfer in a Start-Up Craft Brewery", *Business Process Management Journal*, Vol. 25, No. 1, pp. 219-243.

Fındıklı, M.A. and Bayarçelik, E.B. (2015) "Exploring the Outcomes of Electronic Human Resource Management (E-HRM)?", *Procedia - Social and Behavioral Sciences,* Vol 207, pp 424-431.

Giones, F. and Brem, A. (2017) "Digital Technology Entrepreneurship: A Definition and Research Agenda", *Technology Innovation Management Review*, Vol 7, No 5, pp. 44-51

Giudice, M.D., Scuotto, V., Vincenzo, L., Ballestra, L.V. and Pironti, M. (2022) "Humanoid Robot Adoption And Labour Productivity: A Perspective on Ambidextrous Product Innovation Routines", *The International Journal of Human Resource Management*, Vol 33, No 6, pp 1098-1124, [online], https://doi.org/10.1080/09585192.2021.1897643

Guinan, P.J., Parise, S. and Langowitz, N. (2019) "Creating an Innovative Digital Project Team: Levers to Enable Digital Transformation", *Business Horizons*, Vol 62, No 6, pp 717–727, [online], https://doi.org/10.1016/j.bushor.2019.07.005

Jaiswal, A., Arun, C.J. and Varma, A. (2022) "Rebooting Employees: Upskilling for Artificial Intelligence in Multinational Corporations", *The International Journal of Human Resource Management*, Vol 33, No 6, pp 1179-1208, [online], https://doi.org/10.1080/09585192.2021.1891114

Kang, Q., Li, H., Cheng, Y. and Kraus, S. (2021) "Entrepreneurial Ecosystems: Analysing the Status Quo", *Knowledge Management Research & Practice*, Vol 19, No 1), pp 8-20.

Linzalone, R., Schiuma, G. and Ammirato, S. (2020) "Connecting Universities with Entrepreneurship Through Digital Learning Platform: Functional Requirements and Education-Based Knowledge Exchange Activities", *International Journal of Entrepreneurial Behavior & Research*, Vol 26, No 7, pp 1525-1545, [online], https://doi.org/10.1108/IJEBR-07-2019-0434

Lombardi, R., Lardo, A., Cuozzo, B. and Trequattrini, R. (2017) "Emerging Trends in Entrepreneurial Universities Within Mediterranean Regions: An International Comparison", *EuroMed Journal of Business*, Vol. 12 No. 2, pp. 130-145.

Mucchielli, R. (1974). *L'Interview de Groupe*, Paris, Librairies Techniques, Entreprise Moderne d'Edition e Les Editions ESF (3rd Edition).

Ogbeibu, S., Pereira, V., Emelifeonwu, J. and Gaskin, J. (2021) "Bolstering Creativity Willingness Through Digital Task Interdependence, Disruptive and Smart HRM Technologies", *Journal of Business Research*, Vol 124, pp 422-436, [online], https://doi.org/10.1016/j.jbusres.2020.10.060

Pan, Y., Froese, F., Liu, N., Hu, Y. and Ye, M. (2022) "The Adoption of Artificial Intelligence in Employee Recruitment: The Influence of Contextual Factors", *The International Journal of Human Resource Management*, Vol 33, No 6, pp 1125-1147, [online], https://doi.org/10.1080/09585192.2021.1879206

Ramaswamy, V. and Ozcan, K. (2018) "What is Co-creation? An Interactional Creation Framework and Its Implications for Value Creation", *Journal of Business Research*, Vol 84, pp 196-205.

Rippa, P. and Secundo, G. (2019) "Digital Academic Entrepreneurship: The Potential of Digital Technologies on Academic Entrepreneurship", *Technological Forecasting and Social Change*, Vol 146, pp 900-911, [online], https://doi.org/10.1016/j.techfore.2018.07.013

Seeck, H. and Diehl, M-R. (2016) "A Literature Review on HRM and Innovation – Taking Stock and Future Directions", *The International Journal of Human Resource Management*, [online], https://doi.org/10.1080/09585192.2016.1143862

Sengupta, A., Lalwani, S., Goswami, S. and Srivastava, P. (2021) "Reinventing HR Functions with SMAC Technologies: An Exploratory Study", *Materials Today: Proceedings,* Vol 46, pp 10169–10174.

Suseno, Y., Chang, C., Hudik, M. and Fang, E. S. (2022) "Beliefs, Anxiety and Change Readiness for Artificial Intelligence Adoption Among Human Resource Managers: The Moderating Role of High-Performance Work Systems", *The International Journal of Human Resource Management*, Vol 33, No 6, pp 1209-1236, [online], https://doi.org/10.1080/09585192.2021.1931408

Tekic, Z. and Koroteev, D. (2019) "From Disruptively Digital to Proudly Analog: A Holistic Typology of Digital Transformation Strategies", *Business Horizons*, Vol 62, No 6, pp 683-693.

Trequattrini, R., Lombardi, R., Lardo, A. and Cuozzo, B. (2018) "The Impact of Entrepreneurial Universities on Regional Growth: A Local Intellectual Capital Perspective", *Journal of the Knowledge Economy*, Vol 9, No 1, pp 199-211.

Vrontis, D, Christofi, M., Pereira, V., Tarba, S., Makrides, A. and Trichina, E. (2022) "Artificial Intelligence, Robotics, Advanced Technologies and Human Resource Management: A Systematic Review", *The International Journal of Human Resource Management*, Vol 33, No. 6, pp 1237-1266, [online], https://doi.org/10.1080/09585192.2020.1871398

Yin, R.K. (2014) *Case Study Research: Design and Methods*, SAGE, Los Angeles.

Zhou, Y., Cheng, Y., Zou, Y. and Liu, G. (in press) "E-HRM: A meta-analysis of the antecedents, consequences, and cross-national moderators", *Human Resource Management Review*, [online], https://doi.org/10.1016/j.hrmr.2021.100862

University and Industry Collaboration in the Era of Smart Specialisation: Empirical Research on Sustainable Knowledge Transfer

Carla Mascarenhas[1], Anderson Galvão[2], Telma Mendes[3], Carla Marques[4] and João Ferreira[5]
[1]Centre for Transdisciplinary Development Studies (CETRAD) and University of Trás-os-Montes and Alto Douro (UTAD), Vila Real, Portugal
[2]CETRAD and UTAD, Vila Real, Portugal; School of Technology and Management (ESTG), Polytechnic Institute of Porto (P. Porto), Porto, Portugal
[3]Centre for Research and Innovation in Business Sciences and Information Systems (CIICESI), ESTG, P. Porto, Porto, Portugal; University of Vigo, Vigo, Spain
[4]CETRAD and UTAD, Vila Real, Portugal
[5]Research Centre for Business Science (NECE) and University of Beira Interior, Covilhã, Portugal
carlam@utad.pt
anderson@utad.pt
tilm@estg.ipp.pt
smarques@utad.pt
jjmf@ubi.pt

Abstract: The coronavirus disease-19 pandemic has forced universities worldwide to develop stronger crisis responses in order to support the surrounding communities more effectively. These solutions are based on collaborations between higher education institutions and industries that facilitate knowledge co-creation. Historically, universities have been knowledge-intensive institutions capable of producing additional findings through research. Currently, these organisations' most important contributions to national economies are related to universities' development of fresh knowledge and technical expertise. In parallel, all industries' business environments have become extremely dynamic, which requires companies to focus on new solutions, rapid development and cost efficiency. To cope with these pressures, industries have been forced to search for new partners, so university-industry collaboration (UIC) has become a key resource for managers seeking to promote innovation and technological development. This study explored the relationship between research and innovation based on smart specialisation strategies and UIC, including the roles of university-industry (U-I) joint research and academics' motivations for interacting with industries. Based on data collected from 841 Portuguese and Spanish researchers, the results reveal that smart specialisation policies' effects on UIC are driven by U-I joint research development and university faculty members' motivations for co-operating with industry professionals. The findings indicate that U-I research activities and universities' incentives to collaborate with industries fully convert smart specialisation strategies' effects into higher levels of U-I knowledge transfer.

Keywords: university-industry (U-I) collaboration; knowledge transfer; smart specialisation strategies; motivation; U-I joint research

1. Introduction

Previous studies of innovation management have highlighted innovation processes' potential in terms of recombination, co-creation and path dependence (Porter, 1998). These findings have led researchers to construct complex theories that seek to explain the triple helix model of government-industry-university collaboration and these ecosystems' importance to successful innovation and economic growth (Geels, 2002). Policymakers have started to develop policies and programmes based on this research, such as Europe's smart specialisation strategies and Canada's Innovation Superclusters Initiative (Aksoy *et al.*, 2022). However, the literature on this topic suggests that these new policies still lack a solid foundation in empirical research, with strategies sometimes formulated based on purely anecdotal evidence (Balland *et al.*, 2019).

Every country has felt the coronavirus disease-19 pandemic's impacts to a greater or lesser extent, and organisations must deal with complex situations generated by collateral events that threaten each nation's prosperity and long-term survival (Terán-Bustamonte *et al.*, 2021). Industries by nature are adaptative and evolutionary, but this crisis is unprecedented. Firms must thus seek alternative solutions that increase their innovativeness and competitiveness. One possible strategy is to form links with universities and the wide range

of services that they offer (Boardman and Ponomariov, 2009). The literature has highlighted this type of co-operation's benefits, including positive effects on the relevant universities' competitiveness and productivity (Teixeira *et al*., 2019).

In this context, university-industry collaboration (UIC) is defined as any activity involving interactions between academic and industry professionals (Ankrah *et al*., 2013; Chedid *et al*., 2020). UIC's main purpose is to create and share knowledge (Daria and Kostiantyn, 2018) that offers significant benefits to research team members, the organisations involved and thus the surrounding societies (Boyarchuk *et al*., 2018). UIC relies heavily on knowledge sharing and management practices (Philbin, 2008), which provide mechanisms that help professionals create, capture, analyse and act on knowledge (Chedid *et al*., 2020). Universities and industries with a broad knowledge base offer better conditions that meet their researchers' needs and foster stronger collaborations (Daria and Kostiantyn, 2018).

Although the existing literature indicates that UIC is an important research topic, few studies have focused on knowledge management in UIC (Hansen *et al*., 2017; Teixeira *et al*., 2019). In addition, a gap exists in terms of research that clarifies the link between UIC and the process of smart specialisation strategy development (Bukhari *et al*., 2021). Understanding how these collaborations can best be conducted has become extremely important because successful co-operation is essential to ensure not only UIC's viability but also its sustainability (Roncancio-Marin *et al*., 2022).

The present study thus explored the ways in which smart specialisation strategies influence UIC while taking into consideration university-industry (U-I) joint research and academics' motivations for interacting with industries. The remainder of this paper is organised as follows. Section two briefly characterises smart specialisation strategies and then discusses topics related to UIC and knowledge transfer. Section three introduces the data collection and analysis methodology used. The results are covered by section four, and section five provides the conclusions drawn and suggestions for future research.

2. Theoretical Background

The European Commission recognises smart specialisation strategies' value as a way to reduce developmental differences between European Union (EU) regions. In 2011, the European Commission established a platform to monitor smart growth development and provide regional information, methods and expertise to national and local decision makers (Bukhari *et al*., 2021). Smart specialisation initiatives also seek to enable regions to foster growth in specific areas in order to exploit their competitive advantages, generate jobs, support academia and businesses and develop long-term strategies supported by entrepreneurial universities (McCann *et al.*, 2012).

Smart specialisation strategies appear to be directly related to UIC's ability to address increased environmental constraints and gaps in institutions and industries, thereby helping regional clusters find better positions in global value chains (Bukhari *et al*., 2021). Universities' mission is no longer limited to research and training but instead incorporates a third mission: contributing to the surrounding regions' economic growth (Terán-Bustamonte and Colla-De-Robutis, 2018; Rasmussen and Wright, 2015). Smart specialisation has become one of the most common approaches to innovation policies seeking to encourage entrepreneurial universities, regions and countries' growth (Bukhari *et al*., 2021). Based on research and knowledge development, smart specialisation strategies seek to integrate knowledge, technology and production networks (Radosevic and Stancova, 2018; Ling, 2020).

Bukhari *et al*. (2021) report that smart specialisation innovation policies are perceived as supporting and enhancing regional UIC. This effect is achieved by linking universities with industries since weak connections create barriers for entrepreneurial universities. Bukhari *et al*. (2021) also point out that higher education institutions perceive smart specialisation strategies as positive but only if they take into consideration at least some of researchers' motivations. Based on these finding, the present study's first hypothesis was formulated as follows:
H1. *Smart specialisation strategies have a positive effect on UIC.*

UIC is defined as a relationship involving exchange and cooperation that allows universities to advance in terms of scientific and academic research and industries to exchange technological developments and solve specific problems (Terán-Bustamonte *et al*., 2021). This approach appears to be directly related to the push for

specialisation and technological contiguity that is at the heart of debates regarding European smart specialisation policies (Aksoy *et al*., 2022), namely, universities' contribution to economic and social development through teaching, research and entrepreneurial activities (Qiu *et al*., 2017). European universities have experienced cuts in long-term research funding, so smart specialisation strategies can also function as an alternative source of funds and additional incentives for UIC (Marinelli and Elena-Perez, 2017).

According to Ankrah and Al-Tabbaa (2015), UIC's interaction channels can be classified into six categories of which the first is knowledge exchange (e.g. publications, conferences and informal contacts). The second is research and development (R&D) projects (e.g. contract R&D, consulting, and joint R&D). The third is licenses and patents, while the fourth category is business (e.g. purchase of prototypes developed by scientists, creation of physical facilities and university spin-offs. The fifth is training (e.g. supervision of doctoral and masters theses), and the last is human resources (e.g. personal mobility and recent graduates' job placement). Given universities and companies' intensive reliance on knowledge, UIC requires the integration of specialised knowledge (Chedid *et al*., 2020) and smart specialisation frameworks characterised by entrepreneurial opportunities that identify how that knowledge can be applied (Bukhari *et al*., 2021). The current research thus included two more hypotheses:
H2. *Smart specialisation strategies have a positive impact on U-I joint research development.*
H3. *Smart specialisation strategies have a positively effect on academics' motivations for interacting with industries.*

U-I knowledge transfer is a complex iterative process (Aksoy *et al*., 2022). Various authors (e.g. Llopis *et al*., 2018; Centobelli *et al*., 2019) have observed that academic researchers participate in UIC to earn more recognition from their peers or ensure findings are actually applied to real problems. Other studies of industries' motivations (e.g. Fischer *et al*., 2018; Soetanto and van Geenhuizen, 2019) have found that companies seek financial returns through private appropriations of knowledge (i.e. patents and licenses), purchases of university spin-offs or the establishment of joint laboratories. However, knowledge and technology transfer between these two heterogenous actors can be challenging to achieve (Roncancio-Marin *et al*., 2022).

Research on UIC has revealed that individuals' diverse reasons for engaging in collaboration activities depend on whether the relevant professionals are employed by academia or an industry (Perkmann *et al*., 2021). Motivations common to both industry and university staff include responses to institutional policies, financial gain, human capital development, greater efficiency, an improved institutional image, intentions to buy or sell research results and expanded personal contacts (Cunningham and Menter, 2020; Perkmann *et al*., 2021). University faculty are specifically motivated by their institutions' need for social legitimacy, researchers' quest for recognition and a good reputation and academia's dedication to a third mission, that is, contributing to economic growth (Breznitz *et al*., 2008). In general, UIC has focused on outcomes that generate financial benefits for all parties involved (Roncancio-Marin *et al*., 2022). Based on the above findings, the present study's next two hypotheses postulated that:
H4. *U-I joint research development has a positive impact on UIC.*
H5. *Academics' motivation for interacting with industries has a positive effect on UIC.*

At an individual level, researchers' age remains controversial as an explanation for academics' engagement in UIC (Perkmann *et al*., 2021). Abreu and Grinevich (2013) detected a positive relationship between these two variables in their United Kingdom study, but Lawson *et al*. (2019) report a non-linear effect, with the youngest and oldest academic researchers participating less in these projects than middle aged faculty. In addition, Iorio *et al*.'s (2017) study produced evidence for age's non-significant effect in an Italian context, while various scholars (e.g. D'Este and Patel, 2007; Jensen *et al.*, 2008; Giuliani *et al*., 2010) have found a negative link between researchers' age and academic engagement. Another set of studies also confirmed that younger academics focus on publishing articles and neglect UIC (Zhou *et al*., 2016). Older researchers, in contrast, are more involved in UIC, prioritising funded research in order to produce relevant scientific knowledge (McNally, 2010; Betsey, 2017). Overall, UIC is thought to be strongly associated with researchers' age, gender, prior work experience and academic rank (D'Este and Perkmann, 2011; Perkmann *et al*., 2021). Given the existing research, the current study's last two hypotheses were as follows:
H6. *Researchers' age has a positive impact on U-I joint research development.*
H7. *Researchers' age has a negative effect on UIC.*

The seven hypotheses defined were incorporated into the research model (see Figure 1).

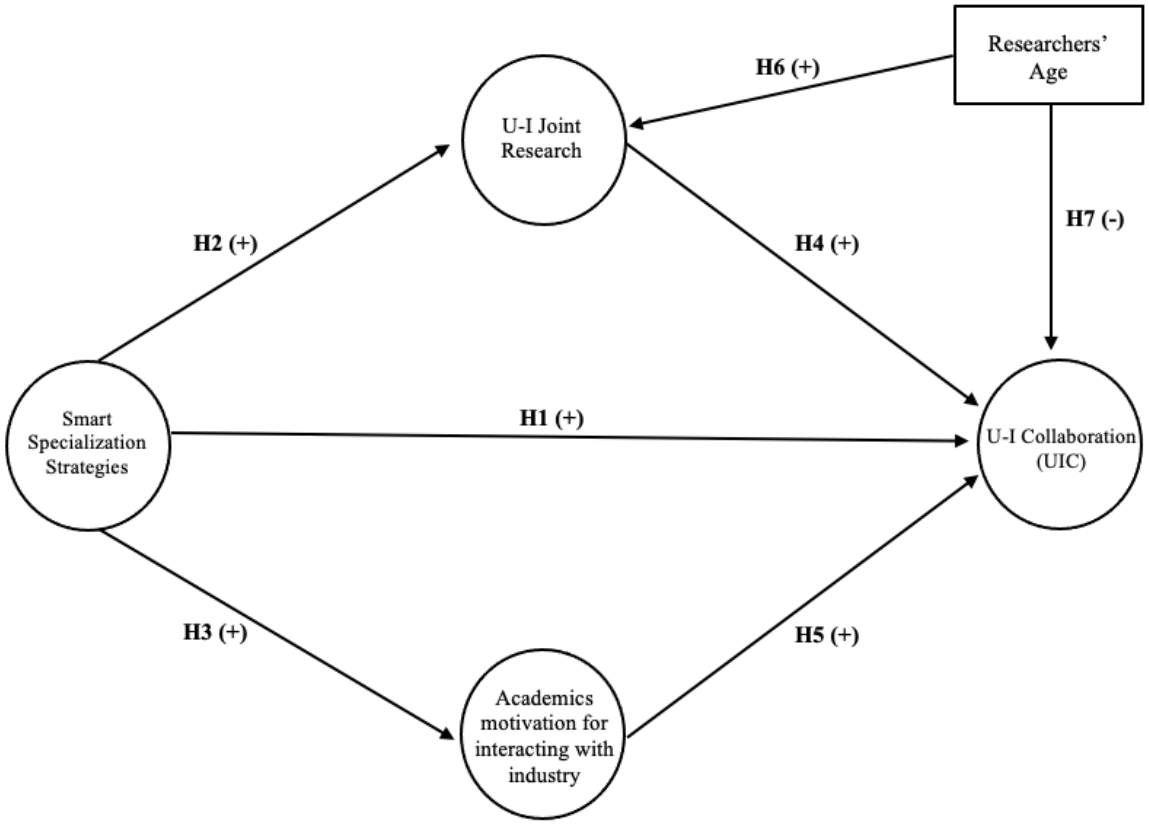


Figure 1: Research Model

3. Methodology

3.1 Data Collection and Sample

To achieve the pre-defined objectives, data were collected via a large-scale survey of selected universities to obtain information on their faculty members' interactions with industries. The questionnaire was administered to academics working in research centres or units of public universities in the North region of Portugal and Castile and Leon region of Spain. The survey was distributed to 4,095 researchers – 1,990 Portuguese and 2,105 Spanish – between March 2018 and March 2019. By the end of the data collection period, the sample included 841 academics – 464 Spanish and 377 Portuguese (response rate = 20.5%).

The latent variable model was tested using SmartPLS v3.3.3 software (Ringle *et al.*, 2015). Partial least squares (PLS) structural equation modelling (SEM) is widely viewed as a valid alternative to Jöreskog's (1973) covariance-based (CB) SEM, which is limited by restrictive assumptions. CB-SEM is usually conducted with the help of software packages as LISREL and AMOS in order to develop a covariance matrix of the data and estimate model parameters while only considering common variance. In contrast, PLS-SEM uses data's total variance to estimate models (Hair *et al*., 2017). As suggested by Hair *et al*. (2019), the current research conducted PLS-SEM primarily because, first, the analyses focused on developing a theoretical framework that would allow predictions to be made. Second, the structural model was complex as it included multiple constructs. Third, distribution issues, such as lack of normality,[1] were a concern, and, last, the present research's primary objective was to understand more fully UIC's increasing complexity by exploring extensions of established theories (i.e. exploratory research to develop theory).

3.2 Variables

3.2.1 Dependent Variable

The target variable was UIC. The respondents were asked to indicate how important various benefits of UIC were to them during the four calendar years from 2014 to 2017, using a 5-point Likert scale ranging from 1 ('Not important') to 5 ('Extremely important'). The questionnaire included a scale developed by Azagra-Caro *et al.*

(2006) that contained 12 items: (1) formation of long-term relationships with industries, (2) better understanding of industry problems, (3) ideas for new products or processes, (4) generation of patents, (5) creation of new equipment or instruments including software, (6) development of new and/or improved research procedures or techniques, (7) problem-solving assistance, (8) joint publications, (9) industrial internships for students, (10) commercialisation of products or technologies, (11) funding for research and (12) graduate student training.

3.2.2 Independent Variables

The explanatory variables were academics' motivations for interacting with industries, U-I joint research, smart specialisation strategies and researchers' age. Faculty members' motivations to engage with industry professionals were determined based on the respondents' responses to the following item: 'Please rank the following reasons for your involvement with industries according to their importance.' The researchers surveyed scored each item's importance on a 5-point Likert scale ranging from 1 ('Not important') to 5 ('Extremely important'). The scale was taken from D'Este and Perkmann's (2011) work, including 11 indicators: (1) research income from industry projects, (2) research income from government funds, (3) information on industry problems, (4) knowledge of industry research, (5) feedback from industry professionals, (6) research applicability, (7) membership in networks, (8) use of materials, (9) access to research expertise, (10) use of equipment and (11) intellectual property rights.

U-I joint research, in turn, was assessed by asking respondents this question: 'How frequently did you engage in the following activities in the four calendar years from 2014 to 2017?' The researchers surveyed were given a choice of 5 intervals: 0 times, 1–2 times, 3–5 times, 6–9 times and 10 times or more. This scale was also based on D'Este and Perkmann's (2011) study. The responses were coded with values ranging from 0 (i.e. the researcher was not involved in any type of activity) to 4 (i.e. the researcher participated 10 times or more in U-I projects).

Smart specialisation strategies were measured by three items (i.e. (1) 'Are you familiar with smart specialisation?' (2) 'Are you familiar with smart specialisation strategic priorities in your region?' and (3) 'Please rank how strongly you agree with the following statements.'). This scale was derived from previous studies (e.g. Capello and Kroll, 2016; Foray, 2017). The responses were coded as follows. Items 1 and 2 were translated as dummy variables (1 = yes vs 0 = no). Item 3 used a 5-point Likert scale ranging from 1 ('Totally disagree') to 5 ('Totally agree'). Finally, the respondents' age was quantified as how old each academic was on his or her last birthday (D'Este and Patel, 2007; Giuliani *et al*., 2010).

4. Results

As recommended by Sarstedt *et al*. (2017), the present analyses included assessing the model's internal consistency reliability and convergent and discriminant validity (see Table 1). The Cronbach's alpha (CA), composite reliability and average variance extracted (AVE) values exceed the established thresholds of 0.70, 0.70 and 0.50, respectively (Fornell and Larcker, 1981; Hair *et al*., 2019). Only academics' motivations for interacting with industries has a CA closer to 0.70, but the value is still acceptable (Hair *et al*., 2019). To confirm discriminant validity, the correlations between each pair of constructs were checked to ensure the values did not exceed the square root of AVE for each construct (Fornell and Larcker, 1981). The heterotrait-monotrait ratio of correlations' values are also lower than 0.85 (Henseler *et al*., 2015). The current results thus indicate that the measurement models' have adequate internal consistency reliability and convergent and discriminant validity.

Table 1: Evaluation of Reflective Measurement Models[2]

Constructs	Number of Items	AVE	CR	CA
Smart Specialisation Strategies	2	0.774	0.873	0.710
UIC	9	0.676	0.949	0.940
Academics' motivations for interacting with industries	2	0.752	0.858	0.670

Note: AVE = Average variance extracted; CR = composite reliability; CA = Cronbach's alpha.

To assess the structural model's soundness, analyses were carried out to detect any collinearity issues by examining the inner variance inflation factor (VIF) values. All the VIF values are below to the recommended cut-off value of 5 (Hair *et al*., 2019), so multicollinearity is not a problem according to the partial regressions conducted. The path coefficients range between –0.132 and 0.338, with different statistical significance levels.

In addition, the explained variance (R^2) values for UIC and U-I joint research are, respectively, 15.9% and 9.5%. The effect size (f^2) further complements the R^2-based assessment, which focuses on determining exogenous variables' relative impact on endogenous constructs based on changes in R^2 values (Cohen, 1988). According to the latter cited author, f^2 values of 0.02, 0.15 and 0.35 represent small, medium and large predictor variable effects, respectively. Higher f^2 values were obtained for the relationships between academics' motivations for interacting with industries and UIC (0.127) and between smart specialisation strategies and U-I joint research (0.105).

5. Discussion

The present findings support most of the pre-defined research hypotheses (see Table 2 and Figure 2). The results for H2 and H3 confirm that smart specialisation strategies have a positive relationship with U-I joint research development (H2: beta value [β] = 0.309; p < 0.001) and with academics' motivations for interacting with industries (H3: β = 0.171; p < 0.001). The outcomes also reveal that smart specialisation strategies' impact on UIC is fully mediated by U-I joint research and academics' motivations. In other words, smart specialisation strategies' direct effect on UIC is not statistically significant, so H1 was not confirmed (H1: β = –0,001; p = 0.494). The findings also suggest that U-I joint research development and academics' motivations for engaging with industries are responsible for smart specialisation strategies' effect on UIC. The evidence produced by this empirical research thus supports the assumption that, when smart specialisation strategies are properly implemented, they facilitate knowledge and technology transfer between universities and industries (e.g. Paiva *et al*., 2020).

Table 2: Evaluation of Structural Model

Direct Effects	R^2	f^2	f^2 **Value**	β	p**-value**	**Hypothesis Supported?**
U-I joint research → UIC	0.159	0.007	–	0.083 (2.432*)	< 0.010	Yes
Researchers' age → UIC		0.020	Small	–0.132 (4.460***)	< 0.001	Yes
Academics' motivations for interacting with industries → UIC		0.127	Small	0.338 (9.308***)	< 0.001	Yes
Smart specialisation strategies → UIC		< 0.001	–	–0.001 (0.015 ^{ns})	0.494	No
Researchers' age → U-I joint research	0.095	< 0.001	–	0.016 (0.472 ^{ns})	0.319	No
Smart specialisation strategies → U-I joint research		0.105	Small	0.309 (9.774***)	< 0.001	Yes
Smart specialisation strategies → Academics' motivations for interacting with industries	0.029	0.030	Small	0.171 (5.323***)	< 0.001	Yes
Indirect Effects		β		p**-value**	**Mediating Effect?**	
Smart specialisation strategies → U-I joint research → UIC		0.026 (2.298 $^{+}$)		< 0.050	Yes	
Smart specialisation strategies → Academics' motivations for interacting with industries → UIC		0.058 (4.843***)		< 0.001	Yes	

Note: R^2 = endogenous variables' explained variance; f^2 = effect size; β = beta value; path coefficients' significance: ^{ns} = not significant, $^{+}$ p < 0.05; * p < 0.01; ** p < 0.005; *** p < 0.001; values in parentheses represent t-values; t-value thresholds for one-tailed test with alpha = 0.05 and 5,000 resamples: t(0.05; 4,999) = 1.645; t(0.01, 4,999) = 2.327; t(0.005, 4,999) = 2.576; t(0.001; 4,999) = 3.091.

The results for H4 show that a positive relationship exists between U-I joint research and UIC (H4: β = 0.083; p < 0.01). The development of research activities, therefore, contributes to greater collaboration between these two types of organisations since these projects are related to researchers' role in knowledge transfer activities that help industries deal with dynamic markets' challenges (D'Este and Patel, 2007). H5 was also confirmed because a positive relationship exists between academics' motivations for interacting with industries and UIC (H5: β = 0.338; p < 0.001). This finding shows that researchers who receive incentives for collaborating with industry professionals (e.g. shares in royalties and spin-offs) increase their U-I activities, which corroborates D'Este and Perkmann's (2011) results.

The results for H7 included a negative standardised coefficient between researchers' age and their UIC (H7: β = –0.132; p < 0.001), suggesting that being older is inversely proportional to knowledge transfer to industries (i.e. UIC). Various other authors have reached this conclusion, such as D'Estel and Patel (2007), Jensen *et al*. (2008)

and Giuliani *et al*. (2010). Finally, the relationship between researchers' age and their development of U-I joint research is not statically significant (H6: β = 0.016; p = 0.319).

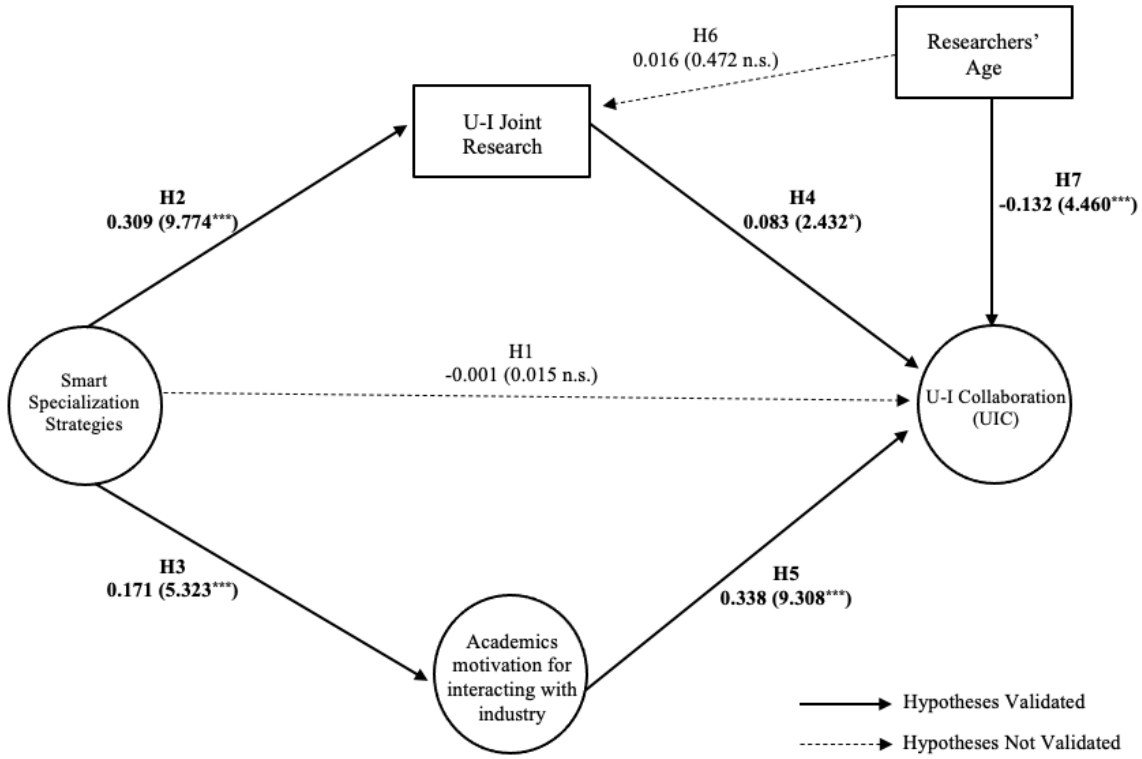


Figure 2: Path Analysis (Number = 841)

6. Conclusion

The present study's findings contribute to a better understanding of the relationship between UIC and smart specialisation strategies that seek to promote research and innovation, including clarifying the role played by U-I joint research and academics' motivations for interacting with industries. UIC offers multiple benefits for both parties. This collaboration allows firms to find solutions for most problems because universities offer a wide range of knowledge derived from different scientific fields, specialists and training programmes. Higher education institutions can also get involved with specialised professionals and industries' real world projects, which in turn support faculty members' research and educational endeavours.

These results have theoretical implications including that universities need to define more clearly their policies towards engagement with industries. Well-defined strategies could encourage internal and external collaboration by establishing institutional channels that facilitate relevant communication between universities and companies. In this way, academia will create a more favourable environment for collaborations that can provide holistic forms of support.

From a managerial perspective, the present findings can help U-I managers define strategies and develop future initiatives that promote an organisational culture based on sustainable knowledge transfer. This approach is extremely important given the emergence of local schemes such as smart specialisation and superclusters. In addition to investment policies that leverage UIC, smart specialisation policies need to be improved. UIC depends heavily on community funding, so fund managers should focus more closely on smart specialisation to strengthen the links between universities and industries. Smart specialisation strategies must become more inclusive, identifying the right priorities for UIC so that all the relevant stakeholders can get involved (i.e. universities, industries, governments and societies).

Regional policymakers should also support financial boundary spanners, for example, by creating science parks and prototyping facilities, so that full use can be made of universities as valuable sources for innovation and economic development. Smart specialisation monitoring and governance policies are also crucial ways to

provide industries with what they need, including an efficient use of EU funds to support UIC more fully. Mandatory measures are already in place that encourage this collaboration through U-I joint research development. However, entrepreneurial systems are mostly composed of small and medium-sized enterprises, which have economic and financial constraints. Concurrently, quite inactive universities are still looking for industrial partnerships. Thus, UIC needs to be rethought, and more specialised structures encouraging interrelationships must be set up, for instance, taxation reductions for firms and monetary and/or non-monetary rewards for universities.

Although the above findings comprise important contributions, this study was not exempt from limitations. First, the analyses only covered two cross-border regions rather than two countries. Future research could thus compare data on Portugal, Spain and other European nations to determine whether the current results are applicable to other contexts. Second, since only public universities were surveyed, scholars may generate interesting results by evaluating whether the outcomes differ for polytechnic institutes and private universities.

The current findings highlight the importance of providing incentives and supporting structures that encourage UIC. Social media can potentially enhance knowledge management processes and encourage participation in UIC, so future studies should evaluate whether these platforms are an environment in which academics and industry managers can work more easily together. Finally, another avenue for future research could be the development of a holistic, systematic model of governance and management procedures that ensure UIC can reach its full potential.

Endnotes

[1] Many scholars suggest that the absence of distributional assumptions is the main reason for selecting PLS-SEM (Hair *et al*., 2012). This feature is clearly an advantage in social sciences studies, which almost always rely on non-normal data, but it is not a sufficiently strong justification (Hair *et al*., 2019). In a limited number of situations, non-normal data can also affect PLS-SEM results (Sarstedt *et al*., 2017), producing peaked and skewed distributions (Hair *et al*., 2019). BC and accelerated (BCa) bootstrapping addresses this issue since these techniques adjust confidence intervals to avoid skewness (Efron, 1987). For this reason, the present study used BCa bootstrapping to estimate the structural model.

[2] The rules followed to decide whether to maintain reflective indicators is based on outer loadings. All the items were included in this study's PLS-SEM, and outer loadings above 0.60 were retained (Hair *et al*., 2013). In the current research, the variable U-I joint research only kept one indicator, so this factor was treated as a single variable instead of as a construct.

Acknowledgments

Telma Mendes acknowledges the support received by national funds through FCT - Fundação para a Ciência e Tecnologia under the project UIDP/04728/2020.

References

Abreu, M., and Grinevich, V. (2013) "The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities", *Research Policy*, Vol 42, No. 2, pp 408-422.

Aksoy, A. Y., Pulizzotto, D., and Beaudry, C. (2022) "University-Industry partnerships in the smart specialisation era", *Technological Forecasting and Social Change*, Vol 176, pp 121438.

Ankrah *et al*. (2013) "Asking both university and industry actors about their engagement in knowledge transfer: What single-group studies of motives omit", *Technovation*, Vol 33, No. 2-3, pp 50-65.

Ankrah, S., and Omar, A. T. (2015) "Universities–industry collaboration: A systematic review", *Scandinavian Journal of Management*, Vol 31, No. 3, pp 387-408.

Azagra-Caro *et al*. (2006) "Faculty support for the objectives of university–industry relations versus degree of R&D cooperation: The importance of regional absorptive capacity", *Research Policy,* Vol 35, No. 1, pp 37-55.

Balland *et al*. (2019) "Smart specialization policy in the European Union: relatedness, knowledge complexity and regional diversification", *Regional Studies*, Vol 53, No. 9, pp 1252-1268.

Betsey, C. L. (2017) "Faculty research productivity: Institutional and personal determinants of faculty publications", In *Historically black colleges and universities* (pp 49-84), Routledge.

Boardman, P. C., and Ponomariov, B. L. (2009) "University researchers working with private companies", *Technovation*, Vol 29 No. 2, pp 142-153.

Boyarchuk, A., Kharchenko, V., and Sklyar, V. (2018) "Models and cases for sustainable university-industry cooperation in IT sector". *2018 IEEE 9th International conference on dependable systems, services, and technologies (DESSERT)* (pp 667–671), Kyiv, Ukraine: IEEE.

Breznitz, S. M., O'Shea, R. P., and Allen, T. J. (2008) "University commercialization strategies in the development of regional bioclusters", *Journal of Product Innovation Management*, Vol *25* No. 2, pp 129-142.
Bukhari *et al*. (2021) "Entrepreneurial university: The relationship between smart specialization innovation strategies and university-region collaboration", *Technology in Society*, Vol 65, pp 101560.
Capello, R., and Kroll, H. (2016) "From theory to practice in smart specialization strategy: emerging limits and possible future trajectories", *European Planning Studies*, Vol 24 No. 8, pp 1393-1406.
Centobelli, P., Cerchione, R., and Esposito, E. (2019) "Exploration and exploitation in the development of more entrepreneurial universities: A twisting learning path model of ambidexterity", *Technological Forecasting and Social Change*, Vol 141, pp 172-194.
Chedid, M., Carvalho, T., and Teixeira, L. (2020) "University-software industry collaboration: an empirical study based on knowledge management", *Knowledge Management Research & Practice*, pp 1-13.
Cohen, J. (1988) *Statistical Power Analysis for the Behavioral Sciences,* Lawrence Erlbaum Associates.
Cunningham, J.A., and Menter, M. (2020) "Micro-level academic entrepreneurship: a research agenda". *Journal of Management Development*, Vol 39, pp 581–598.
Daria, S., and Kostiantyn, D. (2018) "Evaluation of knowledge management system for university-industry cooperation", *Proceedings of 2018 IEEE 9th international conference on dependable systems, services and technologies, DESSERT 2018* (pp 672–676), Kyiv, Ukraine: IEEE.
D'Este, P., and Patel, P. (2007) "University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry?", *Research Policy,* Vol 36, No. 9, pp 1295-1313.
D'Este, P., and Perkmann, M. (2011) "Why do academics engage with industry? The entrepreneurial university and individual motivations", *The Journal of Technology Transfer*, Vol 36, No. 3, pp 316-339.
Efron, B. (1987) "Better bootstrap confidence intervals", *Journal of the American statistical Association*, Vol 82, No. 397, pp 171-185.
Fischer *et al.* (2018) "Quality comes first: university-industry collaboration as a source of academic entrepreneurship in a developing country", *The Journal of Technology Transfer*, Vol 43, No. 2, pp 263-284.
Foray, D. (2017) "The economic fundamentals of smart specialization strategies", In *Advances in the theory and practice of smart specialization* (pp 37-50), Academic Press.
Fornell, C., and Larcker, D. F. (1981) "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol 18, No. 1, pp 39-50.
Geels, F. W. (2002) "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", *Research Policy*, Vol 31, No. 8-9, pp 1257-1274.
Giuliani *et al*. (2010) "Who are the researchers that are collaborating with industry? An analysis of the wine sectors in Chile, South Africa and Italy", *Research Policy*, Vol 39, No. 6, pp 748-761.
Hair *et al*. (2017) "A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)", Sage, Thousand Oaks, CA.
Hair *et al*. (2013) "A primer on partial least squares structural equation modelling", *Long Range Planning*, Vol 46, No. 1–2, pp 184–185.
Hair *et al*. (2019) "When to use and how to report the results of PLS-SEM", *European Business Review*, Vol 31, No. 1, pp 1-25.
Hair *et al*. (2012) "An assessment of the use of partial least squares structural equation modeling in marketing research", *Journal of the Academy of Marketing Science*, Vol 40, No. 3, pp 414-433.
Hansen, I.-E., Mork, O. J., & Welo, T. (2017) "Knowledge management of university-industry collaboration in the learning economy", *2017 2nd international conference on knowledge engineering and applications (ICKEA)* (pp 173–177), London, UK.
Henseler, J., Ringle, C. M., and Sarstedt, M. (2015) "A new criterion for assessing discriminant validity in variance-based structural equation modelling", *Journal of the Academy of Marketing Science*, Vol 43, No. 1, pp 115-135.
Iorio, R., Labory, S., and Rentocchini, F. (2017) "The importance of pro-social behaviour for the breadth and depth of knowledge transfer activities: An analysis of Italian academic scientists", *Research Policy*, Vol 46 No. 2, pp 497-509.
Jensen *et al*. (2008) "Scientists who engage with society perform better academically", *Science and Public Policy*, Vol 35, No. 7, pp 527-541.
Jöreskog, K.G. (1973) "A general method for estimating a linear structural equation system", In: Goldberger, A.S. and Duncan, O.D. (Eds), *Structural Equation Models in the Social Sciences*, Seminar Press, New York, NY, pp 255-284.
Lawson *et al.* (2019) "Citizens of somewhere: Examining the geography of foreign and native-born academics' engagement with external actors", *Research Policy*, Vol 48 No. 3, pp 759-774.
Ling, M. (2020) "Advanced Technologies", Internal Market, Industry, Entrepreneurship, and SMEs – European Commission, [online], https://ec.europa.eu/growth/industry/strategy/advanced-technologies_en.
Llopis *et al*. (2018) "Scientists' engagement in knowledge transfer and exchange: Individual factors, variety of mechanisms and users", *Science and Public Policy*, Vol *45*, No. 6, pp 790-803.
Marinelli, E., and Elena-Perez, S. (2017) "Catalan universities and the entrepreneurial discovery process: Challenges and opportunities emerging from the RIS3CAT communities", *Industry and Higher Education*, Vol 31, No. 6, pp 360-372.
McCann *et al*. (2012) *Guide to Research and Innovation Strategies for Smart Specialization (RIS 3*), Publications Office, Luxembourg.
McNally, G. P. (2010) "Scholarly productivity, impact, and quality among academic psychologists at group of eight universities", *Australian Journal of Psychology*, Vol 62, No. 4, pp 204-215.

Paiva, T., Ribeiro, M., and Coutinho, P. (2020) "R&D Collaboration, Competitiveness Development, and Open Innovation in R&D", *Journal of Open Innovation: Technology, Market, and Complexity*, Vol 6. No. 4, pp 116-134.

Perkmann *et al*. (2021) "Academic engagement: A review of the literature 2011-2019", *Research Policy*, Vol 50, No.1, pp 104114.

Philbin, S. (2008) "Process model for university-industry research collaboration". *European Journal of Innovation Management*, Vol 11, No. 4, pp 488-521.

Porter, M. E. (1998) *Clusters and the new economics of competition* (Vol 76, No. 6, pp 77-90), Boston: Harvard Business Review, [online], http://marasbiber.com/wp-content/uploads/2018/05/Michael-E.-Porter-Cluster-Reading.pdf.

Qiu, S., Liu, X., and Gao, T. (2017) "Do emerging countries prefer local knowledge or distant knowledge? Spillover effect of university collaborations on local firms", *Research Policy*, Vol *46*, No. 7, pp 1299-1311.

Radosevic, S., and Stancova, K. C. (2018) "Internationalising smart specialisation: Assessment and issues in the case of EU new member states", *Journal of the Knowledge Economy*, Vol 9, No. 1, pp 263-293.

Rasmussen, E., and Wright, M. (2015) "How can universities facilitate academic spin-offs? An entrepreneurial competency perspective", *The Journal of Technology Transfer*, Vol 40, No. 5, pp 782-799.

Ringle, C. M., Wende, S. and Becker, J. M. (2015) "SmartPLS 3, Boenningstedt: SmartPLS GmbH", [online], http://www.smartpls.com.

Roncancio-Marin *et al.* (2022) "University-Industry joint undertakings with high societal impact: A micro-processes approach", *Technological Forecasting and Social Change*, Vol 174, pp 121223.

Sarstedt M., Ringle C.M., and Hair J.F. (2017) "Partial Least Squares Structural Equation Modeling", In: Homburg C., Klarmann M., Vomberg A. (eds) *Handbook of Market Research*, Springer, Cham.

Soetanto, D., and van Geenhuizen, M. (2019) "Life after incubation: The impact of entrepreneurial universities on the long-term performance of their spin-offs", *Technological Forecasting and Social Change*, Vol 141, pp 263-276.

Terán-Bustamante, A., and Colla-De-Robertis, E. (2018) "Vinculando el talento de investigadores y emprendedores para la innovación", *Revista Mexicana de Economía y Finanzas*, Vol 13, No. 4, pp 547-569.

Terán-Bustamante *et al.* (2021) "University–Industry Collaboration: A Sustainable Technology Transfer Model", *Administrative Sciences*, Vol 11, *No.* 4, pp 142-159.

Teixeira, S. J., Veiga, P. M., and Fernandes, C. A. (2019) "The knowledge transfer and cooperation between universities and enterprises", *Knowledge Management Research & Practice*, Vol 17 No. 4, pp 449-460.

Zhou *et al*. (2016) "Research performance and university–industry–government funding sources in Taiwan's technological and vocational universities", *Innovation*, Vol 18, No. 3, pp 340-351.

Relating Organizational Knowledge with ISO 9001: 2015: An Empirical Approach

Florinda Matos[1], Valter Vairinhos[2], Ana Anes [3], Maria Francisca Matos[4] and José Vale[5]
[1]DINÂMIA'CET-IUL - Centre for Socioeconomic Change and Territorial Studies, Iscte - University Institute of Lisbon, Lisboa, Portugal
[2]ICLab - ICAA - Intellectual Capital Association, Santarém, Portugal and CINAV - Naval Research Centre - Escola Naval, Almada, Portugal
[3]Iscte - University Institute of Lisbon, Lisboa, Portugal
[4]ICLab - ICAA - Intellectual Capital Association, Santarém, Portugal
[5]CEOS.PP - Centre for Organisational and Social Studies of P. Porto, Porto Accounting and Business School, Polytechnic Institute of Porto, Porto, Portugal
florinda.matos@iscte-iul.pt
valter.vairinhos@icaa.pt
Ana_Teresa_Anes@iscte-iul.pt
mfrancisca.matos@icaa.pt
josevale@iscap.ipp.pt

Abstract: In a business market environment highly marked by competition, standardisation has proven distinctive in answering continuous challenges. Thus, organisations have been investing in obtaining ISO certifications, being "ISO 9001 – Quality Management System" among the most popular. The present empirical study aims to discover what is, in the opinion of managers expressed by their answers to the questionnaire, the relationship between the implementation of Knowledge Management practices, the Quality System and Organizational Performance while verifying if the introduction of Knowledge Management principles in the Standard ISO 9001 has affected the company's overall organisational performance. The proposed analysis methodology is supported by applying a questionnaire to 36 Portuguese Small and Medium Enterprises sample. The investigation results allowed us to infer that, in the managers' opinion expressed by the answer to the questionnaire, Knowledge Management acts as a mediator between the Quality System and performance while not directly influencing organisational performance. Within the companies studied, holders of the certification ISO 9001, through the application of Knowledge Management practices, show improvements in the management of the Quality System, with a consequent increase in organisational performance.

Keywords: Knowledge Management, Quality Management, ISO 9001, Organizational Performance

1. Introduction

The recent implementation of ISO 9001:2015 (ISO, 2015) represents a significant change expressed by enhancing knowledge management as a quality and enterprise performance factor.

The objective of this exploratory work is to study the perceptions of managers of Portuguese Small or Medium-sized companies (SMEs) involved in the implementation of quality systems, based on ISO 9001:2015, about relationships between the Performance (P) of these companies and their Quality Management System (Q) and Knowledge Management (KM).

Specifically, it aims to discover if those perceptions are compatible with a theoretical model such as Performance = f (Quality, Knowledge), associating those three variables, in which f represents a linear or non-linear relationship.

This figure is a graphical expression of the main scientific hypothesis in this study. More specifically, it is intended to discover if underlying the opinions expressed by the managers of 36 Portuguese SMEs seem to present the perception that there are relationships or causal influences between those three variables represented by the model presented in Figure 1. In this figure, arrows " a " mean that the variable at its left-hand side influences the variable at its right-hand side.

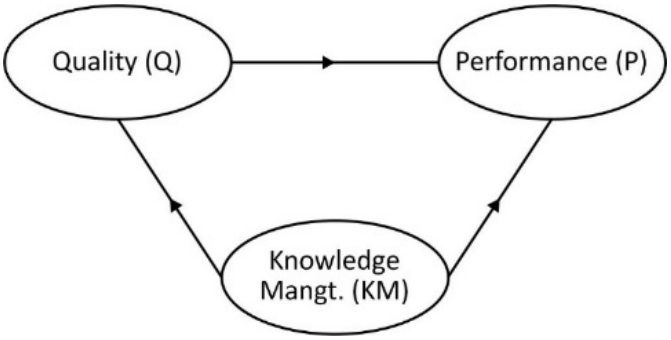


Figure 1: Hypothesis to be investigated

Q-Quality; KM-Knowledge; P-Performance

2. Theoretical Considerations

Although some authors (Duran, Çetindereb and Şahanc, 2014; Zakeri, Goudarzi, Atamanesh and Koochaki, 2014; Honarpour, Jusoh and Nor, 2012; Moballeghi and Galyani Moghaddam, 2008) have previously explored the relevance of combining quality practices with knowledge management, only since 2015 with the new version of ISO 9001 (ISO, 2015), the organisations started to see knowledge management as a necessity to obtain market advantages.

The first version of the ISO 9001 Standard (ISO, 2015), published by the International Organization for Standardization (ISO), dates from 1987. It was inspired by the theories developed by authors, such as Deming (1986), Juran and Godfrey (1998), and Ishikawa and Lu (1985), among others.

The ISO 9001: 2015 follows the seven principles of Quality Management (ISO, 2015): (1) Focus on the customer; (2) Leadership; (3) Employee commitment; (4) Process approach; (5) Continuous improvement; (6) Decision-making based on facts; and (7) Relationship management.

The ISO 9001:2015 replaced the previous version dated 2008. The most notable change concerns the structural organisation since the new version follows the same general structure of the remaining standards of management systems, known as the "High-Level Structure (HLS)" (ISO, 2015).

As for knowledge management, although its presence was implicit in previous versions, it is now explicit under the term "organisational knowledge", with an entire section dedicated to the theme. Knowledge management is now assumed to be a key element in competitive success, with knowledge being addressed as an organisational resource comparable to any other and must be managed (Ribière and Khorramshahgol, 2014, Aldanondo, 2015, Aimran *et* al., 2016, Dückert, 2016, Wilson and Campbell, 2016, 2020, Demir *et* al., 2021).

In the ISO: 9001: 2015, a new clause (7.1.6) introduces Organisational Knowledge knowledge as a resource: "The organisation shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services. This knowledge shall be maintained and be made available to the extent necessary. When addressing changing needs and trends, the organisation shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates."

Among the main changes in the new version, the authors (e.g. Murray, 2016; Wilson and Campbell, 2020, Demir *et* al., 2021) highlighted the accentuated emphasis given to the commitment of the top management of the organisation to the management system; the emphasis placed on the organisational context; the focus on risk-based thinking; greater flexibility in documentation; and the decrease in prescriptive requirements. This version of the Standard is less focused on documentation, more focused on management processes, less prescriptive, and more performance-oriented.

This new version does not present a clear definition of organisational knowledge, allowing auditors and companies to have different interpretations. However, the idea of making tacit knowledge explicit as a factor in organisational development and gain of competitive advantages seems to be underlying.

3. Methodology and Data Sources

3.1 Sampling

The Target Population for this research is the set of Portuguese SMEs. A convenience sample was extracted from an available sampling frame formed by the list (publicly available) of 212 enterprises affiliated with COTEC Portugal – Business Association for Innovation, considered in the SME Innovation COTEC Network list (COTEC Portugal, 2021)

A questionnaire aimed to verify SMEs leaders' perceptions of SME Innovation COTEC Network about implementing ISO 9001:2015 was developed. This questionnaire was sent to those 212 affiliated enterprises, and 36 answers were obtained.

Given the limitations of the available data frame, sample dimension, and reply rate, it is assumed that the results obtained cannot be generalised to the Target Population. The present study is seen as a pilot study to support future research.

The questionnaire comprises 55 questions expressed by Likert scales with 5 points. The questions were grouped, according to their meanings, into three groups or blocks corresponding to Quality (Q), Knowledge Management (KM) and Performance (P). These groups are shown in Tables 1,2 and 3.

The questions were labelled using labels Qi (i = 1 to 27); KMj (j = 1 to 24) and Pk (k =1 to 4).

Table 1: Variables related to Quality Management practices

Label	Question meaning
Q1	Your company's performance is analysed
Q2	The characteristics of the sector of activity in which your company is located are analysed in the process of defining strategies
Q3	Your company's target customers are identified
Q4	The social impacts (including environmental impacts) of your products and services are identified
Q5	Value aggregation processes are identified
Q6	Currently, the needs of your customers are always met
Q7	Internal environment information (degree of satisfaction, performance, commitment to employees – regardless of hierarchical level) is used to analyse your company's performance
Q8	The internal environment of your company is analysed in the process of defining strategies
Q9	The needs of your customers are understood
Q10	The requirements applicable to your company's core processes are determined by the
Q11	External environment information is used to analyse your company's performance
Q12	Organizacional strategies are evaluated
Q13	Information about products and services is disclosed to customers
Q14	The social impacts (including the environmental impact) of your company's products and services are shared with society
Q15	The occupational health hazards of employees are identified
Q16	The scope of the company's strategies is evaluated
Q17	Indicators are defined to evaluate the implementation of the company's strategies
Q18	Cao
Q19	Risks related to the occupational health of employees are addressed
Q20	Customer needs are identified
Q21	Factors affecting employee satisfaction are identified
Q22	Performance analysis is used by management to make decisions aimed at increasing
Q23	Actions implemented as a result of the analysis of complaints are shared with customers
Q24	Factors affecting employee satisfaction are addressed
Q25	Customer satisfaction is assessed
Q26	The degree of satisfaction of the communities in relation to the company is evaluated
Q27	Employee satisfaction is assessed

Table 2: Variables related to Knowledge Management practices

Label	Question meaning
KM1	Your company's information needs for decision support are identified
KM2	The training needs of your employees are identified
KM3	Knowledge about the social impacts (including environmental impact) of your company's products and services is used to address those impacts
KM4	Knowledge about information needs is used to make this information available to employees
KM5	Knowledge about the training needs of employees is used to carry out training programs
KM6	Relevant comparative information needed to improve your company's results are identified
KM7	Knowledge about product and service requirements is used to plan key work processes
KM8	Customers' level of knowledge about your company's products and services is assessed
KM9	Issues related to organisational strategy are shared with employees
KM10	The decisions taken after performance analysis are shared with employees
KM11	Company strategies are shared with employees
KM12	Information on relationship channels is shared with customers
KM13	Comparative information is used to improve your company's results
KM14	Knowledge about product and service requirements is used to manage work processes
KM15	Knowledge about the company's performance is used to formulate strategies
KM16	Knowledge about the needs of neighbouring communities is used to carry out social projects
KM17	Intangible assets that add value to the business are identified
KM18	Knowledge about the performance of key processes is captured through analysis performed regularly
KM19	Knowledge about intangible assets is used to develop them
KM20	Knowledge about the performance of core processes is used to improve and add value to customers
KM21	Information obtained from customers is used to enhance customer satisfaction
KM22	Knowledge about your company's image with customers is used to improve this image
KM23	Knowledge about intangible assets is used to protect those same assets
KM24	Knowledge about employee satisfaction is used to improve employee satisfaction.

Table 3: Variables related to Organizational Performance Management practices

Label	Question meaning
P1	The current satisfaction of its employees is high
P2	The current degree of community satisfaction with your business is high
P3	The number of work processes that have improved in the last twelve months is high
P4	Your company's current level of innovation is high

The 36 answers obtained allow obtaining a table (36X55) with the structure illustrated in Table 4.

Table 4: Data Set structure (partial view). Columns (variables) are answers to questions answered by all 36 top managers, and each row represents the answers of a single top manager.

SME_ID	Q1	Q2	…	Q27	KM1	KM2	…	KM24	P1	….	P4
2638942	5	5		5	5	5		5	5		4
2375816	4	3		4	3	4		3	3		3
1909475	5	4		3	4	5		4	4		5
1896941	4	4		5	4	5		5	5		5
1896694	5	5		5	5	5		5	5		5
1896293	5	5		5	5	5		5	4		4
1896278	5	5		2	4	5		2	3		4
1896240	5	5		5	5	5		5	5		5
1831708	4	5		5	4	5		5	4		5
1829608	5	5		4	5	4		4	4		5
1820392	5	5		4	4	4		4	3		4
1799714	5	4		5	5	5		4	4		4
1798374	5	5		5	5	5		4	4		5

3.2 Methods and Modeling

In methodological terms, the first question to be addressed is to show that the answers to questions in each group/block can be replaced by a single scale that approximates or summarises the set of answers in that group. In other words, it should be shown that there is empirical evidence supporting the idea that, subjacent to each group of answers, there is a latent variable that explains the observed answers. This can be obtained using Cronbach alfa or Principal Components Analysis (PPC) by the per cent of Variance explained by each group's first

principal component of variables. When this per cent is very high, that means that the variables in the group can be roughly approached by a single empirical variable such as the mean of variables in the group or its first principal component.

If this is justified by the available data, Qm, KMm, and Pm are the labels for those three new variables representing the blocks in tables 1,2 and 3. If there are significant correlations between those three new variables, that would suggest that Q, KM, and P, of which Qm, KMm, and Pm, are rough approximations, are also associated. Linear regression can now be used to obtain approximations of eventual relationships between Q, KM and P and predict P as a linear function of Q and KM. Specifically, if the regression Pm = a + b1 * Qm + b2 * KMm + Error has a large R2, that would suggest that a similar relation could exist between P, Q and KM.

If the previous empirical analysis results find support in data, it would be interesting to discover if data also suggests eventual influence relations between the variables Q, KM, and P, as stated by the investigation hypothesis expressed in Figure 1. Now, Q, KM, and P represent latent variables whose indicators are the variables containing data with the managers' answers. The result is expressed in Figure 2, where all manifest variables are of a reflective type and shown by rectangles labelled using the variable labels in Table 1,2,3 (See: Sarstedt et al., 2019, Monecke et al., 2012, Rosseel Y., 2012; Skrondal et al., 2004).

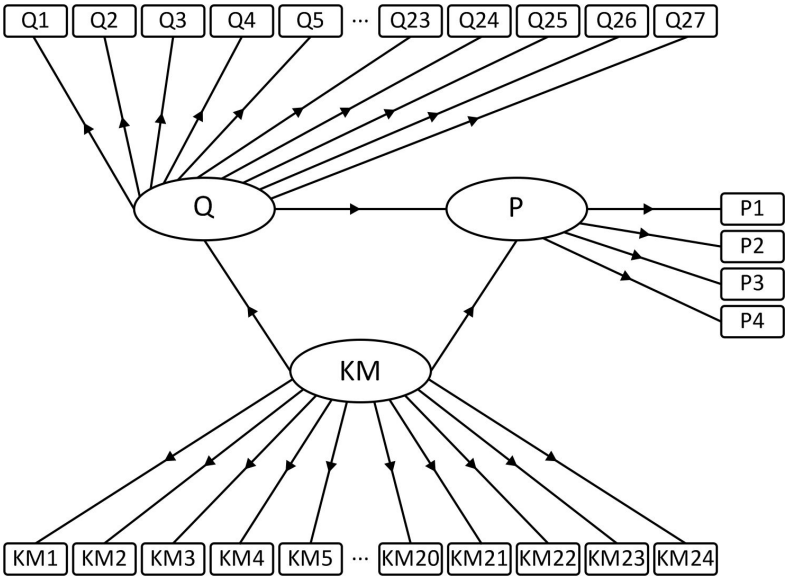


Figure 2: Structural model corresponding to the hypothesis under investigation. Latent variables: Q - Quality; KM – Knowledge Management; P - Performance.

The estimation of the model in Figure 2 can be performed using *R* packages "PLS-PM" by Gaston Sanchez (2013) or *semPLS*, Monecke, *et* al. (2012). Both packages implement the PLS method and are especially useful given the rectangular data set (36 X 55). The results of this study were obtained using package semPLS (Monecke, et *al*., 2012). Similar results can be obtained with the two packages.

The global goodness of fit for this model was gof = 0,63

4. Data analysis

4.1 Statistical Summarization of Variable Groups.

Table 5 shows Cronbach alfa and the percentage of Variance associated with the principal components 1 and 2 in each group of variables. The large values of Cronbach alfa and large value of per cent of Variance of First Principal Component suggest that those groups of variables are replaceable by just one (latent) variable.

Table 5: For each group, the Cronbach Alfa value and the Variance explained by the first two main Principal Components (PPC)

Group	Cronbach Alfa	% of Variance	
		1st PPC	2nd PPC
Table1 (Q)	0.951	48.2	10.2
Table 2 (KM)	0.956	54.2	7.7
Table 3 (P)	0.716	56.9	22.9

These variables underlying the groups of observations can be roughly approximated either by the mean value (a simple linear combination) or by the first PPC of observed variables of each group (a weighted simple linear combination). Both are linear combinations of group variables, the simple mean being more easily interpretable.

4.2 Regression Study of Relationships between Variable Groups.

If the choice is to use the means of each set of observed variables in each group, let these new empirical variables be labelled by Qm, KMm and Pm, representing now crude estimates of the corresponding -non observable. The three models summarised in Table 6, can be used to fit Qm, KMm, Pm data:

Model 1: Pm = 1.01* Qm (R^2 = 0,79)
Model 2: Pm = 0.83 * KMm (R^2 = 0,74)
Model 3: Pm = 0.053 * KMm + 0.96 * Qm (R^2 = 0,79)

Table 6: Regression models for Pm. N.S – Nonsignificant; S – Significant

Model	Explanatory		Cte.	b_1	b_2	R^2
	KMm	Qm				
1	-	x	(NS)	1.01 (S)	-	0.79
2	x	-	(NS)	0.83 (S)	-	0.74
3	x	x	(NS)	0.053 (NS)	0.96 (S)	0.79

In summary, both Qm and KMm, when considered in isolation, are good explanations for Pm with significant values (S) for corresponding coefficients and high values of R^2 = 0.79, when considering only the explanatory variable Qm and R^2 =0.74 when considering only the variable KMm.

When both explanatory variables KMm and Qm are considered, R^2 = 0.79, but only Qm contribution is significant. These results suggest that by simultaneously including the two explanatory variables (Qm and KMm) in the model, the direct explanation of KMm on Pm is not significant.

4.3 Structural Equations Estimation using PLS.

Tables 7 and 8 below summarise the estimation results of the model in Figure 2 and the confidence intervals obtained from 500 bootstrap samples.

Table 8 refers to the one-dimensionality of the groups of variables (blocks) corresponding to each latent variable, expressing to what extent it makes sense to replace the observable manifestations in each block with just one underlying latent variable.

In addition, to the previously used Cronbach Alfa, *dg.rho* (Goldstein-Dillon) indices' and the variance values of the first and second main components are now occurring, expressed by *eig.1st and eig.2nd*.

Table 7: One-dimensionality of blocks. (*R* means a Reflexive Manifest Variable)

	Type of Manifests	Number of Manifests	C.alpha	DG.rho	1st eig.	2nd eig.
KM	R	24	0.959	0.963	12.36	1.837
Q	R	27	0.957	0.961	13.02	2.758
P	R	4	0.738	0.838	2.27	0.917

DG.rho values ≥ 0.7 mean that the block/group is well expressed by a single variable (one-dimensional). In the present case, this occurs with the three groups.
This table confirms previous findings that a single latent variable well summarises each group of observed /manifest variables. See Table 8 for synthesis.

Table 8: Synthesis of Structural Model (NS for Nonsignificant)

Equation	Estimate
KM -> Q	0,95
KM -> P	-0.16 (N.S)
Q -> P	0.96

This table (probabilities obtained by bootstrap) means that the structural model estimated with PLS is:
Q = 0.950 * KM ; 2) P = 0.96 * Q - 0.16 * KM

The (-0.16) estimate for KM in the second equation is nonsignificant (Boostrap of 500 pseudo samples). Figure 3 presents the final estimated model for the relationship between the latent variables of Figure 2.
P = 0.96 * Q and Q = 0.950 * KM

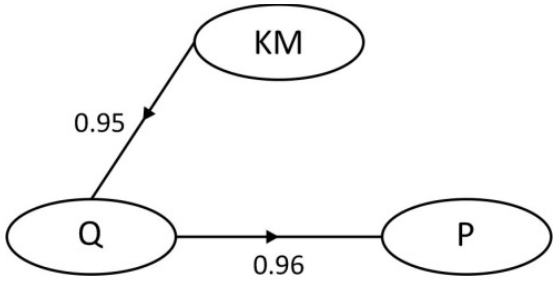


Figure 3: Estimated Structural Model

A similar result had already been obtained above, with latent variables Q, KM and P being roughly approximated by blocks, means Qm, KMm and Pm.

Figure 3 and Table 9, numerically, show the meaning of the estimated final model. NS is a nonsignificant effect.

Table 9: Total effects

	Relationships	direct	indirect	total
1	KM → Q	0.95	0.000	0.95
2	KM → P	(NS.)	0.825	0.75
3	Q → P	0.96	0.000	0.96

In summary (see Figure 3 and Tables 8 and 9), it is observed that KM has no significant direct effect on the dependent variable P. Its effect on the variable P (performance) is indirect (0.91 = 0,95 * 0,96) exerted through the variable Q. In other words, Quality (Q) acts as a mediation variable between KM (Knowledge Management) and Performance (P).

This finding has an interesting scientific interpretation: it expresses the idea that, according to the managers' perception, knowledge management is used to improve the organisation and technology of companies; the results on performance are not immediate but, given enough time for knowledge to spread and to act, its effects on performance manifest because of those improvements in the organisation. In our specific context, the system's quality has to do with the organisation and improvement of the methods and processes allowed by knowledge management.

5. Conclusion and Future Work

According to the results of this research, It was possible to find empirical support for the hypothesis formulated at the beginning of this research. In the opinion of high-level managers, who answered the questionnaire, knowledge management significantly directly affects quality management from the perspective of ISO 9001:2015. Quality management also has a direct effect on performance. The direct effect of knowledge management on performance is not significant, but there is an indirect effect that is manifested through quality management.

The analysis clearly illustrates that the managers' perceptions express a mediation effect of quality between knowledge management and companies' performance. In other words, according to those perceptions,

organisations that do knowledge management will improve the quality of management, which in the medium term will positively impact performance.

New research on the subject, with larger samples and a greater diversity of companies, is necessary to generalise the results obtained in this research and demonstrate to managers the importance of knowledge management practices to improve organisational performance.

References

Aimran, A. N., Ahmad, S., and Afthanorhan, A. (2016) 'Confirming the Mediation Effect of A Structural Model By Using Bootstrap Approach: A Case Study of Malaysian 8th Grade Student' Mathematics Achievement,' *International Journal of Business, Economics and Management* 3(4), 44-51.

Aldanondo, J. M. (2016) 'Gestión del conocimiento, calidad y la nueva ISO 9001'. Available at: http://www.catenaria.cl/km/newsletter/newsletter_116.htm (Accessed: 10 January 2022)

COTEC Portugal (2021). Available at: https://cotecportugal.pt/pt/ (Accessed: 15 September 2021)

Deming, W. E. (1986) *Out of the Crisis: Quality, Productivity, and Competitive Position*. Cambridge, MA: Cambridge University Press.

Demir, A., Budur, T., Omer H. M. and Heshmati, A. (2021) 'Links between knowledge management and organisational sustainability: does the ISO 9001 certification have an effect?', *Knowledge Management Research & Practice.* https://doi.org/10.1080/14778238.2020.1860663

Duran, C., Çetindereb, A., and Şahanc, Ö. (2014) 'An analysis on the relationship between total quality management practices and knowledge management: The case of Eskişehir', 2nd World Conference On Business, Economics And Management – WCBEM. *Procedia - Social and Behavioral Sciences* 109, 65 – 77.

Honarpour, A., Jusoh, A. and Nor, K. M. (2012) 'Knowledge Management, Total Quality Management and Innovation: A New Look', *Journal of Technology Management & Innovation, 7*(3), 22-31.

Ishikawa, K. and Lu, D. (1985) *What is total quality control?* Englewood Cliffs, NJ: Prentice-Hall.

ISO (2015) *Quality Management principles*. Genebra, Switzerland: ISO. Available at: https://isotc.iso.org/ (Accessed: 10 January 2022)

Juran, M. and Godfrey, A. (1998) *Juran's Quality Handbook*. 5th ed. Washington, DC: McGraw-Hill Companies, Inc. https://doi.org/10.1080/01621459.2012.695640

Moballeghi, M. and Moghaddam, G. (2008) 'Knowledge Management and TQM: An Integrated Approach to Management', *GITAM Journal of Management, 6*(1), 45-54.

Monecke, A. and Friedrich, L. (2012) 'semPLS: Structural Equation Modeling Using Partial Least Squares', *Journal of Statistical Software*, 48 (3), 1-32. Available at: http://www.jstatsoft.org/v48/i03/ (Accessed: 10 January 2022)

Murray, W. (2016) 'Risk and ISO 9001: 2015', *Quality Magazine*. Available at: http://www.qualitymag.com/articles/93103-risk-and-iso-9001-2015 (Accessed: 15 January 2022)

Ribière V.M., Khorramshahgol R. (2014) 'Integrating Total Quality Management and Knowledge Management', *Journal of Management Systems*, 16(1), 39-54.

Rosseel, Y. (2012) 'lavaan: An R Package for Structural Equation Modeling', *Journal of Statistical Software, 48*(2).

Sanchez, G. (2013) *PLS Path Modeling with R*. Trowchez Editions. Berkeley. Available at: http://www.gastonsanchez.com/PLS Path Modeling with R.pdf (Accessed: 10 January 2022)

Sarstedt, M.; Hair Jr, JF and Cheah J.H. et al. (2019) 'How to specify, estimate, and validate higher-order constructs in PLS-SEM', *Australasian Marketing Journal*. https://doi.org/10.1016/j.ausmj.2019.05.003

Skrondal, A. and Rabe-Hesketh S. (2004) *Generalized Latent Variable Modeling. Multilevel, Longitudinal, and Structural Equation Models*. 1st Edition. Chapman and Hall/CRC.

Zakeri, S., Goudarzi, H. T., Atamanesh, H., and Koochaki, H. (2014) 'Total Quality Management and Knowledge Management: A Researches Review', *Technical Journal of Engineering and Applied Sciences*, 135-142.

Unaware Unethical Behavior and 'Learning from Error' through the Knowledge Sharing

Concetta Metallo[1], Rocco Agrifoglio[2], Concetta Cristofaro[3], Maria Ferrara[2], Paolino Fierro[2], Reina Reina[3], Mauro Romanelli[2] and Roberta Oppedisano[2,1]
[1]Department of Science and Technology, University of Naples "Parthenope", Naples, Italy
[2]Department of Business and Economics, University of Naples "Parthenope", Naples, Italy
[3]Department of Law, Economics, and Sociology, University of Catanzaro "Magna Graecia", Catanzaro, Italy
concetta.metallo@uniparthenope.it
rocco.agrifoglio@uniparthenope.it
concetta.cristofaro@unicz.it
maria.ferrara@uniparthenope.it
paolino.fierro@collaboratore.uniparthenope.it
rreina@unicz.it
mauro.romanelli@uniparthenope.it
roberta.oppedisano@uniparthenope.it

Abstract: The paper focus on fraudulent or unethical behaviors in which there is no awareness, reasoning, or intention, but an incorrect action that results from lack of knowledge in terms of action errors. Using error management framework, we focus on the potential positive effects of errors, to link the errors with the more general goal of learning. Literature has shown that errors are often related to communication failures and of sharing of information. To enrich our understanding about fraudulent or unethical behaviors, this article contributes to the extant literature by investigating how knowledge sharing behaviors impact on the process of learning from error within the firm, to preventing future fraudulent or unethical behavior. The study reports a case study for examining the characteristics of the knowledge sharing behaviors, and how these behaviors characteristics impact the process of learning from error within the organization, to preventing future fraudulent or unethical behavior.

Keywords: unethical behaviors, fraudulent behaviors, knowledge sharing behaviors, error management, learning from error

1. Introduction

Previous research has theoretically and empirically examined fraudulent or unethical behaviors in organizations. However, the reasons why individuals act unethically are not clear and well defined (Brief et al. 2001; Lewicki et al. 1997). Unethical behaviors are defined as acts that are harmful to others and are "illegal or morally unacceptable to the broader community" (Jones, 1991, p. 367). Kish-Gephart and colleagues (2010, p. 2) add additional attributes to Jones' definition by delineating unethical behaviors as "any action by members of the organization that violates widely accepted (social) moral norms". Much research incorporates the intent behind the fraudulent or unethical action that is behaviors intended to benefit the organizations, its members, or both. But often individuals are unconscious of fraudulent behavior and do not consider their behavior non-compliant.

We focus on fraudulent or unethical behaviors in which there is no awareness, reasoning, or intention, but an incorrect action that results from lack of knowledge in terms of action errors (Van Dyck et al., 2005). In fact, there are some situations in which individuals do not recognize that the behavior is fraudulent or unethical (Tsang, 2002), but it's about actions involving errors, mistakes, or unconscious negligence (e.g., Asare and Wright, 1995).

The error that generates fraudulent or unethical behavior can represent for organization a learning opportunity, by understanding causes and implementing changes that will prevent future errors or reduce the negative consequences when errors reoccur (Reason, 2000). Errors are defined as the actions of multiple participants in the organization that deviate from the organization's specified rules and procedures and that can potentially lead to adverse organizational outcomes (Bell and Kozlowski, 2009).

[1] Corresponding author

Lipshitz et al. (2002, p. 81) state that learning must be seen as "a cyclical process of evaluating past behavior, discovering the mistake or opportunity, inventing new behaviors and implementing them". The evaluation of past behaviors and acting based on the awareness that errors support useful information are in fact considered important practices to learn from error (Van Dyck et al., 2005).

Several scholars argue that error communication facilitates learning from error (Ledva et al., 2017). Communication is one of the most important conditions to learn from the occurrence of the error (Edmondson, 1996; van Dyck et al., 2005). Edmondson (1996) points out that creating an environment that fosters frequent knowledge sharing supports learning from error. In fact, errors are often linked to errors in communication and in updating and sharing information (Bell and Kozlowski, 2011).

Mistakes are often related to communication failures and failures of updating and sharing of information (Bell and Kozlowski, 2011). Thus, communication about errors and knowledge sharing behaviors probably constitutes the most important error management practice (Van Dyck et al., 2005; Murphy and Dacin, 2011; Khorakian et al., 2019), enabling individuals to learn from error (Keith et al., 2020).

Knowledge sharing behaviors manifest when employees share their knowledge with other colleagues, through a mutual exchange of knowledge and providing an opportunity for the employees to acquire new knowledge (Khorakian et al., 2019; Yu, Yu-Fang, and Yu-Cheh, 2013).

Knowledge management research agrees that organizational improvement and change occur when employees are engaged in knowledge-related behaviors (e.g., Longo and Mura, 2011; Mura et al., 2013). Managers implemented a set of initiatives to improve daily work practices and to avoid fraudulent behaviors by mobilizing employees' knowledge (Mura et al., 2013).

To enrich our understanding about fraudulent or unethical behaviors, this article proposes a research model that integrates three research streams, namely error management, learning from error, and knowledge management. This article contributes to the extant literature by investigating how knowledge sharing behaviors impact on the process of learning from error within the firm, to preventing future fraudulent or unethical behavior. In particular, the research question of the study is: Can a fraudulent or unethical behavior generated by error represent for organization a learning opportunity through knowledge sharing behaviors?

2. Methodology

To investigate our research questions, we adopted a qualitative approach based on a single case study. We believe that this procedure is an opportunity to describe the process through which our phenomenon takes place (Taylor et al. 2011). In addition, the use of case study methodology is particularly useful for investigating the "how" and "why" of a set of contemporary events (Yin, 2009). The aim of the method used in this research is not to generalize the case under examination, but rather to understand it accurately in its peculiarity, uniqueness, complexity and in its specific social and economic context (Stake R., 1994). Our investigation looked in depth at a contemporary case within a real-life context (Yin, 2009), for understanding how a fraudulent or unethical behavior generated by an error can represent a learning opportunity for the organization through knowledge-sharing behaviors. The detailed analysis of the case allowed us to learn about the phenomenon through intensive exploration (Becker, 1970). We followed Yin's (2009) guidelines that ensure the regularity of the construct, planning, and execution of the case study. This methodology provided a comprehensive understanding of the phenomenon at hand without the rigidity of a predefined structure for observations and analysis (Fidel, 1984). The choice of case study rather than another method was dictated by several reasons. Firstly, the subject of the case study is specific and significant of unethical and fraudulent behavior. Secondly, the case study is representative of a unique situation and a phenomenon that has never been investigated before. Most importantly, it was chosen as a 'revealing case' to which researchers had a privileged access.

Moreover, the case study allowed us to investigate all those activities carried out within the company that are part of the " routine " and to understand the peculiarities of the context in which the organization operates. The data collection combined several methods: archival research, interviews, direct observations, and other sources (e.g., institutional documents, newsletters, and local newspapers). During the research, two of the authors attended meetings, workshops, and training sessions held at organization and observed the work practices of

employees going about their daily routines. In terms of secondary data, we also collected data by reviewing some of the extensive internal documentation that was shared with us by staff after an explicit request.

Data collected from a variety of sources between 2019 and 2020 were analyzed throughout the study, constantly reviewing any new data resulting from the research observations and surveys. In addition, the study was conducted through the observational mode to bring objectivity to the study and reduce bias. This technique ensures valuable information and a deep understanding of the individual case study in addition to leading to sound scientific conclusions (Yin, 2009; Reischauer, 2015).

2.1 The case study

The “XXX” (organization requested anonymity) founded in the late 1700s, is a private law organization under public control and has as its purpose the dissemination of musical art, the musical education of the community, as well as the artistic and professional development of its staff (Article 2, paragraph 2, of the Statute). The State, the Campania Region and the Municipality of Naples are the public founders participating in the activity of "XXX". It has a single headquarters in Italy in Naples and consists of about 400 operators including employees, collaborators, artists, and freelancers. The “XXX” carries out its activities in Italy and abroad and is a body of overriding national interest. It manages an important theater, a classical dance academy and a singing school for young artists as well as organizing world-class musical and artistic events annually. The "XXX" is a non-profit organization and is prohibited by its statutes to distribute profits or other assets. The purpose of the "XXX" is related to the dissemination of musical art, musical education to the community, as well as the artistic and professional development of its staff. It organizes opera, theatre, music, concerts, and ballets in Italy and abroad. For these reasons, the organization maintains institutional relationships with individuals (subscribers, school students, families) and with companies that provide the most diverse services from marketing to cyber security to communication.

In 2018, "XXX" began the complex process of adapting to the General Data Protection Regulation (GDPR) not only because the company has a regulatory obligation but also to assess the riskiness of the processing carried out, and to provide for security measures, technical and organizational, appropriate to the riskiness detected. The GDPR (EU Regulation 2016/6791) is the body of legislation designed to reinforce and standardize the personal data protection within the borders of the European Union by influencing extra European operators within EU borders. Its main objective is to reinforce the rights of individuals in terms of protection of personal data while facilitating the free circulation of data within the digital single market.

To this end, 'XXX' decided to use external consultants to adapt to the GDPR data protection model. In fact, since the company did not have the necessary resources to achieve the data protection objective, it chose external consultants, qualified specialists who were neutral with respect to the problem to be solved. The external consultants interacted with the company members, offering professionalism that enriched the company with skills and experience. Two researchers joined the company consultants to take part in this research and collaborated to draft interviews aimed at studying the working practices and procedures of the officers and whether these activities were in line with the provisions dictated and regulated by the GDPR. Thus, business advisers assisted by the researchers, during the interviews, detected incorrect, unethical, and fraudulent behavior in accordance with the GDPR.

Exploratory interviews were conducted with 14 key officers and 3 service providers, for understanding the cybersecurity procedures in relation to data management. They have been a very effective way of collecting large amounts of information, especially since the phenomenon of interest is not particularly frequent. All interviews were recorded and then transcribed to analyze the data. The information provided by the respondents enabled the company consultants to draw up a proper data management model according to the GDPR, and the researchers to conduct this research.

Here are some testimonials:
“*In the administration area there are 9 workstations that access the management system. For convenience we have only one user and password so that if someone is missing, anyone is able to operate*” (Employee). This interview testifies to incorrect behavior that exposes the organization to risks but is perceived as correct because it is legitimized and accepted by the context.

"*Cybersecurity is an issue that does not interest us, we are not a marketing company or a healthcare company*" (Key officer). The respondent shows reluctance to the correct procedures indicated by the business consultants and researchers involved in the drafting of the GDPR data management model.

"*If you force me to change my password every 120 days, I'll have to paste a post on the monitor to remind me!*" (Employee). In this case too, the employee's testimony indicates incorrect behavior that exposes the organization to risks, but which is perceived as correct because it is legitimized by the context.

Other misconduct also concerned the video surveillance system of the company 'XXX'. Company images were being recorded by the company without the employees' permission to use them. 'I didn't know it was a problem to record company images, I thought it was useful to protect all employees' (Company summit). Such behavior according to the GDPR is actionable.

These testimonies highlight a problem of awareness of one's roles and responsibilities, and of the consequences of non-compliance. Increasing employees' knowledge of the laws and regulations that affect their specific job role helps protect them and the organization from a range of damaging impacts such as personal fines, financial penalties, and loss of employment, to name but a few.

2.2 Results

Starting from an erroneous perception of the problem, the real challenge of external consultants was to change behaviors considered and perceived as correct by the staff as the result of a long process of action that has built up over time. In this sense, the consultants provided an alternative frame and the necessary support to define the necessary adaptation strategies and actions, stimulating people's awareness of the mistakes made by learning from them.

The approach was based on the identification of a sustainable path that was effectively commensurate with the specific needs of the organization. The path included several steps that ensured minimal adjustment in the short term (as per mandatory regulation), but at the same time became the basis for an evolutionary path aimed at developing full maturity on the Data Protection of corporate data (Fig. 1).

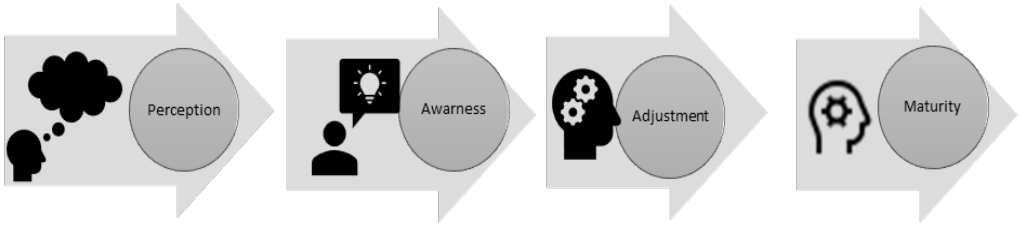


Figure 1: Process of prevention of unawareness unethical behavior

3. Perception

In the process of preventing unconscious unethical behavior, focus groups were evaluated as an adequate cognitive resource useful to collect data through group interaction. This technique allowed corporate counsellors and researchers to collectively elaborate the view of the phenomenon to be investigated and focus the debate on the topic in depth. It was preferred to use this tool to identify possible socialization processes and rationalization tactics. Taken together, rationalization and socialization practices allow perpetrators of wrong or unethical activities to believe they are behaving correctly, thus enabling them to continue to engage in these practices without questioning their compliance. Indeed, the focus group tool was used to build moments of active discussion with key officers and IT service provider of the company "XXX" to implement changes by identifying any problems and seeking new growth opportunities. Participants that were employees of "XXX", had to be convinced that compliant behavior was not an obstacle to operation. The evidence of such focus groups was verified through direct observation of behavior.

After an initial phase of sharing the analysis perspective, the focus groups focused on identifying errors and on correcting methods that could reduce the gap existing between the actual behaviors of the staff compared to those compliant with the GDPR. The role of moderator was assumed by the project leader, an external senior consultant, who urged, throughout the discussion, the participants to clarify as much as possible the meanings of the terms and expressions they use. In this way, the researchers collected it was possible to collect the many different meanings that are hidden behind the same term or expression.

3.1 Awareness

The phase highlighted a substantial discrepancy between the expected and actual behaviors. The discussion highlighted that often the behaviors that turned out to be wrong were assumed because they were perceived by all as organizational routines. To help develop awareness of cybersecurity among all employees of the company "XXX", a continuous training program was launched, to emphasize the contribution of IT security on the compliance. In addition to external regulations, internal regulations such as internal guidelines and operating instructions can also be relevant to adhering to compliance measures. In compliance with laws and regulations, the tool of the focus group brought to light the need to implement both technical and organizational measures. This is because technology is not always the cause of data loss; human behavior also plays a critical role.

3.2 Adjustment

At this point, the moderator asked for the contribution of all the participants (employees of 'XXX') for the drafting of an adjustment plan aimed at developing awareness of the potential consequences deriving from the assumption of incorrect (non-compliant) behavior. The adjustment phase generated a remediation plan or the implementation of the adjustment to the GDPR in terms of changes to organizational and technological models as well as to those of behavior. This plan considered lessons learned from mistakes, so in practical terms the unethical behavior of the employee who shared his username and password to colleagues in the office was recognized in the plan as an error not to be repeated.

3.3 Maturity

The last phase of the intervention involved the dissemination and sharing of a new wealth of organizational knowledge. The maturity phase corresponds to the follow up of the adjustment plan. The initial focus group has been transformed into a continuous improvement workgroup for the company "XXX" that mainly deals with defining the training needs of new hires and creating, in collaboration with the consultants, the so-called "training pills" lasting about 20 minutes, uploaded to the cloud. The employees themselves develop the content. As observed by an employee: "*It is better if a colleague explains certain topics to you than a superior or a consultant*". A monitoring system was also envisaged that made it possible to check whether all employees had taken advantage of the training pills. The key officers, on the other hand, with the collaboration of the consultants, contributed to defining the contents of the specialized training that is different from the role covered by each employee.

4. Conclusions

This manuscript contributes to the unethical behavior's literature focusing on unaware behavior and stressing the role of knowledge sharing behaviors on the process of learning from error within organizations.

Case study focused on the data protection that is multidimensional concept. It has a broad meaning and emphasizes a change of perspective: the underlying problem is not simply to be in possession of sensitive data, but to be able to manage them in the right way. It therefore places the emphasis on a process dimension rather than content. In fact, findings have shown that the expressions and concepts that emerged from the interviews, it's possible to detect signs of employee behavior in the management of sensitive data that was in some cases incorrect, in others unethical or fraudulent, and therefore punishable under the GDPR.

Findings case study has shown that communication and knowledge sharing played a central role within of process of prevention of unethical behavior. In fact, the perception and awareness phases were aimed to highlight the existing gap between the behaviors and actions in the cyber security field of the organization's personnel compared to those compliant with the GDPR.

In particular, the sensemaking process implemented by focus group allowed clarifying individual positions, according to a sharing and comparing procedure (Morgan, 1998), for leading to the definition and explanation of subjective meanings. Through this process, the members of the group assigned an area of semantic

correspondence and a specific meaning to the terms and expressions that become part of the discussion. But the most relevant aspect that emerged from the focus group was that before implementing any adaptation plan, a continuous training plan should be provided to help develop the awareness of all employees on cybersecurity through participation, commitment, and relevance. Organizations can create a culture of privacy by educating employees of the role they play in protecting assets and information. Thus, it's necessary a rethinking of the concepts of privacy and protection of personal data, as well as an organizational action that points to the development of a new culture of data in organizations. From an organizational point of view, there's a requirement to comply with the provisions of the regulation. The concept of compliance, however, is often understood by organizations in a static sense, as a best fit between regulatory requirements and organizational action at a given historical moment. However, to comply with the GDPR, organizations are required not only to ensure the implementation of rules and regulations, but also to encourage a set of virtuous behaviors and cultural changes that transform compliance tout court in a process of dynamic and incremental change. In fact, the remediation plan (adjustment phase's output) was realized through an approach "learning from error" and knowledge sharing behaviors, such as the continuous improvement workgroup has represented a useful starting point for improving internal organizational processes defining new practices that contribute to the development of a new and mature awareness on compliance issues.

References

Anand, V., Ashforth, B. E., & Joshi, M. (2004). *Business as usual: The acceptance and perpetuation of corruption in organizations.* Academy of Management Perspectives, 18(2), 39-53.

Asare, S. K., and Wright, A. (1995). "Normative and substantive expertise in multiple hypotheses evaluation". *Organizational Behavior and Human Decision Processes*, 64(2), 171-184.

Becker, B. A., Glanville, G., Iwashima, R., McDonnell, C., Goslin, K., and Mooney, C. (2016). "Effective compiler error message enhancement for novice programming students". *Computer Science Education*, 26(2-3), 148-175.

Becker, M. H. (1970). "Sociometric location and innovativeness: Reformulation and extension of the diffusion model". *American sociological review*, 267-282.

Bell, B. S., and Kozlowski, S. W. (2009). *"Toward a theory of learner-centered training design: An integrative framework of active learning". In Learning, training, and development in organizations* (pp. 283-320). Routledge.

Bell, B. S., and Kozlowski, S. W. (2011). "Collective failure: The emergence, consequences, and management of errors in teams". In Errors in organizations (pp. 128-156). *Routledge*.

Chow, C. W., Deng, F. J., and Ho, J. L. (2000). "The openness of knowledge sharing within organizations: A comparative study of the United States and the People's Republic of China." *Journal of Management Accounting Research*, 12(1), 65-95.

Edmondson, A. (1999). "Psychological safety and learning behavior in work teams". *Administrative science quarterly*, 44(2), 350-383.

Fidel, R. (1984). "The case study method: A case study". *Library and Information Science Research*, *6*(3), 273-288.

Frese, M. (1991). *Error management or error prevention: Two strategies to deal with errors in software design.*

Hofmann, D. A., and Frese, M. (Eds.). (2011). *Error in organizations. Routledge.*

Huy LV, Rowe F, Truex D, Huynh MQ (2012) "An empirical study of determinants of e-commerce adoption in SMEs in Vietnam an economy in transition". *J Glob Inf Manag 20(3):23–54*

Jones, T. M. (1991). "Ethical decision making by individuals in organizations: An issue-contingent model". *Academy of management review,* 16(2), 366-395.

Khorakian, A., and Sharifirad, M. S. (2019). "Integrating implicit leadership theories, leader–member exchange, self-efficacy, and attachment theory to predict job performance". *Psychological reports, 122(3), 1117-1144.*

Khorakian, A., Mohammadi Shahroodi, H., Jahangir, M., and Nikkhah Farkhani, Z. (2019). "Innovative work behavior in public organizations: The roles of ethical and knowledge sharing behaviors". *Creativity Research Journal*, 31(2), 164-173.

Kish-Gephart, J. J., Harrison, D. A., and Treviño, L. K. (2010). "Bad apples, bad cases, and bad barrels: meta-analytic evidence about sources of unethical decisions at work". *Journal of applied psychology, 95(1), 1.*

Ledva, G. S., Vrettos, E., Mastellone, S., Andersson, G., and Mathieu, J. L. (2017). "Managing communication delays and model error in demand response for frequency regulation". IEEE Transactions on Power Systems, 33(2), 1299-1308.

Lewicki, R. J., Poland, T., Minton, J. W., and Sheppard, B. H. (1997). *Dishonesty as deviance: A typology of workplace dishonesty and contributing factors. Elsevier Science/JAI Press.*

Lipshitz, R., Popper, M., and Friedman, V. J. (2002). "A multifacet model of organizational learning". *The journal of applied behavioral science,* 38(1), 78-98.

Longo, M., and Mura, M. (2011). "The effect of intellectual capital on employees' satisfaction and retention". *Information & Management, 48(7), 278-287.*

Morgan, D. L., and Krueger, R. A. (1998). *The focus group guidebook. Sage.*

Mura, M., Lettieri, E., Radaelli, G., and Spiller, N. (2013). "Promoting professionals' innovative behaviour through knowledge sharing: the moderating role of social capital". *Journal of Knowledge Management.*

Murphy, P. R., and Dacin, M. T. (2011). "Psychological pathways to fraud: Understanding and preventing fraud in organizations". *Journal of business ethics*, 101(4), 601-618.

Nonaka, I. (1994). "A dynamic theory of organizational knowledge creation". Organization Science, 5(1), 14–35.

Reason, J. (2000). "Human error: models and management". *Bmj, 320(7237), 768-770.*

Reischauer, G. (2015). "Combining artefact analysis, interview and participant observation to study the organizational sensemaking of knowledge-based innovation". Historical Social Research/Historische Sozialforschung, 279-298.

Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)

Sitkin, S. B. (1992). "Learning through failure: The strategy of small losses". *Research in organizational behavior, 14, 231-266.*

Stake, R. E. (1994). Case study: Composition and performance. Bulletin of the Council for Research in Music Education, 31-44.

Teigland, R., and Wasko, M. M. (2003). "Integrating knowledge through information trading: Examining the relationship between boundary spanning communication and individual performance". Decision Sciences, 34(2), 261-286.

Teigland, R., and Wasko, M. M. (2003). "Integrating knowledge through information trading: Examining the relationship between boundary spanning communication and individual performance". *Decision Sciences*, 34(2), 261-286.

Tsang, J. A. (2002). "Moral rationalization and the integration of situational factors and psychological processes in immoral behavior". *Review of General Psychology,* 6(1), 25-50.

Van Dyck, C., Frese, M., Baer, M., and Sonnentag, S. (2005). "Organizational error management culture and its impact on performance: a two-study replication". *Journal of applied psychology*, 90(6), 1228.

Van Dyck, C., Frese, M., Baer, M., and Sonnentag, S. (2005). "Organizational error management culture and its impact on performance: a two-study replication". *Journal of applied psychology,* 90(6), 1228.

Weiss, H. M., and Brief, A. P. (2001). "Affect at work: A historical perspective". *Emotions at work: Theory, research and applications in management, 133, 171.*

Yin, R. K. (2009). *Case study research: Design and methods* (Vol. 5). *Sage.*

Yu, C., Yu-Fang, T., and Yu-Cheh, C. (2013). "Knowledge Sharing, Organizational Climate, and Innovative Behavior: A Cross-Level Analysis of Effects". *Social Behavior and Personality: An International Journal,* 41(1), 143–156. http://doi.org/10.2224/sbp.2013.41.1.143

Zhao, B., and Olivera, F. (2006). "Error reporting in organizations". *Academy of Management Review,* 31(4), 1012-1030.

Organising and Coordination in Support of Knowledge Work: Examples from Practice

Ludmila Mládková
Prague University of Economics and Business, Prague, Czech Republic
mladkova@vse.cz

Abstract: One of the primary tasks of organisations is to find a way to use the knowledge they have at their disposal. From this perspective, organisations have three critical tasks; to manage their employees' personal knowledge, make personal knowledge of employees available for their colleagues, and find how to use the knowledge embedded in artefacts and procedures. Coordination and organising are managerial activities through which organisations orchestrate their employees' work and knowledge and balance reliability and adaptability. Coordination is a horizontal process of orchestration of individual activities and knowledge by rules, guidelines, normative or spontaneous emergent activities of individuals and organising is a vertical process through which organisations make their decisions. This paper aims to discuss how different arrangements of coordination and organising influence work with knowledge. The paper explains the potential, advantages and disadvantages of different arrangements of coordination and organising for work with knowledge and provides examples of organisations that use these arrangements in practice.

Keywords: knowledge, work with knowledge, coordination, organising

1. Introduction

People are social beings, and as such, they live in groups. Organised groups of people with purpose are called organisations (Cambridge Dictionary, 2022). All organisations, regardless of their purpose, must interconnect the activities of their members to achieve their objectives, develop and survive in their environment.

When looking deeper, we see that organisations do not interconnect activities of different members but their knowledge, specifically its creation, sharing and exploitation. Knowledge of an individual even though a highly educated expert is limited. Therefore, the work with knowledge in an organisation is always a collective action. “Our intelligence resides not in individual brains but in the collective mind. To function, individuals rely not only on knowledge stored within our skulls but also on knowledge stored elsewhere: in our bodies, in the environment, and especially in other people. When you put it all together, human thought is incredibly impressive.” (Sloman and Fernbach, 2017, p.7).

From this perspective, organisations have three critical tasks; to manage their employees' personal knowledge, make personal knowledge of employees available for their colleagues, and find how to use the knowledge embedded in artefacts and procedures (Sloman and Fernbach, 2017). Personal knowledge is in employees' heads, often in tacit form, and it is the foundation of employee expertise. The organisation's role is to help the employee develop it and use it in work for the organisation. As an individual's knowledge is always limited and every individual strongly depends on other people's knowledge, organisations must also organise flows of personal knowledge (tacit and explicit) among their members. Up to this, artefacts and procedures in an organisation comprise a considerable amount of knowledge that needs to be released, coordinated, and interrelated with employees' personal knowledge.

Organisations use two tools to orchestrate the activities and work with the knowledge of their employees, coordination and organising. Different arrangements of coordination and organising support or inhibit different knowledge tasks. Even though organising and coordination may be understood as synonyms or one part of the other, we understand them as different sets of activities in our paper. This approach allows us to demonstrate their different impact on knowledge work. Organising is a vertical process through which organisations make their decision. The result of organising is an organisational structure. Coordination is a horizontal process of orchestration of individual activities by rules, guidelines, normative or spontaneous emergent activities of individuals. They interconnect activities and knowledge sharing regardless of hierarchy in an organisation.

This paper aims to discuss how different arrangements of coordination and organising influence work with knowledge. The paper explains the potential, advantages and disadvantages of different arrangements of coordination and organising for work with knowledge and provides examples of organisations that use these arrangements in practice.

2. Background

2.1 Knowledge and Organisations

In our paper, we understand organisations as entities that depend on the division of cognitive labour (Sloman and Fernbach, 2017, p. 12), e.g. as entities dependent on the knowledge they have at disposal and the work with it (Bedgood, 2022).

We agree with Sloman and Fernbach (2017, p. 12) that "The secret to our success is that we live in a world in which knowledge is all around us. It is in the things we make, in our bodies and workspaces, and in other people" (Sloman and Fernbach, 2017, p. 12) and with von Hayek (1945) that "Knowledge is not, and cannot, be concentrated in a single mind, and no single mind can specify in advance what kind of practical knowledge is going to be relevant, when and where". We also believe that "Sharing skills and knowledge is more sophisticated than it sounds. Human beings don't merely make individual contributions to a project, like machines operating in an assembly line. Rather, we are able to work together, aware of others and what they are trying to accomplish. We pay attention together, and we share goals." (Sloman and Fernbach, 2017, p. 13). "Organizational success depends on adopting the learning processes using various mechanisms and technologies" (Adel Odeh et al., 2021, p.11). From this perspective, organisations are environments where people come together and together share and develop knowledge.

"The implementation of Knowledge Management (KM) supports business organizations to achieve both process outcomes and organizational outcomes" (Usman et al., 2021, p.15). Organisations have three critical tasks concerning work with knowledge; to manage their employees' personal knowledge, make personal knowledge of employees available for their colleagues, and find how to use the knowledge embedded in artefacts and procedures (Sloman and Fernbach, 2017).

2.2 Coordination and organising

Coordination and organising are sets of activities that allow organisations to manage their division of labour, cognitive labour and knowledge. To organise means to "arrange systematically" (Dictionary, 2022a) and "organising is understood as a managerial function that arranges people and resources to work toward a common goal. It identifies who is to do what and who is in charge of whom (Schermerhorn, 2014, p.208-209). Schermerhorn (2014) goes on explanation "When managers organise things, they arrange people and jobs into meaningful working relationships. They clarify who is to do what, who is in charge of whom, and how different people and work units are supposed to cooperate. This creates what we call the organisation structure, a formal arrangement that links the various parts of an organisation" (Schermerhorn, 2014, p. 209).

Coordination is defined as "organisation of the different elements of a complex body or activity so as to enable them to work together effectively" (Dictionary, 2022b) or as the process through which people arrange actions in ways that they believe will enable them to accomplish their goals (Cannon-Bowers et al., 1995; Weick, 1979).

Organising and coordination are often defined vaguely as interrelated terms, sometimes are used as synonyms, or one is superior to the other. For example, by Barnard (1968), organisations are recurring achievements of human coordination (Barnard, 1968), or coordination is the process people use to create, adapt, and re-create organisations (Quinn and Dutton, 2005). Lee (2022) writes, "coordination happens via formally dividing decision-making tasks into smaller components and vertically delegating those components among managers at each hierarchical level" (Lee, 2022, p. 62). Bouty and Drucker-Godard (2019, p. 569) see coordination as "accountability (distribution and assuming of responsibilities), predictability (anticipation of subsequent tasks), and common under-standing (shared perspective on the task)".

Some authors of managerial literature tend to understand coordination as a specific set of activities inside organising (Schermerhorn, 2014, Veber, 2009, Robins and Coulter, 2012).

Birkinshaw (2012) separates the lateral task of coordination with the vertical task of organising, e.g. organising and coordination are two distinct and separated sets of activities, each of which has its purpose in the organisation and its tools (Birkinshaw and Goddard, 2009; Birkinshaw, 2012).

Organising is a vertical process through which organisations make their decisions. Organising defines decision-making rights and competencies, and it results in organisational structure. Coordination is a horizontal process

of orchestration of individual activities by rules, guidelines, normative or spontaneous emergent activities of individuals. They interconnect activities and knowledge regardless of hierarchy in an organisation (Birkinshaw and Goddard, 2009; Birkinshaw, 2012).

Birkinshaw and Goddard (2009) and Birkinshaw (2012) argue that organisations can approach organising (it is called decision-making in the Birkinshaw model) and coordination differently, either in a more traditional way or in a more alternative way. As for coordination, the traditional way is bureaucracy, e.g. a horizontal process of coordination based on normative, standards, rules and processes. The alternative way is emergence, the spontaneous coordination through the self-interested behaviours of independent actors. Traditional organising is represented by a hierarchy, legitimate authority over subordinates. The alternative organising is represented by collective wisdom, the ability to aggregate the expertise of a large number of people. A different approach to organising introduces different adaptability; a different approach to coordination introduces different reliability (Bernstein et al, 2016) and influences the organisation's work with knowledge.

3. Objective and Methodology

This paper aims to discuss how different arrangements of coordination and organising influence work with knowledge. We use the experience of four companies as an example.

The data used in this paper are secondary data from the literature. The literature review on coordination, organising and their tools started with the keyword search in relevant 10 top AIS journals. The additional literature was collected based on relevant citations found in these journals and further keyword searches in other types of academic and practice-oriented resources. Keywords were coordination, organising, hierarchy, emergence, bureaucracy, collective wisdom. The literature review of knowledge management topics followed the same pattern. Keywords were knowledge, work with knowledge, organisational knowledge. This paper covers only the works relevant to this paper.

Companies discussed in this paper were chosen from the pool of companies already known and discussed in the literature on different types of management models. Collection of data about the company started with corporate web pages and materials. This search provided us with basic data about companies and their management. The next step was the key-world search in the EBSCO database. We searched for three fundamental keywords – the name of the company, the company's name with the word management and the name of the company together with the word case. This search provided us with research papers on companies. The third step was the Google search that allowed us to collect data from professional journals and blogs.

In this paper, coordination and organising are perceived in terms of the Birkinshaw model of management models. Organisations can coordinate and organise either in a more traditional way or a more alternative one. We do not work with options between these two. As for coordination, the traditional way is bureaucracy, e.g. a horizontal process of coordination based on normative, standards, rules and processes. The alternative way is emergence, the spontaneous coordination through the self-interested behaviours of independent actors. Traditional organising is represented by a hierarchy, legitimate authority over subordinates. Alternative organising happens by collective wisdom, the ability to aggregate expertise of a large number of people (Birkinshaw and Goddard, 2009; Birkinshaw, 2012).

4. Findings

There are four basic combinations of traditional and alternative ways companies can adopt for coordination and organising; bureaucracy and hierarchy, emergence and collective wisdom, bureaucracy and collective wisdom and emergence and hierarchy. Each of them influences how an organisation works with knowledge in a different way.

4.1 First combination – Bureaucracy and hierarchy

The first combination puts together bureaucracy (coordination) and hierarchy (organising). It is a traditional combination. A typical example of an organisation using this combination is McDonald’s.

As for organising, McDonald’s uses a centralised international structure with power allocated to Mcdonald's headquarters (Prezi, 2022). The centralised global hierarchy is based on performance-based divisions (US, International Lead Markets, High Growth Markets, Foundational Markets and Corporate), functional groups

(People group, Supply chain group), and regional managers who decide on licenses and locations, approve independent distribution and warehouses and control quality. This arrangement enables to direct all activities from CEO down to middle managers, franchisees, restaurant managers and employees and to control the company (McDonald's, 2022b).

Bureaucracy is represented by strong standardisation, various normative and processes and keeps McDonald's services compatible in different regions. "The restaurants do not all have identical menus, but they do have the same mission and accomplish this mission by employing proven processes and methods. These processes and methods have been developed, evaluated, documented, and shared with all employees and franchise owners. Even though the menus may differ, the business practices are the same" (Hurley, 2005). The company works on standardised processes, design and offer where every employee is a part of a puzzle with clearly defined specialised tasks. Activities are planned on job roles, locations and moves. Quality of service is evaluated to clear criteria.

McDonald's orientation to centralised, hierarchical management and bureaucracy that standardises various parts of their operation (food preparation, search for suppliers, quality measures, etc.) directs the company's work with the knowledge to the explicit dimension. The work with tacit knowledge is limited by its high costs of replication and the inability of the firm to appropriate its value (Grant, 2000). McDonald's employees go through a detailed training system. They are perfectly trained for their specialised job. Since July 2018, 1,000,000 young people have participated in training programs (McDonald's, 2022a). Knowledge sharing between employees of different specialisations is not supported. Employees cannot change the system but can propose changes to their managers. Employees who want to get to higher levels of the organisation are offered training, education and leadership development programs (McDonald's, 2022a) and may participate in the Hamburger University, which emphasises socialisation and cultural integration conducive to the replication of organisational routines (Grant, 2000). Due to bureaucracy represented by strict standardisation, a lot of knowledge is embedded in artefacts and procedures, for example, in the specific document called the Bible. McDonald's style of work with knowledge does not call for highly specialised employees with high requirements for training and development. The company's success is based on low-cost replication of its systematised knowledge (Grant, 2000). On the other side, this approach brings the challenge of building barriers to external replication. McDonald's procedures are well known (maybe except for some recipes); thus, as all the major purveyors of systematised knowledge McDonald's invest heavily in brand building (Grant, 2000).

4.2 Second combination – Emergence and collective wisdom

This combination is an alternative combination to the previous one. It is the combination where coordination (emergence) and organising (collective wisdom) are informal and left on employees. Buurzorg, the Dutch healthcare company, can serve as an example. The company was founded in 2006 in response to bureaucratisation of social services in the Netherlands. The vision of the founders was a customer and employee friendly company. "Buurtzorg's organisational structure is simple and flat with no middle management layers, no departmentalisation, minimal back-office functions and minimal employee monitoring and controlling functions. Home care employees are organised in independent, autonomous, self-managing teams with no team leaders and under no line-managerial direction or control" (Kaloudis, 2016, Section A). The decisions happen in the teams, that regularly meet to decide on patient care (visit schedules, timetables, type of care, contact with client) and team administration (salaries, holidays, new hires) (Laloux, 2014).

Buurzorg coordination is emergent, except for a few rules (and medical regulations). The basic rules are: team availability for clients 24 hours 7 days a week, max size of team 12 members, 60% of contracted hours of an individual must be billable, decisions must be collective, tasks and responsibilities are distributed, teams must participate in coaching, team members appraise each other, teams create yearly plans and monitor client satisfaction (Laloux, 2014; Kaloudis, 2016).

Buurtzorg works with knowledge is focused mostly on work with tacit knowledge. The company works primarily with two types of knowledge - professional knowledge and knowledge on management and administration of teams. Nurses who join the company are already professionals who have professional knowledge. Still, when a nurse joins the team, she gets knowledge support and peer-coaching from her team members, if necessary, from regional coaches at headquarters. Knowledge sharing inside teams is very intense, and teams are actually communities of practice (the domain is the care for the client). Knowledge sharing among teams is supported by Buurtzorg Web. Teams can also visit other teams or ask via the Web other teams for knowledge, help and

support. The annual conference meeting takes all teams together. The Buurzorg Web is the primary pool of codified knowledge. It includes Buurtzorg Academy and provides training and e-learning materials (Laloux, 2014; Kaloudis, 2016; Buurzorg, 2022).

As for knowledge on management and administration, Buurtzorg trains individuals and teams in self-management. Solutions-Driven Interaction System (Laloux 2014) helps employees with group decision-making, conducting meetings, active listening, non-violent communication, conflict-resolution, problem-solving and peer coaching (Laloux, 2014; Kaloudis, 2016). Administrative tools, aids, forms are available in the BuurtzorgWeb, the small back office that provides teams with administrative help in finances and contracts (Gray et al., 2015).

Buurtzorg approach based on loosed coordination and organising built on small teams (communities of practice) enables smooth knowledge flow, supports knowledge sharing and development of new knowledge. Since 2006 when founded by five people, the company grew to over 10000 people operating in 25 countries (Buurzorg, 2022).

4.3 Third combination – Bureaucracy and collective wisdom

The combination of traditional coordination (bureaucracy) and alternative organising (collective wisdom) appears in organisations that decided to organise in a loose, non-hierarchical way but did not or failed to release the coordination. The result is a flat organisational structure combined with bureaucracy.

A good example of such an organisation is Zappos, the US online shoe store. In 2014 Zappos adopted a management model based on the concept of holacracy. The concept is inspired by sociocracy, a sort of Quaker meetinghouse decision-making system (Reingold, 2016). Zappos replaced hierarchy by work of circles that operate next to and on top of each other. People do not have jobs; they have "roles". One person can have more roles; similar roles create a circle (Reingold, 2016). Deciding is up to employees in the teams, not managers. So-called "lead links" (leaders) help to assign people to roles but do not decide. Decisions about what each role entails and how various teams should function are instead made by a governing process run by people from each circle. The role of the one who organises and who is organised changes all the time.

The alternative way of deciding is balanced with strict bureaucratic procedures of circle administration, role adjustment and communication (Denning, 2015). These regulations are together with procedures and regulations for meeting management and decision making listed in the so-called Constitution.

Personal learning and growth are one of the company's key values and are supported by a corporate reward system. Employees are motivated to shadow a colleague with the skill they want to learn, demonstrate it successfully in 30 days and then pass the skill test. Most skills translate into an incremental $0.25 to $1/hour increase in hourly wage. Individuals are coached. Personal, professional objectives are discussed with the company head coach. Employees are helped to achieve them via improvement of their accountability, confidence, and planning skills (Cheng, 2013).

The knowledge sharing among individuals is supported through the weekly team meetings, where what went well or wrong, improvements and core values are discussed. Zappos also uses internal wikis and blogs to help employees solve problems together. There are quarterly all-staff meetings where all employees come together to discuss lessons learned and share frequently encountered problems and common solutions. Employees see randomised series of photos of their colleges from different teams on the screen of their departments to stay familiar with them. Conclusion: there are short exercises that help evaluate the strength of the employee's relationship to colleagues and help reinforce the networks of collaboration (Cheng, 2013). The stress on teamwork starts in the recruitment process that involves two interviews - one to assess fit with the job and another to assess cultural fit with the company (Nie & Lennox, 2011).

Zappos is trying to make all the roles, responsibilities and policies of the organisation explicit and stores them in software known as “Glass Frog.”(Denning, 2015). The Constitution serves as a pool of procedures and regulations. Still, the primary stress seems to be on tacit knowledge.

4.4 Fourth combination – Emergence and hierarchy

The last option combines hierarchy (organising) with emergence (coordination). Such companies have centralised deciding but lack typical bureaucratic tools of coordination like job descriptions and design,

guidelines for evaluation, processes, etc. In many cases, this arrangement means that the company is mismanaged by an autocratic manager who tries to manage and control the whole company alone because he does not trust other people. As an example may serve Ford Motor Company after H. Ford forced J. Couzens from the company in 1917. H. Ford was a brilliant engineer and entrepreneur who is highly credited for new managerial techniques such as mass production, standardisation, precise calculations, etc., but many of them were ideas of J. Couzens, company general manager. Ford believed that business does need managers and management, just the entrepreneur and helpers. J. Couzens, before he left, moderated such ideas and actually managed the company, including finances, distribution, marketing, sales and personnel. After his departure, H. Ford had taken every single top-management function into his own hands and developed a specific one-person hierarchy with himself as the exclusive decision-maker on the top. He disregarded not only managers but also managerial tools of coordination (except these in operation) and strictly applied his ideas, firing or sidelining any one of his "helpers," no matter how able, who dared act as a "manager," make a decision or take action without orders from Ford. He misdirected managers, set up their jobs improperly, created a spirit of suspicion and frustration, disorganised his company, and stunted or broke management people. (Drucker and Maciariello, 2008). This led the company to big problems until it was taken over by H. Ford II., the grandson of the founder, in 1944.

This managerial approach does not support work with knowledge at all. Knowledge, its creation and use are limited to the knowledge of the autocratic manager who does not share it with other people. Knowledge of other people, tacit or explicit, is not shared either.

5. Discussion

Examples of organisations from practice discussed in our paper indicate that different combinations of tools of organising and coordination provide distinct support to knowledge work. This result is compatible with the ideas of Usman et al. (2021), who write that internal procedures influence how organisations manage their knowledge.

The combination of emergence and collective wisdom supports work with tacit knowledge (both individual and group) but creates a chaotic environment that does not support codification and where knowledge may be lost. These findings correspond with the idea that decentralised non-hierarchical structures facilitate knowledge creation by motivating people in the organisation to be involved in sharing ideas (Lee and Choi, 2003) and support natural knowledge building (Howells, 2000, Usman et al., 2021, Nonaka and Takeuchi, 1995).

The example of McDonald's shows that bureaucracy combined with hierarchy does not support individual learning and knowledge sharing among individuals, but it supports the creation of codified knowledge. This finding conflicts with the belief that knowledge creation requires flexibility and less emphasis on work rules (Lee and Choi, 2003) and Jamali et al. (2006) and Drucker (1999) statement that the traditional bureaucratic approach is no longer suitable for organisations in a hyper-dynamic environment.

The combination of bureaucracy and collective wisdom helps organisations overcome chaos caused by the implementation of loose organisational structures with formal rules. This concept puts stress on tacit knowledge development and sharing. This finding corresponds with Laloux (2014) and Robertson (2015) ideas.

The combination of emergence and hierarchy in the clear form indicates problems in management, as noted by Drucker and Maciariello (2008). It neither promotes a culture of learning nor collaboration, necessary prerequisites for facilitating knowledge creation and dissemination, as stated by Kothari et al. (2011).

6. In Conclusion

The objective of this paper was to discuss how different arrangements of coordination and organising influence work with knowledge. We used the experience of four companies as an example and showed that different approaches to coordination and organising support different aspects of work with knowledge.

The major limitation of this paper is that every combination of coordination and organising was discussed only on one company; therefore, our paper provides examples from practice, not the result of representative research of the topic. Future papers and research should go deeper and cover the topic in more detail.

References

Adel Odeh, A.H., Ammar, A. and Tareq, A.O. (2021) "The mediation role of the organizational memory in the relationship between knowledge capturing and learning organization". *Cogent Business & Management*, *8*(1), p. 11.

Barnard, C. (1968) *The functions of the executive*, Cambridge, MA: Harvard University Press.

Bedgood, C (2022) "The new elephant in the room: Organizational knowledge." *Industrial Management,* 64(2), pp 18-22, [online] https://web-p-ebscohost-com.zdroje.vse.cz/ehost/detail/detail?vid=8&sid=f30abefb-ebfe-45d3-947f-df9d82f1dc17%40redis&bdata=Jmxhbmc9Y3Mmc2l0ZT1laG9zdC1saXZlJnNjb3BlPXNpdGU%3d#AN=155719241&db=bsu

Bernstein, E., Bunch, J., Canner, N. and Lee, M. (2016) Beyond the holacracy hype. *Harvard business review*, *94*(7).

Birkinshaw, J. (2012) *Reinventing management: Smarter choices for getting work done*, John Wiley & Sons.

Birkinshaw, J. and Goddard, J. (2009) What is your management model? *MIT Sloan Management Review*, *50*(2).

Bouty, I. and Drucker-Godard, C. (2019) "Managerial work and coordination: A practice-based approach onboard a racing sailboat". *Human Relations*, *72*(3), pp.565-587.

Buurtzorg (2022) "Welcome to Buurtzorg", [online] https://www.buurtzorg.com/

Cambridge Dictionary (2022) "Organization", [online], https://dictionary.cambridge.org/dictionary/english/organization.

Cannon-Bowers, J.A., Tannenbaum, S.I., Salas, E. and Volpe, C.E. (1995) "Defining competencies and establishing team training requirements". *Team effectiveness and decision making in organisations*, *333*, p.380.

Cheng K. (2013) "A case study in work environment redesign Delloite University Press", [online] https://www2.deloitte.com/content/dam/insights/us/articles/zappos/DUP345_Case-Study_Zappos_vFINAL.pdf.

Denning, S. (2015) "Is holacracy succeeding at Zappos?" May 23 2015, *Forbes.* [online] https://www.forbes.com/sites/stevedenning/2015/05/23/is-holacracy-succeeding-at-zappos/?sh=6411e53e56dc.

Dictionary (2022a) "Organizing", [online], https://www.google.com/search?client=firefox-b-d&q=organising.

Dictionary (2022b) "Coordination", [online], https://www.google.com/search?client=firefox-b-d&q=coordination.

Drucker, P. (1999) *Management Challenges for the 21st Century*, Harper Collins, New York, NY.

Drucker, P.F. and Maciariello, J.A. (2008) *Management: revised edition*. Collins, New York.

Grant, R.M. (2000) Shifts in the world economy: the drivers of knowledge management. *Knowledge horizons: The present and the promise of knowledge management*.

Gray, B.H., Sarnak, D.O. and Burgers, J.S. (2015) *Home care by self-governing nursing teams: The Netherlands' Buurtzorg Model*. NewYork: Commonwealth Fund, [online], https://www.urban.org/sites/default/files/publication/53626/2000250-Home-Care-by-Self-Governing-Nursing-Teams-The-Netherlands'-Buurtzorg-Model.pdf.

Howells, J. (2000) "Knowledge, innovation, and locations". In J. R. Bryson, P. W. Daniels, N. D. Henry, & J. S. Pollard, *Knowledge, Space, Economy.* (pp. 50-62). London: Routledge,Routledge.

Hurley, T.A. and Green, CW (2005) "Knowledge management and the nonprofit industry: A within and between approach", *Journal of Knowledge Management Practice*, *6*(1).

Jamali, D., Khoury, G. and Sahyoun, H. (2006) "From bureaucratic organisations to learning organisations: an evolutionary roadmap". *The Learning Organization*.

Kaloudis, H. (2016) "A systematic overview of the literature in English on Buurtzorg Nederland:
Part B — The Buurtzorg Organisational and Operational Model", [online], https://medium.com/@Harri_Kaloudis/a-systematic-overview-of-the-literature-in-english-on-buurtzorg-nederland-part-b-the-buurtzorg-189a7e4704b0.

Kothari, A., Hovanec, N., Hastie, R. and Sibbald, S. (2011) "Lessons from the business sector for successful knowledge management in health care: a systematic review". *BMC health services research*, *11*(1), pp.1-11.

Laloux, F. (2014) *Reinventing Organisations: A Guide to Creating Organisations Inspired by the Next Stage in Human Consciousness*, Brussels, Nelson Parker.

Lee, H. and Choi, B. (2003) "Knowledge management enablers, processes, and organisational performance: An integrative view and empirical examination". *Journal of management information systems*, *20*(1), pp.179-228.

Lee, S. (2022) "The myth of the flat start-up: Reconsidering the organizational structure of start-ups". *Strategic Management Journal*, *43*(1), pp.58-92.

McDonald's (2022a) "Skills & Education", [online], https://corporate.mcdonalds.com/corpmcd/our-purpose-and-impact/jobs-inclusion-and-empowerment/skills-and-education.html.

McDonald's (2022b) "McDonalds organizational structure analysis", [online], http://panmore.com/mcdonalds-organizational-structure-analysis.

Prezi (2022) "McDonalds: 4 principles of managements", [online], https://prezi.com/qjw99wjy2god/mcdonalds-4-principles-of-managements/?frame=05375346e221284a78dd4e1932dcaea53dbe9224.

Nie W., Lennox B. (2011) "Case study: Zappos" *Financial Times*, February 16 2011, [online], https://www.ft.com/content/98240e90-39fc-11e0-a441-00144feabdc0.

Nonaka I., Takeuchi, H. (1995) *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation,* Oxford University Press, UK. 1995. ISBN 0-19-509269.

Quinn, R. W. and Dutton J. E. (2005) "Coordination as energy-in-conversation", *Academy of Management Review* 2005, Vol. 30, No. 1, 36–57.

Reingold, J. (2016) "The Zappos Experiment, Fortune, 173(4), pp. 206–214, [online], http://search.ebscohost.com.zdroje.vse.cz:2048/login.aspx?direct=true&db=bth&AN=113500241&lang=cs&site=ehost-live&scope=site/.
Robertson, B.J. (2015) *Holacracy: The new management system for a rapidly changing world*. Henry Holt and Company.
Robins S. P. and Coulter M. (2012) *Management*, Prentice Hall.
Schermerhorn Jr, J.R. (2014) *Exploring Management*, John Wiley & Sons.
Sloman, S. and Fernbach, P. (2017) *The knowledge illusion*, Riverhead Books Penguin Random House LLC, New York, pp. 7.
Usman, S.H., Zaveri, J. and Hamza, A. (2021) "An Integrated View of Knowledge Management Enablers, Components, and Benefits: Comprehensive Literature Review". *Journal of International Technology and Information Management*, *30*(4), pp.1-23.
Veber, Jaromír. *Management: základy, moderní manažerské přístupy, výkonnost a prosperita*. Management Press, 2009.
Von Hayek, F. A. (1945) „The use of knowledge in society", *The American economic review*, 35(4), 519-530.
Weick, K. E. (1979) *The social psychology of organising*, McGraw-Hill, New York.

Factors Facilitating Knowledge Sharing and Transfer in the South African Transport Sector

Donovan Nadison and Enis Elezi
Teesside University, International Business School, Middlesbrough, United Kingdom
V8197017@live.tees.ac.uk
Enis.elezi@yahoo.com

Abstract: The success of a modern public sector depends on knowledge sharing and transfer (KST). This study was motivated by the lack of qualitative studies in the public sector to gain in-depth knowledge of the factors which facilitate KST. While KST is acknowledged to be a critical success factor (CSF) for organisational survival, these factors are under-explored in South Africa (SA). This paper reports on an exploratory study undertaken in the SA public sector to identify the formal and informal practice-based factors which facilitate effective KST. The aim of the study is to investigate two research questions, identify antecedent KST factors in the SA and to investigate the enabling factors which facilitate effective KST amongst employees in the public sector. Qualitative data was collected by semi-structured interviews, guided by the antecedent and enabling research objectives. Data was collected from a purposeful sample of managers in the transport sector. The qualitative interviews were analysed by means of thematic analysis, to interpret the data to identify the CSF which facilitate effective KST in the South African public sector. The study identified two categories of CSF, essential antecedent and complementary enabling practices which combine to facilitate effective KST. Knowledge governance factors, knowledge strategy and change management factors were classified as essential antecedent practices. KST motivation factors and KST enablers, trust, culture, rewards, social networks, and adult learning methods were identified and classified as complementary practices. To solve KST problems, the study elaborates on past research and the blend of complementary and essential practices to facilitate KST in the public sector. The study modifies the literature on KST drivers suggesting how essential and complementary enabling factors facilitates KST.

Keywords: public sector; essential factors; complementary factors; critical success factors; knowledge sharing and transfer

1. Introduction

Knowledge management (KM) is recognised as a critical organisational resource, providing public organisations and the public service with competitive resources. According to Edge (2005) it has the potential to modernise the public sector through its renewal processes. The success of KM in the public sector is however dependent on the efforts that public service organisations put in to foster knowledge sharing and transfer (KST) initiatives among individuals, groups, and organisations (Wang and Noe, 2010).

According to Dayan et al., (2017) and Oluikpe (2012) for KST to be effective, KM must be closely linked to a knowledge strategy because it is the only way to achieve competitive strategy. Zia (2020) supports this view, confirming the importance of a knowledge strategy as an antecedent of effective KM. This literature also confirmed the need for specific KM strategies which combine transactional (managerial knowledge policies) and transformational initiatives (change management) as antecedent KST factors.

Anand et al., (2020) point out that various attempts to deliver KST initiatives have not been effective, while Riege (2005) suggests these exchanges rely on employee willingness and employees' intention to share knowledge. While Zia (2020) points to a knowledge strategy as a critical leadership KST factor, Wang and Noe (2010) however point to the importance of motivation, trust, culture, incentives, and networks as equally critically factors. To date South African KM strategies and practices in state-regional public organisations, defined as a government jurisdiction is an under-investigated area. According to Massaro et al., (2015) factors which facilitate effective KST in the public railway service, have not been systematically investigated. According to Glaser et al., (2019) existing KM learning and policy implementation studies in the railway sector is characterised by traditional engineering, objectivist management approaches. They also argue this area is over-analysed while practice based KST management needs to be studied more deeply. It is a under investigated South African theme in KST. To address the research gap outlined above the following research questions are of interest to the researcher:
RQ1: What are the antecedent KST practices which facilitates KM in the public sector?

RQ2: What are managers' views and perceptions of the enabling factors which facilitate KST in the public sector?
The overarching direction of this study is to identify the antecedent and enabling factors in the public sector in South Africa.

2. Literature Review

2.1 Theoretically framing the Study

The researchers critically reviewed the KM literature, to understand and critique the objectivist-perspective on knowledge, a dominant research approach in the transport industry. Hislop et al., (2018) found this literature to be internally focussed on KST. Transport management scholars (Vigar, 2017; Glaser et al., 2019;) concur, a preference exists in the field towards more conventional objectivist engineering centred on internal KM which is more means-end-rationality orientated. According to Hislop et al., (2018) an alternative practice-based perspective on knowledge is new which is a growing perspective, is an under-investigated area.

2.2 Knowledge Management in the Public Sector

knowledge management in the public sector is an important research context which has the influence to improve public sector reform and renewal. Massaro et al., (2015) published work suggest the public sector field is dominated by education research, pointing out the public sector has disincentives for KST, and few articles investigate key public sector organisations where knowledge delivery is more difficult than in the private sector. This requires a distinct focus and agenda. This problem appears worse in Sub-Sahara Africa, which appears to lag in KM implementation compared to developed nations of the public sector (Yum, 2007).

2.3 Knowledge Management Processes and KST definitions

According to Holsapple and Joshi (2000), KM is characterised by four processes - generation, codification, transfer, and application. Zheng et al., (2010) found that three processes have received the most consensus - knowledge generation, sharing and utilisation. This study will deliberately focus on knowledge sharing processes in the South African public sector. According to Alvi and Leidner, (2001) the terms KM transfer, knowledge dissemination, knowledge share and knowledge exchange is used interchangeably in the literature. This study used the terms interchangeably referring to the process as Knowledge sharing and transfer (KST). While KM is considered more important than knowledge, KST is considered the most important and core KM process (Hislop et al., 2018).

2.4 KST Literature: antecedent and enabling factors

A critical review of the KST literature was undertaken to establish a sound understanding of concepts, factors, differences, drivers, and constructs presented by KM scholars. According to Anand et al., (2020) certain individual, organisational and leadership situations unintentionally hide and hoard KST, including competition in organisations. Anand et al., (2020) suggest it is triggered by individual and organisational motivations. While numerous factors influencing KST in the project environment have been explored, Ghodabi, (2015) suggest the field remains fragmented by many divergent efforts. Ghobadi, (2015) based on Leavitt's organisational model, suggests a framework of drivers is needed to integrate the numerous factors in a single framework.

Public sector research on KST antecedents, point to antecedent factors such as knowledge strategies, policies. management support, change management (McDermott, 1999; Kotter, 2012). According to Foss et al., (2010) knowledge governance is an antecedent factor which stimulates KST effectiveness in organisations. This scholar points out formal governance mechanisms may interact in influencing knowledge sharing outcomes, suggesting it is under-researched. No evidence of similar studies undertaken in the South African public sector was identified from the literature reviewed.

These antecedents' contrast with selective enablers, in which Ghobadi (2015) suggest that people factors (both dependence and trust), structure, technology and tasks related factors impact KST in the technology project environment. Scholars (Ismail et al., 2009 and Zhang, 2016) single out trust and culture as significant enablers amongst team members impacts on KST. Ismail et al., (2009) linked trust to the individual motivation factors, including job satisfaction and self-efficiency enablers. On the other hand, Wiewiora (2009) suggests social communication and documented lessons play a role in inter-team KST. Senge (1990) studies points to the importance and application of adult learning principles in knowledge sharing.

According to Karagoz et al., (2020) rewards alone do not suffice as a KST factor. There is however limited KST enabling studies which value collective cultures, a condition for success as in the case of African heritage, in which African ubuntu is a factor which opposes individualism (Woermann and Engelbrecht, 2019). According to Massaro et al., (2015) few authors undertake empirical research in the Public Sector suggesting regional government jurisdictions are understudied.

2.5 Critical Success Factor Literature

This study explored the CSF literature to understand the concept of CSF and its meaning to bring clarity to the use of the term factors. This is to answer the research question- which factors specifically facilitate KST in the public transport sector in SA? The scholar Daniels (1961) uses the term success factors and points out that it differs from company to company and that each industry has a generic set of success factors. Along the same Rockard (1982) supported the concept of success factors in the management literature, defining and popularising the concept of critical success factors (CSF), also pointed out there are two parts to the term 'critical success factors' (CSF). Firstly, that CSFs (Critical Success Factors) are key areas of activity that should receive constant and careful attention from management and secondly, that CSFs are the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance by the organisation. This study will identify a few key factors or areas where things must go right for the rail business to flourish. Bullen and Rockart (1981) emphasis there should be a small number of CSFs for any given manager, preferably ten or fewer.

3. Research Design

To identify the factors which facilitate effective KST, this study adopts an interpretivist philosophical approach. Using purposeful sampling we interviewed three-unit managers after reaching data saturation. Following Saunders (2016) approach the pilot study collected data through English semi-structured interviews which lasted for 45-90 mins. Consistent with the interpretative paradigm (Ponelis, 2015), this study's strategy of inquiry focused on a single case study, of the Gautrain Management Agency, the only provincial public service with a transport concession in SA. A single case study is employed because of the unexplored nature of KST in a transport concession in SA (Yin, 1984). Braun and Clark's (2006) six step stages of Thematic Analysis (TA) were adopted during data analysis.

4. Findings

The pilot study's data informed the developed two themes of factors, antecedent essential factors, and complementary enabling theme of factors. The antecedent knowledge governance factors identified were knowledge strategy and change management. In addition, respondents' narratives revealed two categories of complimentary enablers - motivation, and several people and organisational enablers. Motivation reflects two types of factors, individual and organisational. Respondents' narratives pointed to the following enabling factors, trust, culture, social networks, and partnerships; rewards and incentives, including adult learning methods. These antecedent knowledge governance factors and the enabling complementary factors are discussed below. The table below presents a template of the findings.

THEMATIC ANALYSIS LEVEL 1 THEMES	THEMATIC ANALYSIS LEVEL 2 SUBTHEMES
ANTECEDENT THEME A KNOWLEDGE GOVERNANCE FACTORS	**ESSENTIAL FACTORS** Sub theme 1: Knowledge policy and strategies Sub theme 2: Change management strategies
ENABLING THEME B MOTIVATION FACTORS	**COMPLEMENTARY FACTORS** Sub theme 1: Individual Motivation Sub theme 2: Organisational Motivation
ENABLING THEME C PEOPLE FACTORS ORGANISATION FACTORS ADULT LEARNING FACTORS	**COMPLEMENTARY FACTORS** Sub theme 1: Trust Sub theme 2: Knowledge Sharing and Transfer Culture Sub theme 3: Rewards and Incentive system Sub theme 4: Social networks and partnership with organisations Sub theme 5: Adult learning Principles and Methods

Figure 1: Final Template – Themes identified through Thematic Analysis (Braun and Clark, 2006)

5. Discussion

5.1 Theme 1: Knowledge strategy and knowledge management implementation

The first theme which emerged from all participants' narratives confirmed the presence of several organisational antecedent challenges and strategies. Respondents commented that staff could not leverage existing internal

knowledge from consultants. This theme contributes significantly towards understanding what the key antecedent knowledge challenges were and how the Transport Authorising Company's leadership intervention through the adoption of the knowledge vision, strategy and policy enabled KST. The policy resourced the organisation and empowered management to initiative practice based KST initiatives. This finding confirms previous studies (McDermott, 1999; Foss et al., 2010; Kotter, 2012) that for firms to achieve KM goals, firms need to provide the conditions that activate and facilitate KM. According to Liao and Wu, (2010) these antecedent factors enable and activates KM factors, break obstacles to knowledge share practices and through change management, persuade staff to share knowledge and experience. This finding confirms the importance of the category of antecedent factors and the significance of leadership policy to enable KST.

5.1.1 Subtheme: New knowledge strategy

All participants mentioned the importance of the knowledge strategy of the organisation to overcome the resistance to knowledge sharing. The studies by Guzman (1987) considered and confirmed that knowledge sharing was undermined by hostility in the work environment because of distrust between consultants and newcomers, surrounding the 'expert-inexperience relationships' (Guzman, 2007:197). This was confirmed by the excerpt by a respondent:

> *'the organisation had lots of consultants when I arrived coming as a permanent employee to work with them. I found staff willing to transfer knowledge but consultants where not willing to share and transfer knowledge. They were probably looking after their own interest and so forth'. (Senior Manager 1b).*

Adverse relations are the consequence of various controversies and disagreements in the early stages of the transport concession, respondents considered the environment hostile to KST. This finding provides evidence how firms need to provide the conditions that activate and facilitate KM change. A respondent confirmed this by excerpts below:

> *'So the first milestone to overcome our challenges was the implementation of a knowledge strategy which required consultants at GMA to transfer the knowledge or needed to have appeared to have transferred knowledge. Most of them did so and also submitted reports of knowledge transferred. It was good because it allowed new commers entering new job functions to look at those reports, they could ask questions then' (Senior Manager 1a).*

> *'So, after the whole strategy thing the second milestone was the structure to support the knowledge transfer, it was then that the knowledge management unit was established, one of the goals was to make sure consultants and staff took active roles in transfer of knowledge' (Senior Manager 1 c)*

5.1.2 Subtheme: Implementing Knowledge Management Change

Several participants highlighted and confirmed leadership commitment to change to implement a new business strategy. They cited the action and commitment from leaders in line with Kotter's (2012) change management theory. During the literature review process this theme was identified but was not associated with knowledge exchange hostility in the workplace. The participants highlighted the importance of leaders in the organisation to share the KM vision, the change strategy to communicate the benefits of KST. This study confirms Kotter's (2012) stages of large-scale change underway, suggesting as participants mentioned that staff need a clear and inspiring change vision from leaders why individuals and the organisations benefit from KST and how KM hoarding affects all. A respondent confirmed this vision for change referring to the CEO of the Case organisation change management message.

> *'Jack our CEO has a clear philosophy around knowledge sharing. He once said that he wanted the organisation to become a knowledge centre where people can come to the GMA and Gautrain to learn from us. I think that influenced our strategy and approach to informal organisational practice and knowledge sharing. That approach of Jack was always based on his vision and change approach. He would say it and we as a team had to make it happen' (Senior Manager 1c)*

5.2 Theme 2: Knowledge sharing and transfer motivation

This second theme of motivation emerged throughout the participants narratives as an enabling factor. They all intentionally mentioned why people who share knowledge must be motivated and why those receiving it must also be motivated to accept it. This finding links and flows with theme 1 as an essential practice dimension (Joyce, Norhia and Robertson, 2003; Joyce, 2005). Motivation was modified through several stages of the thematic

analysis. Several participants confirmed, Vinarski Peretz (2020) views that motivation is a key determinant of work-related behaviour. Respondents mentioned motivation is an internal individual factor and can be driven by external organisational factors. The sub themes 'individual motivational practices' and 'organisational motivational practices' respectively were identified, and its benefits explained. Respondents' data confirmed Feher and Gabor (2006), views that individual motivation derives from mindsets and emotions, while their organisational KST motivation is associated with how established the affiliation is between them and others within the organisation. A respondent in one of the interviews highlighted this experience. '

> *'I was given a clear role as the executive head of knowledge management; this role was also defined in the GMA act which required the establishment of structure and so that I could contact partners to access knowledge. This was very affirming early on in my job. My staff was also given clear roles and functions to support knowledge management' (Senior Manager 1b).*

5.3 Theme 3: Knowledge sharing and transfer enablers

The second objective of the study focus on identifying enablers drawing on Wang and Noe's (2010) framework, in which he identified 28 KST drivers classified into four categories (individual organisational and technology). Respondents highlighted, confirmed several significant enablers, and introduced a new enabler, adult education principles (Knowles (1984).

5.3.1 Subtheme: Trust

Manager's responses and narratives consistently revealed the importance of trust. Participants did not report it as a barrier. Several respondents commented positively on organisational trust for KST, they felt the industry needed to do more to welcome and trust Black newcomers and not fear that they will take experienced professionals' jobs. Studies and work by several scholars point to the significance of trust as a key ingredient in the road map to retain scarce skills and facilitate KST to newcomers in the transport and concession construction industry (Saini et al., 2018). Participants mentioned the importance of prior ties where prior work experience creates social relations and trust. It confirmed social exchange theory (Wang and Noe, 2010). Several participants have mentioned how they experienced trust, some saying it is built on the readiness of individuals to rely on the actions of others and how this trust can potentially compromise other actions to share or not share knowledge. This sub theme was supported by several managers, respondent told their trust story in the excerpt below.

> *'Trust in the types of knowledge relationships is critical. You need to trust who you share information with. This includes the network partners you have and know, if you can trust this partner to share confidential GMA strategies, you do not have to rely on a non-disclosure arrangement before partnership starts, so trust plays a significant role' (Senior Manager 1c).*

5.3.2 Subtheme: Culture

This subtheme was recurring across all narratives during thematic analysis (TA). It was provided as another reason which encouraged KST in the case organisation. Many said it was the insurance for KST. One responded referred to the work of Hofstede and Hofstede's (2005) cultural dimensions, suggesting it must be considered across the public sector and transport sector to understand diverse cultures. Respondents clarified what they believe exactly constitutes a knowledge sharing culture and why it facilitated effective KST. Managers highlighted several personal concerns and issues with regards to culture, some believed it was working well others saying more can be done. During the main study, this factor will be explored in more detail, to understand what culture practices must be retained or changed to ensure effective KST. However, all respondents mentioned the need to shift towards a storytelling culture. This practice-based method may offer new insights into culture, storytelling and KST effectiveness (Hislop et al., 2018). Managers highlighted the following importance about culture in the excerpt below.

> *''The killer of knowledge management has been the culture of silo's; its anti-knowledge and the antidote has been the knowledge management unit which has been mandated to create a new knowledge culture' (senior manager 1 a).*

5.3.3 Subtheme: Rewards structures and incentive system

Some respondents mentioned this factor. It emerged as a recurring theme, however respondents presented contrasting views on incentives. Some suggested policy offers a solution to motivate knowledge sharing, while another suggested less contractual incentive policy arrangements arguing people must be personally motivated to share. This sub theme was included in the a priori list. Several studies related to reward structures and

incentive systems revealed that sharing and reusing knowledge whether its explicit or tacit does not happen automatically (Roberson, Sorensen, and Swan, 2001), people they suggest must be incentivised. To overcome these barriers studies, suggest incentives systems, including both rewards and options including career development (Werr, 2013). Several managers in the company commented extensively in support of this factor. Wang and Noe (2010) suggest social exchange and social capital theories fit well with rewards because promotion, bonus, and higher salary is shown to be positively aligned to the frequency of knowledge contribution, it also improves KST. One manager in the company commented in support of rewards and incentives.

> *'Incentivising people to engage in knowledge sharing is important and is the big question that comes up not only in the GMA but in many organisations, knowledge management is seen as an extra on top of work that people need to do, therefore they don't see the value in doing it, so most organisations is pushing for rewards and incentives.' (Senior Manager 1a).*

5.3.4 Subtheme: Social Networks and Partnership

All respondents confirmed the social network and partnership subtheme. KST, they suggest is increasingly effective and evident through various university formal organisational partnership and related networks at the case organisation. All respondents confirmed they had social networks which provide them access to various technical and social support, professional insights, and resources (Wang and Noe, 2010). They all reported unit related social networks and community of practice groups, which have been enabled by boundary-spanning communication between givers and receivers of knowledge (Cummings and Teng, 2003). All the respondents referred to the growing list and varying types of partnership which facilitates KST. A senior manager confirmed this finding through there lived experience below.

> *'For me informal organisational networks mean opportunity, the chance to interact, to learn and share…Our partnerships and networks in which we share information with external parties, to me is effective. These social networks are critically important' (Senior Manager 1b).*

5.4 Subtheme: Adult learning and methods

All pilot respondents highlighted this subtheme. Senge's (1990) work on the learning organisation support the importance of this learning method during KST. According to Senge (1990) his study confirms the importance and application of adult learning principles. Respondents pointed out how they valued self-learning through the knowledge share sessions. Respondents confirmed how it offered them contextual control during KST. Respondents referred to how motivating self-directed learning was, as evident by Knowles' (1984) research and work. Some respondents mentioned that employees are responsible for their own lives and self-directed learning. These strategies according to several participants promoted interaction between theory and practice, and consistently mentioned the many case studies in which they captured the learnings on doing a concession in the transport sector.

6. Conclusion

This research study met the aims of the pilot study and its two objectives as set out in the introduction of this paper. The first objective was to critically investigate and identify the antecedent themes and related factors. The study clarified and identified the antecedent themes knowledge management and change management factors. The second objective was to examine CSF to identify the factors which facilitates effective KST. This study investigated and identified factors which facilitates KST in the transport public service.

The study confirmed the antecedents, knowledge policy and change management. It contributed to the identification of a fifth enabler, building on Ghobadi's (2015) existing four enabling drivers (people related, structure related, task related, and technology related). It also suggests an optimistic interaction between antecedent and enabling drivers. More research during the main study is needed to understand how the antecedent and enabling factors integrate to facilitate KST.

According to Orlowski's theory (1992) of interaction between people, organisations and technology related factors, integration of these antecedent and enabling themes contribute towards effective Knowledge exchange. This pilot study presents a starting point for transport practitioners, to identify and embed KST practices. Further research in the main study is required to understand and address how these categories of factors combine to facilitate effective KST through the case study method.

References

Alavi, M., & Leidner, D. E. (2001) 'Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. MIS Quarterly, Vol 25, No.1, pp 107−136.

Anand, A., Centobelli, P. & Cerchione, R. (2020) "Why should I share knowledge with others? A review-based framework on events leading to knowledge hiding", Journal of organizational change management, Vol. 33, No. 2, pp. 379-399.

Braun, V. and Clarke, V (2006) 'Using thematic analysis in psychology'. Qualitative Research Psychology, Vol 3, No. 2, pp.77-10.

Bullen, C.V., & Rockart, J.F. (1981) A primer on critical success factors: *Sloan School of Management*, Massachusetts Institute of Technology.

Cummings, J.L., and Teng, B.S. (2003) "Transferring R&D knowledge: The key factors affecting knowledge transfer success". Journal of Engineering Technology Management, Vol. 20, pp 39-68.

Daniel, D.R. (1961) "Management information crisis". Harvard Business Review, Vol 39, pp 111-120.

Dayan, R., Heisig, P., & Matos, F. (2017). Knowledge management as a factor for the formulation and implementation of organization strategy. Journal of Knowledge Management, 21(2), 308-329.

Edge, K (2005) "Powerful public sector knowledge management: a school district example", Journal of Knowledge Management, Vol.9, No.6, pp.42-52.

Feher, P., & Gabor, A. (2006) "The role of knowledge management supporters in software development companies", Software Process: Improvement and Practice, Vol 11, No.3, pp 251–260.

Foss, N.J., Husted, K. & Michailova, S. (2010) "Governing Knowledge Sharing in Organizations: Levels of Analysis, Governance Mechanisms, and Research Directions", Journal of management studies, Vol. 47, No. 3, pp. 455-482.

Glaser, M., Brömmelstroet, M and L. Bertolini (2019) "Learning to Build Strategic Capacity for Transportation Policy Change: An Interdisciplinary Exploration." Transportation Research Interdisciplinary Perspectives 1. doi:10.1016/trip.2019.100006.

Ghobadi, S. (2015) "What drives knowledge sharing in software development teams; A literature review and classification framework", Information Management, Vol 52. No.1, pp82-97.

Guzman, G. (2007) "Sharing practical knowledge in hostile environments: a case study" Journal of Workplace Learning, Vol 20 (3), pp 195-212.

Hislop, D., Bosua, R. and Helms, R. (2018) Knowledge Management in Organisations. A Critical Introduction, 4th edn. UK: Oxford University Press.

Holsapple, C.W. and Joshi, K.D. (2000) "An investigation of factors that influence the management of knowledge in organizations", The Journal of Strategic Information Systems, Vol. 9 Nos 2/3, pp. 235-261.

Hofstede, J.S., and Hofstede, G.J. (2005) Cultures and organisations: Software of the mind. New York, N.Y: McGraw-Hill.

Karagoz, Y., Whiteside, N., & Korthaus, A. (2020) "Context matters: Enablers and barriers to knowledge sharing in Australian public sector ICT projects". Journal of Knowledge Management, *Vol 24, No.8, pp* 1921-1941. Doi: HTTP://dx.doi.org.ezproxy.tees.ac.uk/10.1108/JKM-12-2019-0691

Kotter, J.P. (2012) Leading change. Harvard Business Press.

Knowles, M.S. (1984) Andragogy in Action: Applying modern principles of adult learning. San Francisco, CA: Jossey-Bass.

Liao, S.-H., & Wu, C.-C. (2010) "System perspective of knowledge manage-ment, organizational learning, and organizational innovation" Expert Systems with Applications, Vol 37, No.2, pp 1096–1103.

Ismail, W., Nor K.M. and Marjani, T. (2009) "The role of knowledge sharing practice in enhancing project success", Interdisciplinary Journal of Contemporary Research in Business, Vol. 1 No. 7, pp. 34-52.

Joyce, W.F. (2005) "What really works: Building the 4+2 organisation'. Organisational Dynamics, Vol 34, pp 118-29.

Joyce, W W., Nohria, N. and Robertson, B. (2003) What really works: 4+2 formula for sustained business success. New York: Harper Business.

Massaro, M., Dumay, J. and Garlatti, A. (2015) "Public sector knowledge management: a structured literature review", Journal of Knowledge Management, Vol. 19, No. 3, pp. 530-558.

McDermott, R. (1999) 'Why Information Technology Inspired but Cannot Deliver Knowledge Management,' California Management Review, Vol 41, No.1, pp 103-117.

Oluikpe, P. (2012) "Developing a corporate knowledge management strategy", Journal of Knowledge Management, Vol. 16 No. 6, pp. 862-878.

Orlikowski, W.J. (1992) "The duality of technology: Rethinking the concept of technology in organizations". Organization Science, Vol 3, No.3, pp 398–427.

Ponelis, S. (2015) "Using Interpretive Qualitative Case Studies for Exploratory Research in Doctoral Studies: A Case of Information Systems Research in Small and Medium Enterprises", International journal of doctoral studies, Vol. 10, pp. 535-550.

Rockart, J. (1982) 'The changing role of information systems executive: a critical success factors perspective', Sloan Management Review, Vol 23, No.1, pp 3-13.

Robertson, M., Sørensen, C. & Swan, J. (2001) "Survival of the leanest: intensive knowledge work and groupware adaptation", Information technology & people, Vol. 14, no. 4, pp. 334-352.

Saini, M., Arif, M. and Kulonda, J.D. (2018) 'Critical factors for transferring and sharing tacit knowledge within lean and agile construction processes' Construction and Innovation, Vol18, No.1, pp.64-89.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2016) Research Methods for Business Students 7th Edn: Pearson education Limited.

Senge, P. (1990) The Fifth Discipline. New York: Doubleday.

Vigar, G. (2017) 'The four knowledges of transport planning: enacting a more communicative, trans-disciplinary policy and decision-making'. Transport Policy Vol 58, pp 39–45.

Vinarski Peretz, H. (2020) "A view into managers' subjective experiences of public service motivation and work engagement: a qualitative study", Public management review, Vol. 22, No. 7, pp. 1090-1118.

Wang, S. and Noe, R.A. (2010) 'Knowledge sharing: A review of directions for future research'. Human Resource Management Review, Vol. 20, pp.115-131.

Werr. A. (2013) 'Knowledge Management and Knowledge Consulting': In M. Kipping and T. Clark, T (eds), The Oxford Handbook of Management Consulting. Oxford: Oxford University Press, 509-527.

Wiewiora, A., Trigunarsyah, B., Murphy, G.D. and Liang, C. (2009) "Barriers to effective knowledge transfer in project-based organisations", in McCaffer, R. (Ed.), Proceedings of the 2009 International Conference on Global Innovation in Construction, Loughborough University, Holywell Park, pp. 220-230.

Woermann, M., & Engelbrecht, S. (2019) "The ubuntu challenge to business: From stakeholders to relationholders': JBE. Journal of Business Ethics, Vol.157, No.1, pp 27-44.

Yum HY (2007) "Overview of knowledge management in the public sector. In Managing Knowledge to Build Trust in Government" (Qian H, Mimicopoulos M and Yum HY, Eds), pp. 10-20, United Nations Department of Economic and Social Affairs, UN, New York.

Yin, R.K. (1984) Case Study Research: Design and Methods, 3rd edn. Thousand Oaks, CA: Sage.

Zhang, L. and He, J. (2016) "Critical factors affecting tacit-knowledge sharing within the integrated project team", Journal of Management in Engineering, Vol. 32, No. 2, pp. 04015045-1-04015045-10.

Zheng, W., Yang, B., and McLean, G.N. (2010) "Linking organizational culture, structure, strategy, and organizational effectiveness: mediating role of KM", Journal of Business Research, Vol. 63, pp. 763-71.

Zia, N.U. (2020) "Knowledge-oriented leadership, knowledge management behaviour and innovation performance in project-based SMEs. The moderating role of goal orientations", Journal of knowledge management, vol. 24, no. 8, pp. 1819-1839.

Overcoming the Challenges of Digitalisation in Hungarian Manufacturing Companies

Nóra Obermayer, Viktória Nagy, Viktória Erika Tóth and Dénes Kiss
University of Pannonia, Faculty of Business and Economics, Institute of Management, Department of Management, Veszprém, Hungary
obermayer.nora@gtk.uni-pannon.hu
nagy.viktoria@gtk.uni-pannon.hu
toth.viktoria@gtk.uni-pannon.hu
kiss.denes@gtk.uni-pannon.hu

Abstract: The digitalisation has become an imperative for most organisations and their workforces in our world of emergent and continuous changes. Digital technologies are evolving at the speed of light, such as big data analytics, social media, artificial intelligence, internet of things, etc., and the platform built with these technologies. In this context, digitalisation refers to the adoption of these technologies for communications and business activities into digital ones connecting people, products, services and systems. Recently, studies began to emphasise the significant role of integrating human factors into digitalised workplaces and investigate deeply how well prepared they are — workforces and organisations — for the digitalisation challenges in the era of Industry 4.0. The aim of our research is to provide a survey-based result on digital skills of the workforce influenced by digitalisation and to support organisations to fulfil digitalisation challenges. The data used for the analysis come from a primary online questionnaire survey conducted in the spring of 2021. The questionnaire was completed by managers and white collar workers of Hungarian manufacturing companies (n=621). The analysis is based on quantitative methodology, descriptive statistics and relationship analyses were used. The results showed the identified level of experience of workforces related to digital technologies and the level of development of the organisations.

Keywords: digital technologies, digitalisation, digital competences, manufacturing companies

1. Introduction

In the Industry 4.0 era, the more and more widespread use of digital technologies requires a more complex, comprehensive approach focused on managing human-machine knowledge. The most significant challenge lies in exploiting the true potential of digitalisation that uses knowledge and information sharing and data analysis to promote data-driven decision-making (Natarajan, 2018). The increasing volume of data from multiple business sectors and sources proves that the proper management of data, information and knowledge is critical to corporate life (Abonyi and Miszlivetz, 2016). Digital technologies are not meant to replace human work, but to create collaboration between people and technologies. They are not taking over work done by people, but rather facilitate, accelerate problem solving. No jobs were lost to the emergence of the computer, the product of the third industrial revolution. It only created new ones, and the same future is expected from the fourth industrial revolution. People are able to carry out tasks that machines are simply unable to learn or automate. Due to this fact, it has become necessary to develop and reinforce skills that cannot be relegated to machinery through machine learning or artificial intelligence (Mortensen, 2017).

A workforce in the digital age must have technological, methodological, social and personal competencies and is required to continually develop these (Agolla, 2018). The evolution of manufacturing, aimed at maximising efficiency, has progressed from manual processes to automation on the widest possible scale, which will result in the elimination of unskilled jobs; at the same time, the demand for digitally literate labour will increase (Tabarés et al., 2018). This age will bring new challenges for both enterprises and employees (Kaasinen et al., 2020; Demeter et al., 2019). Controlling new technologies requires new skills and competencies (Obermayer and Tóth, 2020) and a more flexible business environment, as corporate performance is still hugely impacted by the capability and dedication of managers and workforces (Stachová et al., 2019). The human factor must be an integral part of the fourth industrial revolution. The future must be shaped so as to emphasise people, as the most dehumanised form of the fourth industrial revolution does “robotize” human beings (Schwab, 2020).

2. Theoretical background

2.1 Digitalisation

The term “digital transformation” has its roots in the word digitalization, which can be described as a change in the business models of organisations to integrate digital technologies (e.g. the Internet of Things (IoT), Artificial Intelligence (AI), machine learning, Augmented Reality (AR)) for the purposes of innovation in products, services and processes (Machado et al., 2021; Birkner and Máhr, 2016). These technologies are known as SMACIT technologies, which is an abbreviation of Social, Mobile, Analytics, Cloud and the Internet of Things (Shahi and Sinha, 2020). Digital transformation is “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies'' (Vial, 2019:121). Digital transformation consists of three primary stages (Verhoef et al., 2019).

During the first stage, organisations undergo digitalisation, which involves transferring processes (e.g. paper-based processes) and systems to digital platforms. The next stage involves further integration and optimization of digital technologies and IT capabilities for the purposes of developing processes and services. Digital transformation is actually implemented only during the last stage of the process, and involves systematic and comprehensive application of digital technologies. The effects of digital transformation, the scope and speed of current changes, and the emergence of digital technologies have led to a radical transformation of workplaces, resulting in a reduction of demand for workforces carrying out routine, manual tasks (Bertani et al., 2020), which means a reduction of demand for essential workforces (Szabó- Szentgróti et al. 2021). Industry 4.0 and digital transformation are focused mainly on technology, and often ignore the role of digital competencies in the labour force (Kozanoglu and Abedin, 2020). However, the currently developing concept of Industry 5.0 emphasises the creativity of people cooperating with efficient smart technologies (Maddikunta et al., 2021). Questions therefore arise concerning the need to develop the competencies of existing workforces, and the competencies of future workforces who will make up the digital workforce. Digital technologies enhance the autonomy of the workforce, and the demand for workforces with digital competencies is continuously growing (Kozanoglu and Abedin, 2020).

2.2 Human perspective

International (Li et al., 2019) and domestic studies have examined the human-centric aspect of Industry 4.0 (Horváth and Szabó, 2019). This latter study summarises the drives and limitations of adopting Industry 4.0. Drives identified include market competition, expectations from corporate management, productivity, and certain elements of efficiency. One the other hand, there are also limitations such as organisational factors, the current capabilities of enterprises, technological and process integration and the lack of collaboration. Certain human resources and financial sources act as drives, others as limitations. Additionally, SMEs with a capacity to respond to challenges flexibly may gain a competitive advantage, although certain drives and limitations may have different levels of relevance for enterprises of different sizes (Horváth and Szabó, 2019). The necessity for new digital technologies came with increasing requirements for collaboration between human beings and technologies (Manimuthu et al., 2021). Companies have attempted to introduce digital technologies, but their workforces often refuse to cooperate (Nagy et al., 2018). Resistance is apparent mostly among unskilled or semi-skilled workforces carrying out routine tasks, and is generated by their fear of losing their jobs (Sciutti et al., 2018). In many cases, workforces clearly lack knowledge on digital technologies and fear the unknown, do not trust as they worry that the intensification of digitalisation will lead to them losing their jobs because they lack the competencies necessary for handling new technologies (Horváth and Szabó, 2019).

Although some believe that Industry 4.0 will replace the human workforce, manufacturing companies are more likely to use robotics to support workforces. The technology will increase productivity, but will not replace human labour. The number of routine tasks will drop, while the number of tasks involving flexibility, problem solving and custom solutions will increase. A survey by the Massachusetts Institute of Technology (MIT) has found that groups of collaborating humans and robots are potentially more efficient than groups consisting of only humans or only robots (Koleva, 2019). According to a study by PwC Strategy&16 involving 26 countries, 10% of global manufacturing companies can be considered digital champion. This means, among other things, that the way they implement digitalisation is innovative and goes beyond automation. In Asia 19%, in America 11% and in the EMEA region only 5% of manufacturers have reached the level of digital champion.

3. Research method

One of the important findings of earlier studies was that the main obstacles hindering digitalisation from a human resources standpoint were lack of trust and the lack of digital competencies among workforces. In 2021, our research group decided to conduct a quantitative research and the aim was to explore the impact of digitalisation on digital competence of the workforces and the challenges raised by implementing digital technologies. In the course of our research, we aimed to find answers to the following questions:

RQ1. What level of digital competence do workforces possess?
RQ2. How has digitalisation intensified various challenges (like lack of digital competence of the workforce)?

3.1 Data collection

The data used in the analysis are from primary sources, from an online questionnaire survey (Limesurvey) conducted in the spring of 2021. The anonymous questionnaire contained questions in five different categories that could be completed in approximately 15-20 minutes. One of them was Digital technologies, which we have chosen as the main topic of this paper. Questionnaires have been completed by managers and white-collar workers of Hungarian manufacturing enterprises. We have invited more than 50 000 companies to complete our questionnaire; we have queried their e-mail addresses from the database of Bureau van Dijk Orbis. We have selected the target group based on two criteria: firstly they must be Hungarian enterprises, secondly they must be manufacturers.

3.2 Sample

There were 621 evaluable responses in the sample (n = 621). All participating organisations were companies operating in Hungary. The sample is categorised by sector (primary activity), industry (ISIC/International Standard Industrial Classification of All Economic Activities) and size (number of employees).

The questionnaire was completed mostly by manufacturing companies (69%). Based on the ISIC, most of the companies were from the following industries: manufacturing (22.4%), construction (16.6%), wholesale and retail trade (15.6%), Agriculture; forestry and fishing (8.5%), other service activities (10.6%) and professional, scientific and technical activities (6.9%). 11% of respondents were white-collar workers, 89% were managers (71% top management). We have determined the size of the companies based on the number of their employees (Figures 1.).

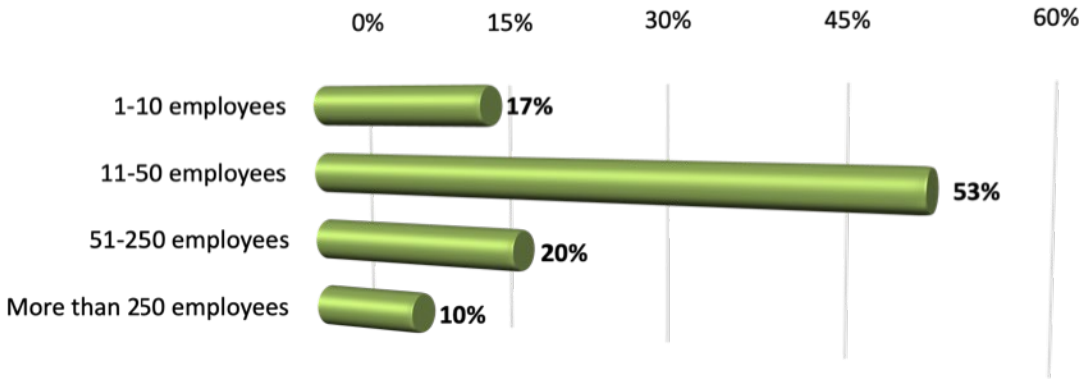


Figure 1: Distribution of employee numbers (%)

More than half (53%) of respondents were small enterprises with 11-50 employees, 20% were medium-sized enterprises with 51-250 employees, 17% were micro-enterprises with no more than 10 employees, and 10% were large enterprises with more than 250 employees. Due to the predominance of SMEs, the sample was representative of the Hungarian corporate sector as a whole.

3.3 Analysis

The analysis is based on quantitative methods, including descriptive statistics and relationship analysis, with Kendall's Tau coefficient (τ). It assumes values in the interval [-1, 1] interval. Results are provided at the 5% significance level. If the p value of V or τ is less than 0.05, the correlation between the two variables shall be considered significant. The absolute value of significant results describes the strength of the correlation (Sajtos

- Mitev 2007): 0: no correlation; [0, 0.2]: weak correlation; [0.2, 0.7]: medium correlation; [0.7, 1]: strong correlation; 1: deterministic correlation. Since τ can be both positive and negative, the associated sign is also relevant, as it determines the type of the relationship. A negative (positive) τ value means that the higher the level of one variable, the lower (higher) the level of the other.

4. Findings

Figure 2 illustrates the level of digital competence of the horizontally fragmented workforce of the company. 75% of companies have employees with basic digital competencies in one (37%) or several (38%) areas, and only 25% of companies have employees with advanced digital competencies in one (23%) or several areas (2%).

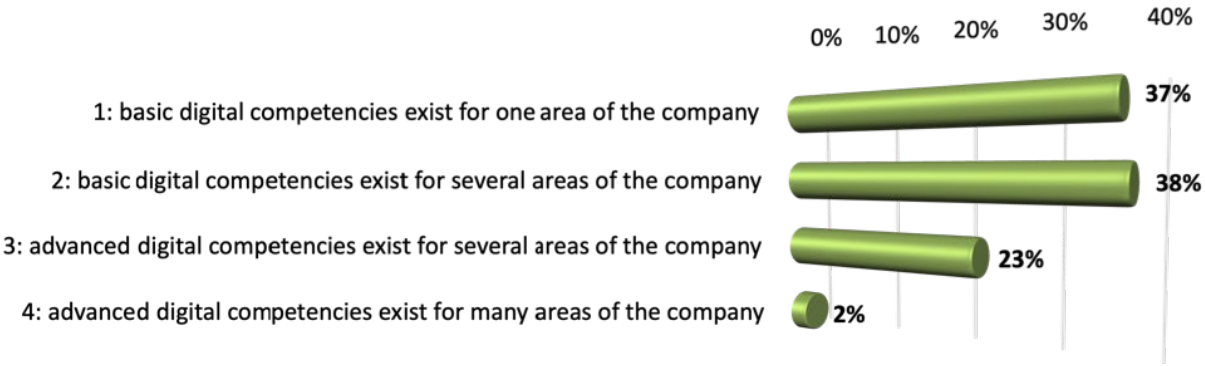


Figure 2: Digital competence in the workforce (%)

Based on the findings above, we stated that the labour force possesses basic digital competence. Analyses have shown that, in accordance with DESI statistics, the majority of respondents only have basic digital competencies, although the results were higher than both the EU (56%) and Hungarian (49%) averages. This means that employees at Hungarian manufacturing companies have above-average levels of digital competence.

The majority of respondents have considered the lack of digital competencies to be a major challenge. 95% of respondents believe that the significance of the challenge has: somewhat increased (33%), greatly increased (49%) or absolutely increased (13%) due to the lack of digital competencies in the workforce (Figure 2.).

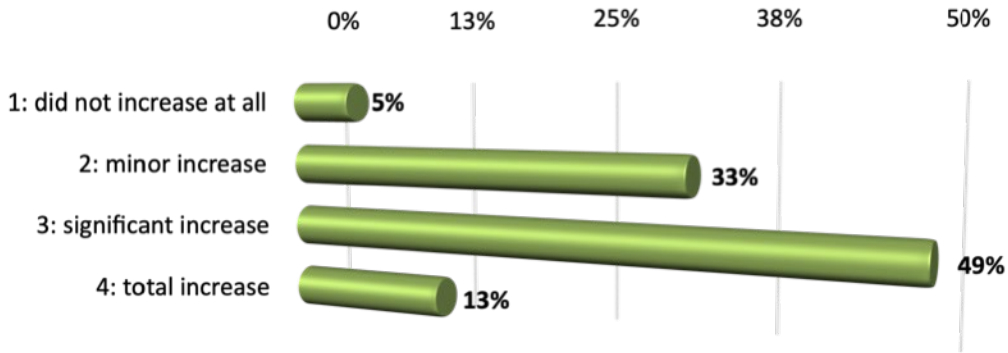


Figure 2: The challenge posed by lack of workforces' digital competencies

The results show that digitalisation has intensified the challenge posed by a lack of digital competence in the workforce.

The diagonal sections of Table 1 show the deterministic correlations with a black background, which means that each variable is in perfect correlation with itself. As for the empty cells, there we have found no significant correlation. Among significant correlations, cells with a red background indicate weak, those with yellow or light green background indicate medium correlation. Since τ can be both positive and negative, the associated sign is also relevant, as it determines the type of the relationship. A negative (positive) τ value means that the higher the level of one variable, the lower (higher) the level of the other.

We have identified many significant correlations, some of them were weak and most of them were medium correlation, but we have found no instances of strong correlations.

Table 1: Results of the correlation study with Kendall's Tau coefficients

		1	2	3.1	3.2	3.3	3.4	3.5
1	**Workforce experience of digital technologies**		**0,418**			**-0,066**		0,077
2	**Level of development of digital technologies at the company**	**0,418**		0,076	0,086			
3.1	**Challenges of 'ad hoc' digitalisation without strategy**		0,076		**0,424**	0,285	0,253	0,298
3.2	**Challenges of lack of workforces' digital competencies**		0,086	**0,424**		0,372	0,350	**0,289**
3.3	**Challenges of distrust towards digital technologies**	**-0,066**		0,285	0,372		**0,529**	0,368
3.4	**Challenges of distrust towards workforces**			0,253	0,350	**0,529**		0,382
3.5	**Challenges of data security**	0,077		0,298	**0,289**	0,368	0,382	

Colour Key: the strength of the significant results is weaker stronger

The more the level of development of digital technologies at the company are, the more the workforce experience of digital technologies (τ = 0.418). This result can be seen almost trivial, but it does not necessarily mean the existence of a digital technology, its application by the workforces.

The more the workforce experience of digital technologies (1) are, the less the challenge posed by distrust towards digital technologies (3.3) (τ = -0.066). It also follows from the result that it is worth developing the digital competence of the workforce, as this will reduce the distrust towards new technologies, so they are more likely welcome changes.

The greater the challenge posed by 'ad hoc 'digitalisation without strategy (3.1) is, the greater the challenge posed by the lack of workforces' digital competencies (3.2) (τ = 0.424). Without an official digitalisation strategy, adequate communication and leadership example about the use of digital technologies, the unskilled workforce is a major challenge.

The greater the challenge posed by distrust towards digital technologies (3.3) is the greater the challenge posed by distrust towards workforces (3.4) (τ = 0.529). If the workforce is distrust towards new digital technologies, management will also be distrust towards the workforces (in an extreme case, there is also a fear that the workforce will harm the digital technology, like robotics).

The greater the challenge posed by the lack of workforces 'digital competencies (3.2) are, the greater the challenge posed by data security (3.5) (τ = 0.289). If workforces are unaware of the use of digital technologies, they are more likely to accidentally, or in the absence of knowledge, act prudently on data security issues, meaning they share data that should not be.

5. Discussion

Today, digitalisation is a priority for the world's manufacturers, particularly in European countries (Qin et al., 2016) - including Hungary. While Hungary is one of the most (5th) highly industrialised countries of Europe, and industry's share of Gross Domestic Product (GDP) was at 24.3% in 2020, the DESI 2021 index shows that Hungary is second to last in integration of digital technologies into corporate activities. Hungarian enterprises perform poorly on all technological indicators, and the uptake of key digital technologies (big data, artificial intelligence, cloud) is low (European Commission, 2021).

Based on the analysis digitalisation at the manufacturing companies strengthen and improve the workforces' experiences at a moderate level. The lack of experience of digital technologies does not give rise to new challenges with implementation, as the managers' attitude to the challenges of embracing new digital

technologies is neutral, even inversely positive to a small degree, which should sooth the bias of managers when it comes to handing new digital technologies to workforces as even if they are unfamiliar with them, they are likely to embrace and use them effectively, with minimal risk to data security. Although decision makers should be wary of deploying new digital technologies without giving enough time for their workforces, as their performance might drop due to the unknown challenges of digital technologies. Our findings, like the research conducted by Obermayer et al. 2021, Müller et al. (2018), Kiel et al. (2017a), and Horváth and Szabó (2019), show that the most difficult obstacle to digitalisation is that companies do not have a digitally competent workforce, so companies do not have or cannot find workforces with appropriate digital competences.

A key factor in the future successful implementation of digitalisation is providing digital attitude training to workforces, which prepares them to accept and trust towards digital technologies. Regular communication with workforces may dispel their doubts. Corporate management can assist workforces in overcoming their distrust when they are worried about new digital technologies and changes because of digitalisation and because they lack of the necessary digital competencies and experience. The company is responsible for providing its workforces with sufficient information and education, and therefore for alleviating resistance to adaptation.

5.1 Limitation and futures studies

The current research has certain limitations that offer opportunities for further research. First, the research's result was based on a sample from Hungarian manufacturing companies. As further study, since the topic is relevant and under-researched, other countries should be analysed. Second, because of the quantitative nature, further qualitative research may be needed to produce more deepen insights. Case study methodology, would make it possible to explore the topic.

Acknowledgements

This work was supported by the TKP2020-NKA-10 project financed under the 2020-4.1.1-TKP2020 Thematic Excellence Programme by the National Research, Development and Innovation Fund of Hungary.

References

Abonyi, J. and Miszlivetz, F. (2016) *Hálózatok metszéspontjain - A negyedik ipari forradalom társadalmi kihívásai.* Savaria University Press, Szombathely

Agolla, J. E. (2018) Human Capital in the Smart Manufacturing and Industry 4.0 Revolution, in Digital Transformation in Smart Manufacturing, *InTechOpen*, London, pp 41-58.

Bertani, F., Raberto, M. and Teglio, A. (2020) The productivity and unemployment effects of the digital transformation: an empirical and modelling assessment. *Review of Evolutionary Political Economy,* Vol 1, pp 329–355.

Birkner, Z. and Máhr, T. (2016), Interpreting innovation – in another way, *Vezetéstudomány/Budapest Management Review*, Vol. 47 No. 10, pp.39-50.

Demeter, K., Losonci, D., Nagy, J. and Horvath, B. (2019) Tapasztalatok az Ipar 4.0-val – egy esetalapú elemzés, *Vezetéstudomány,* Vol 50, No. 4, pp. 11-23.

European Commission (2021) DESI (2021) Digital Economy and Society Index (DESI) 2021 Hungary, [online], https://ec.europa.eu/digital-single-market/en/desi

Horváth D. and Szabó Zs. R. (2019) Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies haveequal opportunities? *Technological Forecasting & Social Change*, Vol 146 (Sept), pp. 119-132.

Kaasinen, E., Schmalfuß, F., Özturk, C., Aromaa, S., Boubekeur, M., Heilala, J., Heikkiläa, P., Kuulaa, T., Liinasuoa, M. And Waltere, T. (2020) Empowering and engaging industrial workers with Operator 4.0 solutions, *Computers and Industrial Engineerin*g, Vol 139, pp. 1-13.

Karacay G. (2018) *Talent Development for Industry 4.0. In: Industry 4.0: Managing The Digital Transformation.,* Springer Series in Advanced Manufacturing. Springer, Cham, pp. 123–136.

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*, Vol 68, pp. 4-19

Koleva, N. (2019) An Empirical Study on Human Resources' Attitude Towards Manufacturing Digitalization. In 2019 *Proceedings of International Conference on Creative Business for Smart and Sustainable Growth* (CREBUS) Sandanski, Bulgaria, pp. 1-5.

Kozanoglu, C. D. and Abedin, B. (2021) Understanding the role of employees in digital transformation: conceptualization of digital literacy of employees as a multi-dimensional organizational affordance, *Journal of Enterprise Information Management*, Vol 34, No. 6, pp. 1649-1672.

Li, D., Fast-Berglund, Å. and Paulin, D. (2019) Current and future Industry 4.0 capabilities for information and knowledge sharing, *International Journal of Advanced Manufacturing Technology,* Vol 105 (Dec), pp. 3951–3963

Machado, C.G., Winroth, M., Almström, P., Ericson Öberg, A., Kurdve, M. - AlMashalah, S. (2021) Digital organisational readiness: experiencesfrom manufacturing companies, *Journal of Manufacturing Technology Management*, Vol 32, No. 9, pp. 167-182.

Maddikunta, P.K.R., Pham, Q.-V. and Liyanage, M. (2021) Industry 5.0: A survey on enabling technologies and potential applications, *Journal of Industrial Information Integration*, 100257

Manimuthu, A., Dharshini, V., Zografopoulos, I., Priyan, M.K. and Konstantinou, C. (2021) Contactless Technologies for Smart Cities: Big Data, IoT, and Cloud Infrastructures, *SN Computer Science*, Vol 2, 334.

Mortensen, D. (2017) Automation may take our jobs – but it'll restore our humanity, [online] *https://qz.com/1054034/automation-may-take-our-jobs-but-itll-restoreour-humanity*

Müller, J.M., Kiel, D. and Voigt, K. (2018) What drives the implementation of Industry 4.0? The role of opportunities and challenges in the context of sustainability, *Sustainability,* Vol 10, No. 1, pp. 247.

Natarajan, G. (2018) *Knowledge management and big data.* Confederation of Indian Industry

Obermayer, N., Csizmadia, T. and Hargitai, D.M. (2021) Influence of Industry 4.0 technologies on corporate operation and performance management from human aspects, *Meditari Accountancy Research*

Obermayer, N. and Toth, V.E. (2020), Organizational dynamics: exploring the factors affecting knowledge sharing behavior, *Kybernetes*, Vol. 49 No. 1, pp. 165-181.

Qin, J., Liu, Y. and Grosvenor, R. (2016) A categorical framework of manufacturing for Industry 4.0 and beyond, *Procedia Cirp*, Vol 52, pp. 173-178.

Schwab, K. (2020) *The fourth industrial revolution 2020*, Crown; Penguin Portfolio, USA; London

Sciutti, A., Mara, M., Tagliasco, V. and Sandini, G. (2018) Humanizing human-robot interaction: On the importance of mutual understanding, *IEEE Technology and Society Magazine,* Vol 37, No. 1, pp. 22-29.

Shahi, C. and Sinha, M. (2021) Digital transformation: challenges faced by organizations and their potential solutions, *International Journal of Innovation Science,* Vol 13, No. 1, pp. 17-33.

Stachová, K., Papula, J., Stacho, Z. and Kohnová, L. (2019) External partnerships in employee education and development as the key to facing industry 4.0 challenges, *Sustainability,* Vol 11, No. 2, 345.

Szabó-Szentgróti, G., Végvári, B. and Varga, J. (2021) Impact of Industry 4.0 and Digitization on Labor Market for 2030-Verification of Keynes' Prediction, *Sustainability* Vol 13, 7703

Tabarés, R., Bartolomé, T., Martelloni, L., Marmo, D. and Shapiro, A. (2018) Towards the popularization of open manufacturing in European industry, *White Paper Version 2.0*, Openmaker Riport

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., Fabian, N. and Haenlein, M. (2021) Digital transformation: A multidisciplinary reflection and research agenda, *Journal of Business Research*, Vol. 122, pp. 889-901.

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., 2019

Entrepreneurial Orientation in Embedding Knowledge-Based Resources in the Organization

Małgorzata Okręglicka
Faculty of Management, Czestochowa University of Technology, Częstochowa, Poland
malgorzata.okreglicka@pcz.pl

Abstract: Knowledge is a key resource for an organization, serving as a source of sustainable differentiation and thus a competitive advantage. Knowledge-based resources are especially valuable to organizations because they are unique and protected against imitation. The advantages of knowledge-based resources mean that investments in these resources translate into benefits for the enterprise, especially when knowledge becomes an attribute of the company as a whole. The ability to embed knowledge in an organization depends on many factors, including those that directly shape the company's organizational culture. One of such factors may be entrepreneurial orientation as a strategic attitude of the firm presented in a given environment. The construct of entrepreneurial orientation should be treated as a multidimensional construct, where the dimensions are: autonomy, proactivity, competitive aggressiveness, innovation and risk taking. Research on the influence of organizational entrepreneurship on building the organization's knowledge resources is relatively rarely presented in the literature, which underlines the scientific contribution of the paper. The main aim of the paper is to study the impact of the level of entrepreneurial orientation on the level of knowledge-based resources embedded in the organization. The implementation of the goal was based on questionnaire surveys conducted in 2022. on the group of 355 enterprises in Poland. The respondents' opinions were diagnosed using a 5-point Likert scale. A managerial approach was used in the study, which constitutes a certain limitation of the research. The results of empirical studies were statistically analysed using tools such as factor analysis and multiple regression. The main research conclusions indicate a positive correlation, of moderate intensity, between the dimensions of entrepreneurial orientation and the level of knowledge-based resources, where the greatest impact was noted in the case of the following predictors: innovation and competitive aggressiveness. The research has implications for management practitioners who, by promoting entrepreneurial attitudes at the organizational level, can manipulate knowledge resources, especially in the area of HR.

Keywords: entrepreneurial orientation, corporate entrepreneurship, knowledge management, knowledge-based resources, perception

1. Introduction

The use of knowledge-based resources (KBR) by modern companies increases the possibility of identification and exploration the entrepreneurial opportunities (Basu et al, 2015). As unique resources that are difficult for competitors to imitate, KBR can make a significant contribution to improving the overall performance of an enterprise and provide a competitive advantage, and also condition the survival and development of new business ventures (Hansen, 2002). It is indicated that the firm's ability to achieve competitive advantage is largely dependent on the ability to collect, accumulate, integrate and, most importantly, use knowledge from the business environment in order to develop new products, services and processes (Yin & Jahanshahi, 2018).

The accumulation, combination and use of KBR is a prerequisite for entrepreneurial and innovative activities (Kaya & Patton, 2011). Possessing this type of knowledge allows enterprises to better predict the nature and commercial potential of market changes, and thus implement an appropriate set of strategic response actions (Caloghirou, Kastelli & Tsakanikas, 2004). This applies to both explicit (declarative) knowledge, obtained from formal education and training programs, and tacit (procedural) knowledge, which can be obtained through direct experience.

In the literature, many studies can be identified that indicate a positive relationship between knowledge management practices and corporate entrepreneurship (Mangenda Tshiaba et al, 2021). Therefore, entrepreneurs, and entire organizations with effective knowledge management practices achieve competitive advantages in terms of organizational and sustainable entrepreneurship. The effectiveness of these practices relates to the acquisition, sharing and application of knowledge within the organization, which then translates into the innovation and efficiency of the firm. The indicated dependence prompts researchers to conduct in-depth research on the impact of an organizational knowledge resources on the intensification of entrepreneurial processes (Qader et al, 2022). However, the reverse relationship has not been fully recognized, i.e. whether entrepreneurial actions and behaviours are conducive to building a knowledge-based organization, described as one that has a chance of success in a turbulent economic environment. Meanwhile, according to the social cognitive theory, human perception is crucial for their behaviour, and people are both products and producers

of their environment, e.g. of the entrepreneurial internal environment of the organization. Hence, this article contributes to the literature by combining an entrepreneurial orientation (EO) perspective with a KBR perspective to argue that the different dimensions of EO contribute to building a knowledge-based organization.

2. Literature review

2.1 Knowledge-based resources in organisation

Organizational resources can be described as the assets and inputs needed to achieve organizational goals (Kaya & Patton, 2011). A resource refers to tangible or intangible contributions to activities that an organization owns and controls. In literature, the concept of resource is often equated with the concept of capability. Admittedly, organizational capability is a broader concept as it refers to the ability to perform a coordinated set of tasks using organizational resources in order to achieve a specific end result. However, in the area of knowledge management, where processes based on information and personal skills, developed through complex interactions between individual elements of the firm's resources, both concepts seem to be very similar in terms of content (Tsai & Jhang, 2010).

The knowledge base is an organisation's resource which seems to serve the most part today as a source of sustainable differentiation and thus a competitive advantage. Knowledge in an organization combines possibilities, capabilities, structured information and technological practices, thanks to which the enterprise can more accurately predict the nature and potential of business changes in the business environment and determine the adequacy of strategic and tactical actions (Wiklund & Shepherd, 2003). KBR are especially valuable as they are protected from imitation by creating barriers of knowledge. They include, among others talents that are elusive and whose relationship with the results is difficult to notice (Nieves, Quintana & Osorio, 2014). The way, speed and efficiency of using knowledge are the most important factors ensuring and maintaining the competitive advantage of the organization, and the imperfection in this respect is the main obstacle in achieving and creating the firm's competitiveness (Omerzel & Gulev, 2011).

From an organizational point of view, knowledge is not a resource accumulated only in the minds of individuals, but is embedded in procedures, processes or organizational structures and in social relationships created with stakeholders. The importance of embedding knowledge in the company and building a corporate knowledge base is emphasized so as to reduce the risk of losing knowledge embodied in units due to e.g. staff rotation (Nieves, Quintana & Osorio, 2014). If knowledge resources become an attribute of the organisation as a whole, and not of individual members of it, they build opportunities for development and success in the long term. Hence, KRB often distinguishes between three main types of intangible organizational resources: human resources, structural resources and relational resources. The first type refers to individuals in an organization and their attributes, which are: knowledge, abilities, skills, experience and innovation. In turn, the second type is intellectual property and infrastructure resources, while the third type is internal and external relations of the firm, including the relational capital of the organization (Krysińska et al, 2018). The enterprise uses these strategic resources to conceptualize, produce and deliver services or products to its customers. Currently, the priority is especially the highest quality human capital, because employees are a strategic and organization-specific means by which firms develop and build relationships and networks (McDonnell et al, 2016). Therefore, top management must mobilize human capital for intra-organizational and inter-organizational integration so that knowledge is embedded and effectively transferred within the organization (Singh et al, 2021). Thus, organizational knowledge is more complex than material resources because it is a socially constructed, intangible resource. KBRs constitute a collective resource at the organizational level that results from the exchange and integration of knowledge of many individuals (Fang et al, 2018).

2.2 Entrepreneurial orientation

EO is an organizational attribute that connects entrepreneurial behaviour with firms ’strategic decision-making styles, methods, and practices (Yin, Hughes & Hu, 2021). EO orientation is crucial for building, integrating, and reconfiguring the internal and external environment so firms can survive challenging situations and helps foster entrepreneurial competencies and firm’s success (Al-Omoush, 2021). EO is an important idea that is significantly added when formulating business strategies, regulations and decision making, further integrating the business approach to general behaviour (Abbas et al, 2021). The idea of EO is also associated with the firm's inclination to move towards new market opportunities (Wendra et al, 2019; Havierniková & Kordoš, 2019).

Krauss et al (2005) indicate that EO is a psychological construct that reflects the intentions and propensities of the main actors in an organization for entrepreneurial tasks and behaviours. It defines the decision-making style and organizational practices, is related to the formulation of the firm's strategy, and shapes the attitudes of individual members of an enterprise, as well as their behaviour (Kollmann & Stöckmann, 2014).

EO can be considered an intangible resource that is embedded in organizational procedures and dispersed among the members of the organization (Lisboa, Skarmeas & Saridakis, 2016). The purpose of EO is to implement in an organization the anticipatory capacity to initiate quick, creative and intelligent responses to adapt to changing market conditions and actively taking advantage of the opportunities. To develop innovative ability to adapt effectively to constantly changing conditions, it is necessary to implement the dimensions of EO, which gives the opportunity to discover and deal with both threats and opportunities in front of competitors (McGrath, 2001; Lemańska-Majdzik, 2019).

A construct is multidimensional when it consists of many related attributes. EO is such a construct, where there are several separate but related dimensions treated as one coherent theoretical concept (Law, Wong & Mobley, 1998). A significant number of researchers lean towards the five-dimensional structure of EO. For example, Voss, Voss, and Moorman (2005) define EO as a firm disposition to engage in behaviours reflecting risk taking, innovation, proactivity, autonomy, and competitive aggressiveness that lead to changes in the organization or market. Similarly, Pearce, Fritz, and Davis (2010) conceptualize the EO concept as distinct but related behaviours that are characterized by innovation, proactivity, aggressiveness, risk, and autonomy.

Firms that are simultaneously involved in specific dimensions of EO are usually seen as dynamic and flexible actors as they are well prepared to take advantage of new opportunities to bring future goods and services to the market (Purkayastha & Gupta, 2022).

2.3 Entrepreneurial orientation in knowledge-based resources building

KBRs are often used to identify and seize entrepreneurial opportunities as market and technological knowledge strengthen the relationship between EO and firm's performance (Wiklund & Shepherd, 2003). It confirms the positive interaction between KBR - such as market and technology knowledge - and the firm's entrepreneurial activity, which in turn translates into better results. Presenting a high level of market and technological knowledge is an important determinant of undertaking entrepreneurial corporate activities. Moreover, some authors emphasize that not only having extensive KBR, but also developing knowledge through organizational learning, can strengthen an important relationship between entrepreneurial activities and firm performance (Covin, Green & Slevin, 2006).

Corporate entrepreneurship requires constantly fresh, innovative perspectives, and KBR, firmly embedded in the enterprise, is often difficult to change. In the long perspective, such KBR can become a source of organizational rigidity, delaying the recognition of new opportunities, the development of new processes requiring innovative perspectives, and ultimately its entrepreneurial activity. In order for EO to be sustained, KBR must be constantly renewed and developed. Acquiring knowledge from relationships with other organizations is an important alternative to overcoming organizational inertia as it updates and enriches the KBR of an enterprise (Bojica & Fuentes, 2012).

Sometimes the literature it is suggested the reverse relationship, i.e. involvement in activities and entrepreneurial processes encourages learning the organization, expanding organizational knowledge (Wang, 2008). Such an assumption can be linked to assumptions by social cognitive theory, which explains how behaviour, cognitive and other personal factors, and environmental events act as determinants of interactions. Due to the bidirectional nature of this interaction, humans are both products and producers of their environment (Wood and Bandura, 1989). In addition, observational science and social experiences lead to personality development, creating a sense of self-efficacy. And the actions and reactions of an individual, including in the organization, are almost always influenced by actions observed in others (Bandura, 1988).

EO seems to be linked to KBR in direct and indirect way. The authors, explaining the relationship between organizational entrepreneurship and the firm's performance, point to the ability of internal entrepreneurship to expand the organization's KBR. Entrepreneurially oriented enterprises reconfigure resources, which entails the development of new knowledge. KBR is a link in the process by which corporate entrepreneurship contributes to the firm's performance as the firm's aspiration to be entrepreneurial contributes to enriching / broadening

the knowledge and skills of members of the organization (Simsek & Heavey, 2011). Thus, knowledge-based theory has the potential to explain the origin and maintenance of EO. It conceptualizes knowledge in terms of a process. While the organizational aspects of a firm may influence the creation of knowledge as a resource (Jiang, Wang & Jiang, 2019), the knowledge-building processes of an organization explain why a firm may adopt a particular organisational form and an accompanying set of behaviours, e.g. EO (Nickerson & Zenger, 2004) and further develop and implement organizational knowledge in structures and processes.

Based on these arguments and business environment observations, the main hypothesis states:
Hypothesis 1: Firms that are more entrepreneurially orientated create higher level of knowledge-based resources.

3. Methods

The main aim of the paper is to study the impact of the level of EO on the level of KBR embedded in the organization.

To test main hypothesis, there was collected data from a sample of enterprises in Poland. The research was conducted in early 2022. The research procedure was carried out in stages, i.e. a questionnaire was prepared after an in-depth review of the literature. It consisted of two groups of questions. The first group concerned EO, and the research questions diagnosed the level of EO in each of the five dimensions, according to the classification initially introduced by Lumpkin and Dess (1996), i.e. organizational autonomy (EO1), proactivity (EO2), innovation (EO3), competitive aggressiveness (EO4) and risk taking (EO5). The second group of variables was to determine the level of KBR. It consists of nine sub-variables and the final KBR variable is the mean of the sub-variables. Considering the diversity of approaches to identifying KBR, it was decided to base on the approach proposed by Wiklund and Shepherd (2003) and Bojica and Fuentes (2012), and then appropriate modifications were made, taking into account the purpose of the research.

The selection of the research group was random and convenient. A direct method of data collection was used. After the initial formal analysis and elimination of incomplete or incorrectly completed questionnaires, it was diagnosed that the final research sample covers 355 Polish enterprises. Among the surveyed enterprises, 42.5% were micro-enterprises, 25.4% - small enterprises, 14.3% - medium-sized enterprises and 17.8% - large enterprises, classified according to the size of employment (in accordance with EU guidelines). The vast majority (80.0%) of the surveyed entities are mature firms that have been operating on the market for over 5 years.

The managerial approach was adopted. For all questions (relating both to EO and KBR), the 5-point Likert scale was used where 1 meant “definitely not” and 5 “definitely yes”, as one of the most fundamental and frequently used psychometric tools in social sciences researches (Joshi et al., 2015). The reliability and validity of the research was investigated using Cronbach’s α coefficient, average variance extracted (AVE) and composite reliability (CR). Then, multiple regression model was built to find the link between the independent variable (EO) and the dependent variable (KBR). The multiple regression analysis studies the simultaneous emotions that some independent variables have over one dependent variable, and it is commonly used for predicting and forecasting in management sciences (Turóczy & Liviu, 2012).

4. Results

The first step of research result analysis was determining the level of validity and reliability of the research (Tab. 1), as the concepts used to evaluate the quality of research. For a measure of internal consistency of a group of items a Cronbach’s alpha was used. As the accepted value of Cronbach's alpha is 0.7, it should be indicated that for EO the level of Cronbach's alpha is satisfactory, and for KBR - high. To determine the accuracy of a measure, the validity tests: Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated. Both tests obtained values exceeding the minimum acceptable values. Factor loading for all analysed factors are higher than 0,5 which means the lack of violation of the assumption for convergent validity based on average variance extracted.

Regression analysis was utilized for hypothesis 1 testing, and the descriptive statistics and correlations of the study’s variables are presented in Table 2.

Table 1: Reliability and validity

Variable	Factor loading	Cronbach's α	CR	AVE
Knowledge-based resources		0.91	0.91	0.52
KBR1	0.668			
KBR2	0.731			
KBR3	0.795			
KBR4	0.758			
KBR5	0.783			
KBR6	0.679			
KBR7	0.741			
KBR8	0.574			
KBR9	0.733			
Entrepreneurial orientation		0.78	0.83	0.50
EO1	0.650			
EO2	0.666			
EO3	0.787			
EO4	0.709			
EO5	0.717			

Initially, the correlations between predictors was identifying. Correlations between variables are statistically significant for the p <0.001, and can be described as modest, ranging from r = 0.28 to r = 0.46, which allow to assumed that regression analysis can be prepared correctly.

Table 2: Descriptive statistics and correlation analysis (n=355; p<0.001)

	Mean	S.D.	KBR	EO1	EO2	EO3	EO4	EO5
Knowledge-based resources (KBR)	3.45	0.69	1.00					
EO1	3.95	0.98	0.29	1.00				
EO2	4.05	0.96	0.33	0.37	1.00			
EO3	3.91	1.02	0.37	0.44	0.46	1.00		
EO4	3.59	1.28	0.35	0.28	0.28	0.43	1.00	
EO5	3.52	1.26	0.32	0.31	0.31	0.35	0.45	1.00

The trends in the impact of EO dimensions on KBR implantation in enterprises were assessed using multiple regression analyses. The KBR level was included as dependent variables in the regression. The summary of the multiple regression model (Table 3) confirmed that the entire model is statistically significant (p <0.05). Moreover, the whole model explained 33.2% of variation in the response, which seems to be a satisfactory result.

Within model, all predictors seem to have the positive influence on the KBR with statistical significance. The 100% increase of the particular EO predictors results in the increase from 8,0% to 11,9% of KBR level implemented in enterprise.

Table 3: Multiple regression model summary

R Square	Adjusted R Square	Sum of Squares SS	df	Mean Square MS	Change Statistics			F	p
					SS	df	MS		
0.342	0.332	57.65	5	11.53	111.12	349	0.318	36.21	0.00

n=355	Parameters estimates Sigma-restricted parameterization			
	KBR Param.	KBR Std. Err.	t	p
Intercept	1.555	0.156	9.963	**0.000**
EO1	0.095	0.036	2.615	**0.009**

n=355	Parameters estimates Sigma-restricted parameterization			
	KBR Param.	**KBR Std. Err.**	**t**	**p**
EO2	0.094	0.038	2.443	**0.015**
EO3	0.111	0.040	2.748	**0.006**
EO4	0.119	0.029	4.076	**0.000**
EO5	0.080	0.029	2.762	**0.006**

5. Discussion

Previous studies clearly emphasize that knowledge management practices and entrepreneurship have a significant and positive relationship (Lam et al, 2021). Knowledge is considered an crucial means in the entrepreneurial process (Lattacher et al, 2021). The knowledge-based view implicitly assumes that because knowledge is a key competitive advantage, the higher the investment in knowledge, the greater the benefits for the enterprise. Researchers primarily focused on the assumption that effective knowledge management supports the organization in building KBR, which leads to the improvement of strategic management of the firm and supports the development of its entrepreneurial process (Reus, Ranft & Adams, 2009). Thus, empirically, the relationship has been proven, in which knowledge management and building KBR are conducive to building an entrepreneurial organization. However, it should be remembered that the mutual interdependence between perception, behaviour and action indicated in the social cognitive theory makes members of the organization both products and producers of their environment.

This paper focuses on a much less frequently discussed topic. First, it was recognized that the relationship between KBR and corporate entrepreneurship is two-way in nature. As indicated above, the influence of KBR on EO has been proven many times, while the influence of EO, as a multidimensional construct, on building and renewing KBR was much less frequently undertaken. Meanwhile, in this study, it was possible to confirm the impact of each of the dimensions of EO, i.e. autonomy, proactivity, organizational innovation, competitive aggressiveness and risk-taking in the organization on the development of KBR. This is consistent with previous considerations. For example, Scuotto et al (2022) have indicated that the spread of knowledge within organization is trigged by the entrepreneurial attitude of individuals sharing the enterprises' common aims and dynamic capabilities. In turn, Friesl (2012) has claimed that knowledge production processes constitute the basis for potential opportunities, and EO becomes the basis for the use of this knowledge. Based on this relationship, long-term strategic attitudes are created. According to Hughes et al. (2021), EO modifies organizational forms and stimulates organizational behaviour in order to better use the knowledge initially dispersed among people. Ultimately, this accumulates KBR within the organization. It is also assumed that EO is considered as a dynamic capability. Meanwhile, the dynamic possibilities of an entrepreneurial company may be limited by the KBR owned, prompting the enterprise to search for new information and gather knowledge in order to take advantage of attractive market opportunities. Entrepreneurial firms actively seek, develop and modify KBR, and all dimensions of EO can contribute for building organizational knowledge (Dung et al, 2021).

6. Future research directions and limitations

The conducted research is not free from limitations. Both the results and limitations of this research set the directions for future research. In the paper, a theoretical model was prepared and tested on the basis of data obtained from enterprises operating only in one domestic market. However, it should be remembered that individual markets may be highly specific, which reduces the possibility of generalizing the results to firms operating in the markets of other countries or in specific sectors. Hence, it would be valuable to carry out comparative studies in the future, which would allow the adopted hypothesis to be tested in other countries with a different level of the socio-economic development.

Another research limitation is the way in which the variables are assessed by the respondents of the questionnaire survey. A research tool was used with the application of a limited 5-point Likert scale, and the respondents were representatives of the managerial staff. Therefore, the measurement was subjective, and when analysing the results, one should bear in mind a small number of options in shaping one's own opinion. Moreover, this type of research on human perception in the organization management is not fully conclusive, but mainly indicates trends in a specific research area. It is also difficult to assume that these are the only determinants, hence full research would have to be very extensive. So, future research may seek a more

comprehensive assessment, i.e. for different groups of members of the organization, using a more extensive assessment scale, and deepen them in the form of qualitative research, e.g. in-depth interview.

Finally, it should be noted that this paper focuses on EO-KBR relationship, and there might be additional intervening actors and mechanisms. The study did not test the moderators of the indicated correlation, which are often discussed in different configurations for EO in the literature. In the future, research should be continued with more variables, including mediating or moderating variables. Additional unforeseen circumstances and boundary conditions that may shape the relationship between EDC and KBR building could also be diagnosed.

7. Conclusion and implications

Summarizing the research results, the two-way relationship between EO and KBR should be emphasized. Enterprises should therefore strategically stimulate corporate entrepreneurship, shaping entrepreneurial attitudes and behaviour of all members of the organization, and strive to create, implement and constantly strengthen the organization's KBR. It should be remembered that both analysed variables stimulate each other, which ultimately stimulates business performance. In this sense, the author has also enlarged previous studies which were mostly based on presentations of the influence of KBR on EO.

It can be assumed that the presented results are also important for the practice of entrepreneurship. Managers can apply the methodology used to assess the current levels of individual dimensions of EO in their enterprises in order to diagnose areas that require reinforcement. On the other hand, the constant KBR analysis will help to avoid the stiffness in knowledge resources that may arise if the organization considers these resources to be a constant value. Managers should also be inclined to treat the analysed quantities as dynamic capabilities that require ongoing adjustments and a strategic management perspective.

The implications for management practice are especially visible with regard to small business. In small firms, resources are often particularly limited, and their managers should be aware that acquiring knowledge is a resource-intensive process. KBR acquisition must be a particularly well thought-out process for small businesses. The advantages of building a knowledge-based organization are now undisputed, but managers must analyse and use the adequate tools to create the proper combinations of resources to use the acquired knowledge and translate it into better financial results.

References

Abbas, M.G., Wang, Z., Ullah, H., Mohsin, M., Abbas, H. and Mahmood, M.R. (2021) “Do entrepreneurial orientation and intellectual capital influence SMEs’ growth? Evidence from Pakistan”, *Environmental Science and Pollution Research* (2021).

Al-Omoush, K.S. (2021) “Understanding the impact of intellectual capital on e-business entrepreneurial orientation and competitive agility: an empirical study”, *Information Systems Frontiers*, Vol. Jan. 2021.

Basu, S., Sahaym, A., Howard, M.D. and Boeker, W. (2015) “Parent inheritance, founder expertise, and venture strategy: Determinants of new venture knowledge impact”, *Journal of Business Venturing*, Vol 30, pp 322–337.

Bojica, A.M. and Fuentes, M.M.F. (2012) “Knowledge acquisition and corporate entrepreneurship: Insights from Spanish SMEs in the ICT sector”, *Journal of World Business*, Vol 47(3), pp 397–408.

Caloghirou, Y., Kastelli, I. and Tsakanikas, A. (2004) “Internal capabilities and external knowledge sources: Complements or substitutes for innovative performance?” *Technovation*, Vol 24, pp 29–39.

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*, Vol 30(1), pp 57–81.

Dung, T.Q., Bonney, L.B., Adhikari, R. and Miles, M.P. (2021) “Entrepreneurial orientation and vertical knowledge acquisition by smallholder agricultural firms in transitional economies: The role of interfirm collaboration in value-chains”, *Journal of Business Research*, Vol 137, pp 327–335.

Fang, H., Kotlar, J., Memili, E., Chrisman, J.J. and De Massis, A. (2018) “The pursuit of international opportunities in family firms: Generational differences and the role of knowledge-based resources”, *Global Strategy Journal, Special Issue: Family Firms and Family Governed Multinationals in the Global Economy*, Vol 8(1), pp 136-157.

Friesl, M. (2012) “Knowledge acquisition strategies and company performance in young high technology companies”, *British Journal of Management*, Vol 23(3), pp 325–343.

Hansen, M.T. (2002) “Knowledge networks: Explaining effective knowledge sharing in multiunit companies”, *Organization Sciences*, Vol 13, pp 232–248.

Havierniková, K. and Kordoš, M. (2019) “Selected risks perceived by SMEs related to sustainable entrepreneurship in case of engagement into cluster cooperation”, *Entrepreneurship and Sustainability*, Vol 6, Iss. 4, pp 1680–1693.

Hughes, M., Hughes, P., Hodgkinson, I., Chang, Y.-Y. and Chang, C.-Y. (2021) "Knowledge-based theory, entrepreneurial orientation, stakeholder engagement, and firm performance", *Strategic Entrepreneurship Journal*, pp 1–33.
Jiang, F., Wang, G. and Jiang, X. (2019) "Entrepreneurial orientation and organizational knowledge creation: A configurational approach", *Asia Pacific Journal of Management*, Vol 36(4), pp 1193–1219.
Joshi, A., Kale, S., Chandel, S. and Pal, D.K. (2015) "Likert Scale: Explored and Explained", *British Journal of Applied Science & Technology*, Vol. 7(4), pp 396–403.
Kaya, N. and Patton, J. (2011) "The effects of knowledge-based resources, market orientation and learning orientation on innovation performance: An empirical study of Turkish firms", *Journal of International Development*, Vol 23, pp 204–219.
Krysińska, J., Janaszkiewicz, P., Prys, M. and Różewski, P. (2018) "Knowledge resources development process in business process outsourcing (BPO) organizations", *Procedia Computer Science*, Vol 126, pp 1145–1153.
Lam, L., Nguyen, P., Le, N. and Tran, K. (2021) "The relation among organizational culture, knowledge management, and innovation capability: Its implication for open innovation", *Journal of Open Innovation Technology Market and Complexity*, Vol 7(1), pp 66.
Lattacher, W., Gregori, P., Holzmann, P. and Schwarz, E.J. (2021) "Knowledge spillover in entrepreneurial emergence: A learning perspective", *Technological Forecasting & Social Change*, Vol 166, 120660.
Lemańska-Majdzik, A. (2019) "the factors affecting the level of flexibility in building organizational culture. The perspective of family businesses", 34th International-Business-Information-Management-Association (IBIMA) Conference, pp 11921-11932.
Lumpkin, G.T. and Dess, G.G. (1996) "Clarifying the entrepreneurial orientation construct and linking it to performance", *Academy of Management Review*, Vol 21(1), pp 135–172.
Mangenda Tshiaba, S., Wang, N., Ashraf, S.F., Nazir, M. and Syed, N. (2021) "Measuring the sustainable entrepreneurial performance of textile-based small-medium enterprises: A mediation-moderation model", *Sustainability*, Vol 13, 11050.
McDonnell, A., Gunnigle, P., Lavelle, J. and Lamare, R. (2016) "Beyond managerial talent: 'key group' identification and differential compensation practices in multinational companies", *International Journal of Human Resource Management*, Vol 27(12), pp 1299–1318.
Nickerson, J.A. and Zenger, T.R. (2004) "A knowledge-based theory of the firm - The problem-solving perspective", *Organization Science*, Vol 15(6), pp 617–632.
Nieves, J., Quintana, A. and Osorio, J. (2014) "Knowledge-based resources and innovation in the hotel industry", *International Journal of Hospitality Management*, Vol 38, pp 65–73.
Omerzel, D.G. and Gulev, R.E. (2011) "Knowledge resources and competitive advantage", *Managing Global Transitions*, Vol 9 (4), pp 335–354.
Purkayastha, A. and Gupta, V. K. (2022) "Business group affiliation and entrepreneurial orientation: Contingent effect of level of internationalization and firm's performance", *Asia Pacific Journal of Management*, Vol 39, Iss. 1, pp 173–199.
Qader, A.A., Zhang, J., Ashraf, S.F., Syed, N., Omhand, K. and Nazir, M. (2022) "Capabilities and opportunities: Linking knowledge management practices of textile-based SMEs on sustainable entrepreneurship and organizational performance in China", *Sustainability*, Vol 14, 2219.
Reus, A.L., Ranft, B.T. and Adams, G.L. (2009) "An interpretive systems view of knowledge investments", *Academy of Management Review*, Vol 34(3), pp 382–400.
Scuotto, V., Le Loarne Lemaire, S., Magni, D. and Maalaoui, A. (2022) "Extending knowledge-based view: Future trends of corporate social entrepreneurship to fight the gig economy challenges", *Journal of Business Research*, Vol 139, pp 1111–1122.
Simsek, Z. and Heavey, C. (2011) "The mediating role of knowledge-based capital for corporate entrepreneurship effects on performance: A study of small- to medium-sized firms", *Strategic Entrepreneurship Journal*, Vol 5, pp 81–100.
Singh, S.K., Mazzucchelli, A., Vessal, S.R. and Solidoro, A. (2021) "Knowledge-based HRM practices and innovation performance: Role of social capital and knowledge sharing", *Journal of International Management*, Vol 27, 100830.
Tsai, Y.-Y. and Jhang, J.-R. (2010) "A study of the relationship between knowledge-based resources, organizational learning and dynamic capabilities - The case of solar energy and biotechnology firms in Taiwan", *Proceedings for the Northeast Region Decision Sciences Institute (NEDSI)*, pp 99–104.
Turóczy, Z. and Liviu, M. (2012) "Multiple regression analysis of performance indicators in the ceramic industry", *Procedia Economics and Finance,* Vol. 3, pp. 509–514.
Wang, C.L. (2008) "Entrepreneurial orientation, learning orientation and firm performance", *Entrepreneurship Theory and Practice*, Vol 32(4), pp 635–657.
Wendra, W., Sule, E.T., Joeliaty, J. and Azis, Y. (2019) "Exploring dynamic capabilities, intellectual capital and innovation performance relationship: evidence from the garment manufacturing", *Business: Theory and Practice*, Vol 20, pp 123–136.
Wiklund, J. and Shepherd, D. (2003) "Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium sized business", *Strategic Management Journal*, Vol 24(13), pp 1307–1314.
Yin, M., Hughes, M. and Hu Q. (2021) "Entrepreneurial orientation and new venture resource acquisition: why context matters", *Asia Pacific Journal of Management*, Vol 38, pp 1369–1398.
Yin, M. and Jahanshahi, A.A. (2018) "Developing knowledge-based resources: The role of entrepreneurs' social network size and trust", *Sustainability*, Vol 10, 3380.

Yu, A., Lumpkin, G.T., Praveen, K. and Stambaugh, J.E. (2019) "Autonomy and family business performance: The joint effect of environmental dynamism and national culture", *International Small Business Journal: Researching Entrepreneurship*, Vol 37(2), pp 153–185.

The Dynamics of Power and Micropolitics on Project Management

Johan Olaisen and Birgit Helene Jevnaker
BI Norwegian Business School, Oslo, Norway
Johan.olaisen@bi.no
Birgit.h.jevnaker@bi.no

Abstract: The empirically investigated problem of our paper is: What impact do micropolitics and power have upon the conduct of project management in an organization? The informal power and micropolitics played a massive role in the projects, and personal and relational knowledge appeared in all projects to achieve the expected results. The project manager uses personal networks, personal relations, and mentor's network together with cognitive, affective, and emotional influence as power and politics if needed to achieve expected results. Power and micropolitics were necessary skills and tools for a successful project manager. The findings relate to the manager's intentions. The informal power and micro-politics process are reused in every project because informal power and micropolitics are a part of project work. Power accumulation and wise handling are essential leadership tools for every manager. Employees work for managers who have power over those who do not. The former can get them what they want: visibility, upwards mobility, and resources. Micropolitics and power represent a unique competence (i.e., knowledge, experiences, and attitudes) and tool for handling any project. A democratic and consensus-oriented decision process opens for power games and micropolitics rather than hedging them in more hierarchical organizations. A complex matrix organization involving employees in many projects is also open to micropolitics and power. Micropolitics and power might prolong and complicate decisions processes in ordinary projects and improve processes in fast-track projects. Micropolitics and power might thus both increase and reduce the effectiveness and efficiency of an organization.

Keywords: Power, Micropolitics, Project management, Power games, Power model, Influence

1. Introduction

Norway has a corporate culture for consensus and compromises, fostering micropolitics and power. However, power and politics are considered non-issue in Norwegian project management. This peculiarity is that the Norwegian organization's image is democratic and equal, involving all employees (Olaisen and Revang 2017). Project management is the temporary leadership of teams and the management of working groups compared to more permanent organizational forms. To succeed in project management, you need both to deliver the results and be reappointed by your peers for new projects. The project manager role fosters micropolitics and power in the role intentions and experiences even if not included in any of the role descriptions in any of the four investigated companies. The rules of the project management process are learned on the road as streetwise project tools and attitudes and by that as critical success factors (Olaisen and Revang 2017, 2018).

There is a knowledge gap in project management between what we know and what we do not know about the function of micropolitics and power. Micropolitics and power represent what we formally do not know. However, everybody sees the importance of handling micropolitics and power, and we may then say our problem represents what we do not know. The practical usefulness of the concepts of micropolitics and power for project management is evident, and the theoretical need for knowledge about the concepts is thus also overdue.

The problem of the paper is:

What impact do micropolitics and power have upon the conduct of project management in an organization?

The research problem has resulted in four research questions:

- How do power and micropolitics appear in projects?
- How does the project manager use power and micropolitics to influence the result of his project?
- How are the findings related to the actor's intentions in the projects?
- How do the employees regard the manager's use of power and micropolitics?

The paper is further organized in a methodology, a literature review, findings, discussion, conclusion, practical implications, limitations, and further research.

2. Methodology

We reviewed the literature as the basics for an open survey study of twelve managers to answer the research questions. We followed up the knowledge from the survey study with twelve in-depth interviews with project managers in four Norwegian companies in the oil and gas business, where all activities are based upon project management.

The methodological approach has been to do a survey study as fundamental knowledge for interviewing twelve project managers in four Norwegian hydro, oil, and gas companies. We have little theoretical knowledge about the role of power and micropolitics in projects. The questionnaire survey was done to get a knowledge base of power and politics in projects. We started by surveying the twelve project leaders in a 25 questions questionnaire. The knowledge from the questionnaire was used to make an interview guide with ten questions for a 90-minute personal interview. The sequence of 10 questions is set up in the following way: Question 1 seeks to clarify formal/informal power and micropolitics' definitions to proceed from a joint base. Questions 2 and 3 seek to evaluate the perceived importance of formal power vs. informal power/micropolitics. Questions 4 and 6 try to determine the interviewee's level of knowledge and ability to handle the subjects. We designed the questions to uncover potential gaps between the rated importance of questions 2 and 3 and our skills. Questions 5 and 7 seek to evaluate whether the interviewees are happy with their answers to questions 4 and 6 or whether they would like to learn more. Questions 8 and 9 are phrased as open questions and ask for their own experience. Question 10 is about personal incentives and reward mechanisms for participating in the power and micropolitics game.

The questionnaire and interviews were combined to secure a better validity and reliability for the results. All the companies practice project management throughout the whole organization. We got access to twelve project managers, each handling projects averaging two billion NOK (i.e., 200 million EURO).

3. A selective literature review

3.1 The game concept

Crozier and Friedberg (1979) assume that formal structures will never sufficiently describe or predict individuals' behavior in an organization. The behavior runs in contradiction to traditional theoretical approaches. Assuming that an organization can only be successful by its individuals' combined activities, Crozier and Friedberg's thesis implies that its success is finally not dependent on structures, processes, and procedures. As professional as it might be, this framework always has uncertainties, which individuals will use for their interests. Each actor's primary goal is to increase his control over uncertainty areas, i.e., to become less controllable or predictable. In other words, each actor seeks to accumulate power over others to push through his agenda, which can but must not be in line with the organization's goals since power and micro-politics are informal processes (Kieser and Walgenbach 2007:57). Two fundamental thoughts are hedging the game:

The game's essential rule is that no actor seeks to destroy what he is an integral part of the game. Instead, he must accept a particular organizational framework like a project. The second important parameter is that all actors seek to stay and preferably rise in the organization. The effect of such a structure we do not negate. This ambivalence seems to meet practical experience: a company or a team needs structure, but only partial renunciation of the given framework and the acceptance of uncertainties provide room for change, adjustment, and efficiency according to the formal and informal needs of the stakeholders (Fischer 2005:89).

Significantly, this is eminent in project teams, which require a high level of flexibility and whose matrix - organizations have fundamental conflicts of authority. So, when looking at power and micropolitics in projects, the thoughts mentioned above describe the team's underlying theory and the surrounding organization. The main question is how an actor can best explore and use uncertainties to extend his power. The extension of power will be reused in new projects and strengthen the use of micropolitics and power in projects. The more agility and flexibility, the more power and politics. Delegation and involvement are essential parts of the Norwegian equality model, and equality in this respect offers a paradox of more informal power and politics in addition to rumors and backstage decisions (Olaisen & Revang, 2017) Olaisen and Revang (2018) found that “some of the stakeholders had been talking to each other and the decisions were already taken before the formal meetings."

3.2 Power

> *"Power defines and govern all human relations including all organizations"* (Foucault 2005: 103). *"Power is the potential to allocate resources and to make and enforce decisions"* (HBSP 2005: xi)*." power dressed as a cognitive authority deliver all the results you need*" (Olaisen 1984:47)*." The more bullshit you deal with as a manager the more you need to bend the processes your way*" (Olaisen and Revang 2017:149)." *When you are standing to the shoulders in dirt it is important to keep your head high"* (Interviewed manager)*." The master of the power game is the master of the project"* (Interviewed manager)*.*

We find essential insights about how power constitutes itself in French and Raven (1968). The authors state that seven bases of power exist:

- Legitimate which is solely based on role, position, or title
- Coercive power to negatively sanction a behavior
- Reward power to grant another person what that person desires
- Expert power administers information, knowledge, or expertise
- Information powers are based on the potential to utilize the information
- Referent power which is often regarded as admiration or charisma of a role model
- Incentive power as bonuses, positions, resources

Often, several power bases constitute themselves in the same actor, either openly assigned or hidden (Martin 2003:154). This leads to a further elaborated differentiation of power into formal and informal sections in conjunction with the initial definition. However, no transparent allocation can be made since they are mixed. We may add coalition power, network power, and rhetoric communication power (Olaisen and Revang 2017).

According to Foucault (2005), the relationship power is crucial to influencing today's knowledge society. Foucault stresses the importance of the career pipeline and network relationships on the road to the top. "As a manager you want to come as close as possible to the top, and you do what you have to do to come there" (Interviewed manager). Nonaka (1985:203) concluded in his book "The knowledge-creating company" that personal and relational knowledge handled through power and politics are the key for managers. Olaisen and Revang (2018) concluded that having a leader in a team member of the top management group will secure the transfer of explicit and tacit administrative knowledge needed for resources and decisions. The skills of politics and power are tacit but explicit in their consequences.

3.3 Micropolitics

As per definition, power is a potential that, to be realized, needs a form of expression. Power often expresses itself as micropolitics in organizations: the ability to change, direct, or influence others' behavior without openly ordering or threatening them. In other words, micropolitics describes a way of using formal and informal power to push through our agenda.

The intended outcome is encouraging other people to do what we want them to do, preferably - but not necessarily- through the semblance of their own choice (Bosetzky, 2010). Micropolitics might help, but if not, we do what we need to do to achieve decisions and results (Nonaka 1985, Foucault 2005, Olaisen and Revang 2018). Power and micropolitics in projects are often two sides of the same coin. However, they might also be applied with a Janus face where we both see the smiling face and the revolver face." Tacit and explicit pressure are used in any relations to get what we want" (Foucault 2005:129). "You get an offer so good for your career possibilities that you cannot reject the offer" (interviewed manager)." Somebody is talking to each other at the back office, and what is discussed at the front office is already decided" (Interviewed manager).

3.4 Influence and persuasion

Influence and persuasion are two elements of micropolitics: Influence is a mechanism through which people use power to change behavior or attitudes. Unlike power, influence can produce an effect without the apparent exertion of force, compulsion, or direct command. The strength of one's influence is generally a function of one or another form of power and others' level of dependencies. However, to influence others, one must be open to influence from them; the key is to understand what others want or value (HBSP 2005, 43).

Persuasion is a process that enables a person or group to change or reinforce others' attitudes, opinions, or behaviors. It is essential for success in all relationships - personal and business alike. Persuasion has four

elements: credibility, an understanding of the audience, rhetoric argumentation, and effective communication (HBSP 2005, 73). Credibility is a cornerstone of persuasion. Influence and persuasion are linked to cognitive, affective, and emotional reasons (Olaisen, 1984). Knowing when to show loyalty and when to raise one's voice is a part of persuasion.

4. Findings

4.1 Appearance of power and micropolitics in projects

As one result, all twelve interviewees agree with the definitions of power, informal power, and micropolitics (Question 1). Nothing is added or changed. Hence, we conclude that a common understanding exists and forms the base when answering the subsequent sections.

In all cases, formal power is rated as necessary for controlling the project (Question 2). In 8 out of 12 cases, informal power and micropolitics are rated as very important, and in 4 cases, they are rated as necessary (Question 3). In general, informal power and micropolitics are deemed more important or at least as necessary as formal power. Our finding is generally in line with the theory; Kotter (2012:181) describes an evaluation of organizations empowering employees, resulting in extended use of the accumulated power. Wong (2007:226) conclude that informal power and micropolitics are essential but limited by the hierarchy. Our finding is that the top management does not limit power and micropolitics but encourages it based on their belief in the efficiency of power and micropolitics in project management. Also, it leads to the question of what precisely the formal power among project managers represents.

The experience of using informal power and micropolitics ranges from 4 x good and 8 x perfect (Question 4). The 100% confidence in applying informal power and micropolitics is higher than the knowledge level. The knowledge level about the effect of power and micropolitics ranges from poor (3 cases) to good (3 cases) to 6 outstanding cases (Question 6). Considering that "People generally distrust and fear power and those who seek it" (HBSP 2005:14), the results are remarkable as they could be expected to be lower. On the other hand, the interviewees' group consists only of project managers, each with many years of experience. These managers must have had closer contact with the subject than a randomly chosen group. They are all seeking more competence (Questions 5 and 7 wholly answered with No) and support the conclusion that mastering is vital for the perception and project result. The results show that the knowledge about power and micropolitics is good and that the project managers are ready to use micropolitics and power whenever needed. The managers rank it as their most effective project management tool.

We use preciseness together with expert power to overcomplicate things. The managers agreed, “It is better to be roughly precise than precisely wrong. «If these experts are contractors, the personal agenda is often to justify their positions and extend working contracts. The project manager must restrictively adopt the practical framework to move his project forward and not end up in inefficient theoretical expert exercises. He must rely on his knowledge, experience, and skills to consistently make his project’s target priority. To do this successfully, he needs to have support from key stakeholders. In all the interviews, the support of key stakeholders is essential for running the project and getting enough resources to handle the project's milestones. The stakeholders might represent other companies than the project manager, but these companies might also be the project manager's next job.

Power must be investigated in how far a culture of "democracy and consensus" is open to power processes and micropolitics. The research monograph of Pahlke and Alexander (2009) characterizes Norwegian companies by:

- Flat hierarchies with a consensus and harmony orientation
- Low expression of formal power or strong decision making
- Avoidance of open external conflicts, but allowance of internal conflicts
- Decision processes involve many people, and decisions can permanently be changed.

The findings are entirely in line with the results of our interviews. Accepting that organizations need the power to exist, it can generally be anticipated that their informal counterpart's lack of formal power will be compensated. The more it is unclear who will finally make the call within a considerable team, the more room opens for micropolitics. Consensus-oriented discussions "at the coffee corner" replace open conflict management. The longer the process takes or the more often it changes, the more unclear why decisions are made. These appearances might honorably be called signs of a democratic process. However, in capitalism, a

company is, per se, not set up as a democracy. Leaders are neither elected nor the opinion of the majority finally dominating. Instead, when benchmarked on an international stage, the processes are time-consuming (i.e., costly) and create uncertainty for partners and suppliers. Both aspects have the potential to damage efficiency and effectiveness seriously.

The issue was described as “no badmouthing on my project! All must propose a way forward for success”. Alternatively: “we do behave externally in our project, but we are fighting hard internally," and: “We have to hire communication people for managing the stakeholder politics." Handling the politics decide upon what resources we get," and “We must use our authority for what it is worth. «All the interviewees supported formal and informal politics and power as essential to handling projects.

Most interestingly, the interviewees proposed a new power base: endurance. It seems to lie within persons in the same organization for a long time that everybody anticipates they "must somehow be important." As a result, they are being followed without any visible reason or conspicuous achievement. They are, over time, accepted as cognitive authorities owing to their long experience and the stories of what they have accomplished. In a way, their personal story gives them endurance. The project manager uses these storytellers to convince the project members and stakeholders that “this is the way we are doing business, or “this is business as usual” (interviewed managers).and “this is the way we have achieved our success” (Interviewed manager). The storytellers are however instructed by the project managers about what stories to tell in different settings. Any disagreement might be settled by “this is the way we are doing it around here” or “we have always tried innovative and new ways of doing things. » As a manager expressed, "there is a story for everything, and a good storyteller works like a wandering cognitive authority for any project."

4.2 Active handling of power and micropolitics

Essential points mentioned in the interviews about the usage of informal power and micropolitics are

- The ability to phrase things and the rhetoric to convince
- The knowledge of whom to ask and whom to use
- Acting by example externally and by power internally
- One-on-one conversations within the exemplary network
- Using pipeline networks given on the road up as a manager
- Identifying and using upward mobility among employees
- Using personal relations and stakeholder coalitions
- Using endurance as corporate stories of historical success
- Using political compromises to get a best possible result
- Finding the mix that works for the actual project and actual case

Formal power exertion must be backed up by informal power to work. What is needed is multiple skills and tools found in coalitions and networks. The attitudes and strengths to use the experiences, skills, and tools are required for success. A title, education, or position does not help in a project where the outcome for the members and the project are the two most important factors. A project manager is judged by that outcome and must do what is necessary to achieve the outcome if that is accepted in the corporate culture. All interviewees believed that consensus does not finally drive decisions but is often just created to push through an agreed-upon decision. Decisions are often taken because "somebody has talked together in the back office where everything is decided. «There might be hefty discussions when the project leaders met the stakeholders, but the decisions remained as anticipated.

The most successful actor is the institutional project manager, who controls his stakeholders and makes decisions that he and not necessarily his team can finally justify. The institutional manager knows the game and how to play his cards and knows that the team will appreciate his results. He must keep his career in mind and cannot act entirely independently, but informal power and micropolitics are significant assets used all the time. This institutional manager is the team's hero, and members are lining up both to be on his team and support him. The team members are followers working their way up the pipeline. The followers will never forget who gave them a reward and a position and will keep together through their career and protect each other. There is conservatism in how to handle the project business. However, there is a possibility for change and innovation at the same time since managers are protecting each other from risk and punishment. The balancing of stability and creativity might be the reason for a high degree of effectiveness and efficiency in Norwegian oil and gas

production. All the managers mentioned the fast-track projects where the aim is to finish a project in half of the planned and required time. Firstly, all these managers denied managing fast-track projects then the managers proposed that half of the projects should be fast-track projects and the other half ordinary projects. The fast-track projects were better planned and better staffed, and there was less time for micropolitics but more time for power. The balancing act of ordinary and fast-track projects was also the balancing act of leadership and management through power and micropolitics.

4.3 How are the findings related to the actor's intentions

The actors' intentions raise the following four questions, which are answered elaborately:

- How does power constitute itself (formal/informal), and how does the actor apply it?

In its entirety, power constitutes itself as a sum of formal and informal parts. An actor primarily applies it as a mixture: Pure application of formal power is not sustainable in consensus-driven teams, and informal power alone lacks authority. A project manager is more on the "informal side." A high level of situational awareness must carefully balance the elements of power to push through a case.

- What kind of power - is the manager the actor? What motivates him when applying power?

The affiliative manager who wants to be liked rather than apply power to succeed is often found. It can be assumed that this is the case also for project managers. Avoiding conflicts would be in line with Pahlke and Alexander (2009). The project manager applies power open and directly and indirectly, and hidden. What is his agenda, and how does he influence and persuade?

Within these corporations, power is often applied indirectly and hidden. For a new person in the organization, it can take a considerable amount of time to understand how and why decisions are made, crucial parameters, and who has the authority. Influence and persuasion are often "low profile" and long discussions in long meetings, including virtually everybody. Often, the manager's agenda seems to be consensus and team harmony, giving him informal power to proceed even though he does not fully comply with his team's opinions. It is a fascinating question of how far these rather time-consuming processes move the organizations in a more competitive position than the market or whether the opposite is the case.

- How does an actor express micropolitics?

Actors want to rise in the organization or at least secure their position. The position is often secured by exerting expert or information power, which is used to drive discussions and decisions in a specific direction. In Norwegian organizations, where everybody is heard at length, an expert or information holder has a strong position that can be used for his agenda (i.e., delaying decisions, influencing the allocation of resources, and making himself essential). An institutional manager might use cognitive authority to speed up a process or delay a process and get the decisions the manager wants. The process might be time-consuming and challenging to understand since there are hidden agendas all the time. The institutional project manager muddle through formal and informal power and micropolitics.

4.4 How are the findings related to answering the remaining research questions?

- How do power and micropolitics appear in projects?

The informal power and micropolitics played a massive role in the projects, and personal and relational knowledge appeared in all projects to achieve the expected results. Power and micropolitics appear through main coalitions of stakeholders and project managers talking together in the backroom or forming alliances.

- How does the Project Manager use power and micropolitics to influence the result of his project?

The project manager uses personal networks, personal relations, and mentor's network together with cognitive, affective, and emotional influence as power and politics if needed to achieve expected results. All the project managers use micropolitics and power as a critical success factor and, as such, a tool for successful project management.

- How do the employees regard the manager's use of power and micropolitics?

Employees would work for managers who have power over those who do not. The former can get them what they want: visibility, upwards mobility, and resources. In contrast, subordinates of bosses who have no power are usually dissatisfied with their situation. The upward pipeline is open for those supporting the power and

micropolitics practice. The staffing of fast-track projects is based upon loyalty and long-term knowledge and practice of power and micropolitics. The division into ordinary and fast-track projects is based on the availability of project members trained in using power and micropolitics to achieve their results.

- What organizations foster and hinder power and micropolitics?

A democratic and consensus-oriented culture opens for power games and micropolitics rather than hedging them than more hierarchical organizations. Informal micropolitics and power mean a high potential to prolong and complicate decision processes and significantly reduce or increase efficiency and effectiveness. The Norwegian democratic consensus model and a complex matrix organizational model participating in many projects foster a power and micropolitics game essential for project management. The result fosters a higher degree of effectiveness and efficiency in the projects based upon long-term professional attitudes, experiences, and knowledge, developing a unique competence for handling power and micro-politics in projects.

5. Conclusion

The findings relate well to the manager's intentions. The power and micro-politics process is reused in every project in the way that formal and informal power and micropolitics are a significant part of project work. Actors with a leadership role and cognitive authority power are the primary beneficiaries. The accumulation and wise handling of power and politics are essential leadership exercises for every project manager. Political influence, persuasion, and compromises are also used in all projects. Handling large projects requires balancing leadership and management and understanding power and micropolitics as craft tools. Power and micropolitics were accepted as critical success factors for all the project managers. The managers have developed a unique competence (i.e., knowledge, experiences, and attitudes) in handling power and micro-politics as an essential tool for handling stakeholders, project members, and the end project results. The training in power and micro-politics keep the managers together as a project manager tribe. They secure the recruitment of further project managers and project members trained in handling the tools of power and micropolitics. These are used in new fast-track projects (i.e., projects taking half the time of ordinary projects), serving sound project effectiveness and efficiency.

Although it could be assumed that a flat hierarchy and consensus-oriented decision processes prevent power games, our paper concludes that the opposite is the case. Strong informal power bases exist within all the four investigated companies, positively affecting the efficiency and effectiveness of a project. The main reasons are a lack of discipline and urgency in the Norwegian consensus model for decision-making and a complex matrix organizational model. The result might positively and negatively affect the four companies involved since the companies need more costs (ordinary projects) and fewer costs (fast-track projects) to come to the same conclusions as other companies.

6. Practical implications

Which recommendations can be given for handling the daily project management work subjects? The project manager should make the following clear for his project:

- What does the game look like, who are the actors, and where are the areas of uncertainty?
- Which power and micropolitics bases do each actor have, and how do they constitute?
- What are the relationships (coalitions, dependencies) between the actors?
- Which types of managers are involved, and what drives them?
- Which hidden agendas can be assumed, and how will they be pushed through the project?

In parallel, it is essential, to be honest about one's situation and define the following success factors:

- What is our personal goal? Is it in line with our project's goal?
- What appears to be the minimum / maximum achievable outcome independent of our work order?
- What are our power bases, dependencies, and coalitions?
- Who do we need to influence or persuade, and what is the best way to succeed?
- How do we create a sense of urgency and healthy pressure on the stakeholders?

7. Limitations

The study is done in a Norwegian branch context for oil and gas producing companies, and there is certainly both a cultural and branch bias. Temporary project organization is a key to how these corporations organize their activities which might imply a much higher degree of micropolitics and power games than in more permanently

organized organizations. Norwegian organizations are flat and democratic and might invite micropolitics and power relations more than hierarchical organizations. The respect for solution-based equal professionals versus more position-based elite professionals might also invite more micropolitics and power games.

8. Further research

We need to investigate if the Norwegian model for project management fosters micropolitics power and micropolitics while the hierarchical model hinders micropolitics and power. What are the consequences of different models concerning micropolitics and power? Likewise, we should investigate the corporate culture's power and micro-politics in project management. We should also investigate the costs and benefits of power and micropolitics games in project management.

References

Bosetzky, H., (1988). “Mikropolitik, Machiavellismus und Machtkumulation.” In Mikropolitik. Rationalität, Macht und Spiele in Organisationen, W, Küpper (ed.), 27-38. Opladen: Westdeutscher Verlag.

Crozier, M., and Friedberg, E. (1979). Macht und Organisation. Die Zwänge kollektiven Handelns. Athenaeum, Koenigstein.

Fischer, J. (2005). Macht in Organisationen. Lit Verlag, Muenster.

Foucault, M. (2005). Power. Verso Press, London.

French, J.R. P., and Raven, B. (1968). "The Bases of Social Power." In: Group Dynamics, 3rd ed, edited by Dorwin Cartwright and Alvin Zander, pp. 259-269. Harper & Row, New York.

Glaser, B.G. and Strauss, A, . (1967) The Discovery of Grounded Theory. Adding, San Francisco.

Harvard Business School Press. (HBSP 2005). Harvard Business Essentials: Power, Influence, and Persuasion. Harvard Business School, Boston.

Kieser, A. and Walgenbach, P. (2007). Organisation. Schaeffer-Poeschel, Stuttgart,

Kotter, J. P., (2012). Leading Change. Boston, Harvard Business Review Press, Boston

Lewis, R. D., (2005). When Cultures Collide. Leading Across Cultures. Nicholas Brealey, Boston.

Martin, A., (2003). Verhalten in Organisationen. Kohlhammer, Stuttgart.

Olaisen, J., (1984), Towards a Theory of Information Seeking Behaviour. Ph. D. School of I., UC Berkeley.

Olaisen, J. and Revang, O., (2017). "Working Smarter and Greener ."International Journal of Information Management, Vol 37, No 1, pp 1441-1448.

Olaisen, J. and Revang, O., (2017). "The Dynamics of Intellectual Property Rights“ International Journal of Information Management, Vol 37, No 6, pp 563-589.

Olaisen, J. and Revang, O., (2018).Exploring the Performance of Tacit Knowledge “International Journal of Information Management, Vol 43, No 12, pp 295-304.

Pahlke, J. K. and Thomas, A., (2009). Beruflich in Norwegen. Vandenhoeck & Ruprech, Goettingen..

Wong, Z. (2007). Human Factors in Project Management. John Wiley, New York.

Towards the Essence of Knowledge Research: A Comparative Study of ECKM Papers 2017-21

Johan Olaisen and Birgit Helene Jevnaker
B.I. Norwegian Business School, Oslo, Norway
Johan.olaisen@bi.no
Birgit.h.jevnaker@bi.no

Abstract: The purpose of this paper is to analyze and compare all the academic papers in the proceedings of ECKM in 2017 (Barcelona), 2018 (Padua), 2019 (Lisbon), and the digital conferences in 2020 and 2021. The study classifies the papers according to methodology, analysis, discussion, and conclusion regarding their contribution to the four paradigmatic boxes. The approach uses the five philosophy of science framework and compares this to the content of the research papers. We will use the findings in four representations of knowledge, two typologies of concepts, four paradigmatic classifications, and the concluding framework for knowledge management research. The five conferences heavily emphasize knowledge-itis and instrumental itis and much less on problem-itis. The papers are mostly centered around existing knowledge and accepted methodology and are less related to new problems. The results indicate a conference based upon as-is knowledge and less upon new and often unsolvable issues. The ECKM academic papers in 2017, 2018, and 2019 have relatively low complexity presented in an empirical and materialistic paradigmatic framework through definitive concepts representing a form of atomistic research. The papers in 2020 and 2021 are delivered within a more robust clarified subjectivity and action research-based framework through both definitive and sensitizing concepts. What would ECKM have been with a higher degree of complexity in action and subjective paradigmatic framework through sensitizing concepts representing a form of holistic research? Probably a more creative, engaged, and relevant conference. Probable also a more scientific conference since advances in knowledge demand not living up to the conference expectations data cannot meet. The more critical and green papers in the 2020 and 2021 conferences are open to new perspectives on the choice of methodology, problems, and knowledge. The 2021 conference represents a turning point for critical green and sustainability papers based on clarifying subjectivity through action-based research. The 2021 papers represent the turning point of ECKM into improved relevance through a more critical and constructed research based upon the societal climate crisis and sustainable strategies and business models.

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

1. Introduction

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

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

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

1. Empiricism – is what we are presenting true or false (if true consonance if false dissonance)
2. Criticism – is what we are giving acceptable or not acceptable (if acceptable consonance if not acceptable dissonance)
3. Constructivism – is what we are presenting as adequate or inadequate (if adequate consonance if not adequate dissonance)

4. Pluralism – a triangulation of empiricism, criticism, and constructivism (if congruence consonance if not congruence dissonance)

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

Blumer (1969) argued that research concepts in any social sciences might be divided into definitive concepts and sensitizing concepts. The concepts have an essential role in any scientific inquiry. They are usually the anchor point in the interpretation of findings.

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

The sensitizing concepts have another purpose:
Describe-Explore-Reflect-Participate and Change (A subjective and relative process). Glaser and Strauss (1967) named this process “Grounded-theory-research."

Olaisen (1985) divided any kind of knowledge into four types of knowledge:
1. What we know about defining
2. What we do not know implying
3. What we do not know that we know as a part of
4. What we do not know that we do not know

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

Olaisen (1985) divided the social sciences into four paradigms in a quadrate of harmony versus conflict and objectivity versus subjectivity:
1. The empirical paradigm
2. The materialistic political paradigm
3. The clarified subjective paradigm
4. The action paradigm

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

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

2. Methodology

This paper aims to analyze and compare all the academic papers in the proceedings of ECKM in 2017, 2018, 2019, 2020, and 2021. A total of 542 double-blind reviewed academic papers within a framework of 5000 words each. The approach uses a philosophy of science framework and compares this to the content of the research papers.

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

1. Tornebohm's knowledge, problem, and instrument description (1983)
2. Galtung's scientific perspective triangle (1972)
3. Olaisen's four kinds of knowledge identification (1985)
4. Blumer's two types of scientific concepts (1969)
5. Olaisen's four types of paradigms identification (1985)

This paper has combined (4) and (5) as a pluralistic proposal for future progress in knowledge management research.

Each paper has been classified according to:

1. Problem
2. Methodology
3. Theoretical foundation
4. Propositions or hypotheses
5. Analyze
6. Discussion of results
7. Conclusions
8. Theoretical and practical implications

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

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

3. Knowledge-itis, instrument-itis, and problem-itis

The papers are suffering from "instrument-itis" and to some extent from "knowledge-itis," but they are indeed not suffering from "problem-itis." Problem-oriented research is demanding and requires systematic and logical argumentation (Lawrence 1992). Problem-orientated research might be a weakness for knowledge management researchers. The researchers do the statistical tests well, presenting the data in "nice" total packages as a form of scholarly truth. However, very few results conflict with existing marks. 2 of 3 hypotheses are correct, and 1 of 3 is incorrect. There are many similar hypotheses/propositions (54%) in papers dealing with knowledge sharing and knowledge management, while 61% reach the same result and 39% reach a different outcome for similar propositions and hypotheses. The Popperian falsification process (1973) is used for both explicit and tacit knowledge processes even if 82% in 2017, 84% in 2018, 83% in 2019, 68% in 2020, and 57% of the papers in 2021 do not make any distinction between tacit and explicit knowledge processes. The un-ableness to distinguish between tacit and explicit knowledge might represent a lack of theoretical sophistication. Two-thirds of the papers lack a definition of knowledge, information, management, leadership, or the situations these concepts are used within. The lack of definitions presents a kind of storytelling where a story exemplified by statistics is told. The scholarly and scientific storytelling is what Kuhn (1970) defined as a pre-scientific situation where anything might be equal in importance or what Popper (1973) described as the situation for psychology as a field. Kuhn (1970) called this "something less than research." The lack of problem-itis makes it challenging to make progress and accumulate knowledge; as Nonaka (2018) noted, there had not been any progress in understanding and performing tacit knowledge. There is, however, a greater degree of sophistication in the 2021 papers regarding problem formulations and the knowledge content making the papers more relevant at a business and societal level. The questions of sustainability and green leadership have increased the imagination and creativity of coming up with several problems without any solutions or even pure speculation.

More than 60% of the papers write about the need for new ways of green and knowledge leadership, management, and organizing. The documents, however, are centered around traditional leadership,

management, and organization issues. The paper's label and marketing propose new leadership, management, and organizing ways. However, they neither define the situation today as the situation tomorrow nor how we will take us tomorrow. The papers are promising the "promised land," but in the end, tomorrow's management is the same as today's management. The papers' problems are centered around solvable matters and very seldom related to unsolvable problems. In knowledge management research, we define "instrument-itis" and "knowledge-itis" as a misdirecting striving for respectability. Fifty-five of 542 papers (10%) discuss our ecological systems' problems and what we need to do to solve the climate crisis through sustainable businesses. These green ecological papers ask several questions they cannot answer and are thus speculative and are all conceptual papers without any empirical basis. The 2020 and 2021 conferences doubled the number of such papers and increased the conference's relevance for our actual and future business situation. The bearing, creativity, and scientific quality are enormously improved from our earlier analyses of these aspects (Jevnaker and Olaisen, 2021).

4. The aspects of the world studied.

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

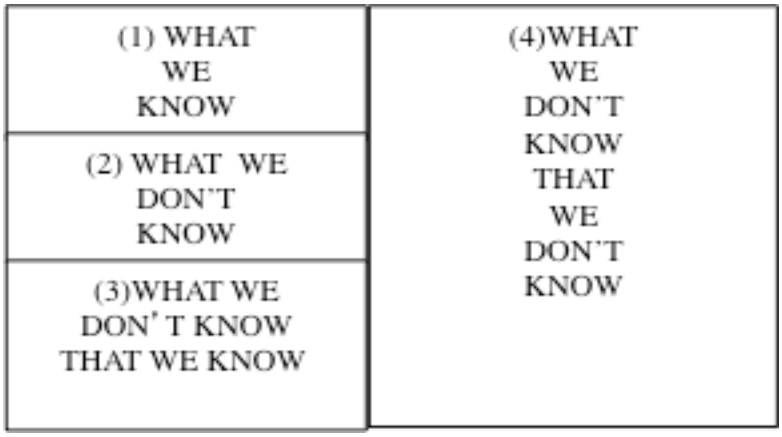


Figure 1: Knowledge representations (Olaisen 1985)

For areas (3) and areas (4), will imagination and intuition be necessary for the creativity needed to make a scientific movement in knowledge management in zone 3 and 4? If we expand only into area two, it will be somewhat limited knowledge research emphasizing instruments and knowledge while the problems will be defined by what we know. We distinguish between the known, the known unknown, the unknown known, and the unknown. The exciting part is the dynamics between the known and unknown and how we make a part of the unknown known in our research process. There is progress from 2016 to 2021 in the papers in defining what is unknown and discussing why tacit knowledge remains unknown in most situations. There is also a beginning discussion of the need to approach the unexplored areas and the challenges looming the unknown domains.

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

foundations. Primarily the 2021 papers represent an improvement with more problem-oriented papers and more speculative papers, including imagination and speculation as a part of the research process. The unknown and unknown areas have gotten more interest, including a few papers (5) in 2021 based upon a constructed empirical basis where the authors discuss unexplored areas to see solutions for sustainability for discussing what green leadership and a green organization represent. The ECKM academic papers at their best in 2021 represent the societal issues addressed later at the Cop 26 conference in Glasgow (Olaisen 2022).

5. Scientific orientations

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

Constructivism implies comparing theory sentences with value sentences to see to what extent the foreseen world is also the preferred world. Consonance refers to what is adequate, and dissonance to what is inadequate. In dissonance, theory and value sentences are prioritized equally, and both might be changed in knowledge management research. Constructivism represents 21% of the papers, increasing from 15% in 2017 to 28% in 2020. The business reality is today complex and global. A combination of understanding wholisms and atomisms is needed in a good research strategy (Minzberg 1979) and actionable puzzle solving (Morgan 1980). Imagination and intuition are required for this process (Bunge 1967, Alvesson and Skjoldberg 2009). The intuitive powers seem to be less trained among the ECKM researchers even if the number of papers including constructed empirical basis through speculations and intuition increases to meet a higher degree of complexity like the solutions of future sustainability problems.

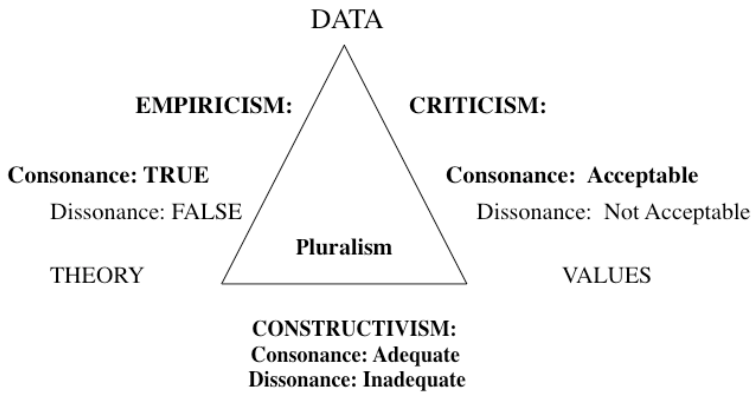


Figure 2: Empiricism, criticism, and constructivism

6. The rise and fall of paradigms

The essence of Kuhn's position (1970) is that paradigms serve a normative and conserving function. When a standard prevails in a discipline, "normal" science practice evolves as a puzzle-solving activity. During normal

science, the scientific community works under the assumption that "it knows what the world is like" and is prepared to defend this assumption "at any cost." (Kuhn 1970: 5). Normal science often suppresses "major novelties, conceptual or phenomenal" (Kuhn 1970:36). Thus, scientists are only preoccupied with solving problems/puzzles according to accepted rules according to traditional viewpoints or preconceptions. With such anomalies built up and scientists losing faith, the field enters the crisis stage.

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

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

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

Looking at knowledge management research at ECKM, we conclude that this is the situation for more than 80% of the papers. The 2020 and 2021 papers were more scientific than 2017, 2018, and 2019 papers – 69% versus 83%. In 2021 and 2020, progress in making knowledge management more scientific and robust. We found that Kuhn's description fit the situation in knowledge management research well. Every researcher starts over again from the beginning with was easily collected survey, and case data are assembled and presented in fancy scientific ways. The papers in 2020 and 2021 (23%) upon sustainable businesses, greener businesses and societies, and the future of knowledge work represent a positive change. Primarily the 2021 conference might illustrate a turning point for making knowledge management research more relevant and scientific.

7. Alternative concepts

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

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

8. Alternative research paradigms

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

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

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

The clarified subjectivity paradigm holds that social reality does not exist in any concrete sense but is the product of individuals and organizations' subjective and inter-subjective experiences. According to this paradigm, knowledge behavior must be understood from the employee and organization's viewpoint rather than from the outside observer. We can only get such understanding by direct, give-and-take interaction with the employees and organizations. We can, of course, get in surveys as questionnaires, but then we are defining the questions and the business situation. 25% of the studies in 2018 are here versus 27% of the 2019 studies, 32% of the 2020 studies, and 35% of the 2021 studies. The action paradigm (5% of the studies in 2018 and 7% of the studies in 2019 compared to 14% in 2020 and 15% in 2021 studies) also assumes that what passes for reality is socially determined. The move towards clarifying subjective and action-based paradigms in 2020 and 2021 is significant.

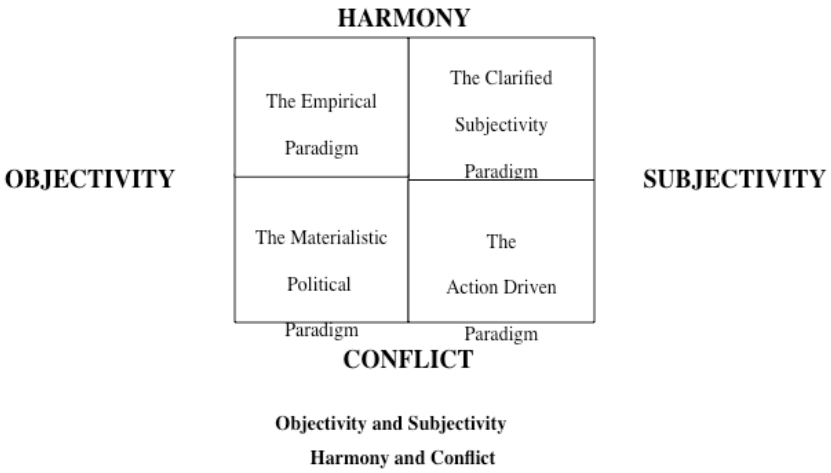


Figure 3: Research paradigms

9. The fall of knowledge management as objective research?

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

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

business models, criticizing existing models and constructing new models. The times are 'changing, and by that, the research methodology with new problems demands other instruments to be helpful in another reality.

Consequently, we will have to define this discipline as a subjective multidiscipline, and we will have to explore, innovate, and simulate an experiment to a much higher degree. We need more subjectivity conflicts and minor harmony and objectivity in our research. Leadership and organizational methodology movement toward phenomenon research take research out of the iron jacket into a flexible and soft jacket opening up for alternative realities (Doh 2015, Schwartz and Stensaker 2014, von Krogh et al. 2012). The driving force for the future might be green business models giving K.M. research new possibilities for understanding the green creating corporation.

10. Synthesis and conclusion

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

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

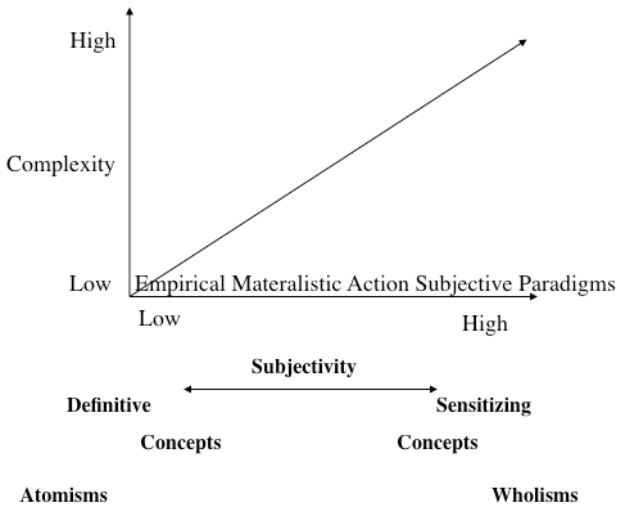


Figure 4: Complexity versus paradigms and concepts for green business models

References

Alvesson, M., and Skjolberg, K., (2009) *Reflexive Methodology*, Sage, London.
Berger, P., and Luckmann, T., (1966), *The Social Construction of Reality*, Wiley, New York.
Blumer, H., (1969), *Symbolic Interactionism*, Prentice-Hall, New York.
Bunge, M.; (1967), *Scientific Research*, Springer Verlag, New York.

Doh, J.P., (2015) "Why We Need Phenomenon-based Research in International Business," Journal of World Business, Vol. 50, No. 9, pp. 609-611.
Feyerabend, P., (1974*), Against Methodology*, Verso, London.
Feyerabend, P., (1987), *Farewell to Reason*, Verso, London.
Eisenhardt, K. M., and Graebner, M. E. (2007) "Theory Building from Cases: Opportunities and Challenges," Academy of Management Journal*,* Vol. 50, No. 1, pp. 25-32.
Jevnaker, B.H., and Olaisen, J., (2022), "A Comparative Study of Knowledge Management Research," Knowledge Management Research& Practise, Vol.31, pp. 1-12.
Jevnaker, B.H., and Olaisen, J., (2021), "Making Knowledge Management Research More Scientific, Relevant and Engaged." Electronic Journal of Knowledge Management, 19(2), pp. 194-212.
Knight, F.H, (1936), *The Ethics of Competition*, Longman, London.
Kuhn, T., (1970) *The Structure of Scientific Revolutions*, Chicago University Press, Chicago.
ECKM, (2017,2018, 2019, 2020, and 2021), Proceedings, Barcelona, Padua, Lisbon and Coventry (digital conference).
Lawrence, P. R. (1992) "The Challenge of Problem-Oriented Research," Journal of Management Inquiry, Vol.1, No. 1, pp. 139-142.
Nonaka (1985) *The knowledge-creating company*, Wiley, New York.
Merton, R., (1968), "The Matthew Effect in Science," Science, Vol. 47, No. 1, 56-63.
Mintzberg, H., (1979), "A Strategy for Research," Administrative Science Quarterly, Vol. 24, No. 1, pp. 582-589.
Morgan, G., (1980), "Paradigms for Puzzle Solving," Administrative Science Quarterly, Vol. 25, No. 6, pp. 605-622.
Olaisen, J., and Revang, O.,(2017), "The Dynamics of Intellectual Property Rights." International Journal of Information Management, 37,6, pp. 583-589.
Olaisen, J., (1985), "Alternative Paradigms in Information Science," Libri, Vol. 35, No. 2, pp. 129-150.
Olaisen, J., and Revang, O.,(2017), "Working smarter and greener." International Journal of Information Management, 37,1, 1441-1448.
Olaisen, J., and Revang, O.,(2018), "Exploring the Performance of Tacit Knowledge." International Journal of Information Management, 43,1, pp. 295-304.
Olaisen, J. et al. (2022), "Climate Change and COP26: Are Digital Technologies and Knowledge Management Part of the Problem or the Solution." International Journal of Information Management, 63,1,1-137.
Popper, K, (1968), *The logic of scientific discovery*, Harper&Row, New York.
Schwarz, G., and Stensaker, I. (2014) "Time to Take Off the Theoretical Straightjacket and (Re-) Introduce Phenomenon-Driven Research," Journal of Applied Behavioral Science, Vol. 50, No. 4, pp. 478-501.
Tornebohm, H., (1983), Research reflections and research sentences, Gothenburg University Press, Gothenburg.
VendeVen, A. H., (2007) *Engaged scholarship*, Oxford University Press, Oxford.
Von Krogh, G., Rossi-Lamastra, C., and Haefliger, S. (2012) "Phenomenon-based Research in Management and Organisation Science: When is it Rigorous and Does it Matter?", Long Range Planning, Vol. 45, pp. 277-298.

Facilitating Cyber Security Threat Modelling: A Social Capital Perspective

Johanna Orjatsalo
LUT University, School of Business and Management, Lahti, Finland
johanna.orjatsalo@lut.fi

Abstract: To identify and manage their cyber security risks, organisations need to form a thorough understanding of various factors that may expose them to these risks. While cyber security professionals and scholars have developed a plethora of practical methodologies and frameworks to support cyber security risk identification and mitigation, the theoretical foundations on what promotes effective knowledge creation when using these methodologies and frameworks are nascent. Yet, theories developed in the field of knowledge management and intellectual capital may provide valuable insight on how to enhance cyber security risk related knowledge creation in organisations. For example, social capital is considered as an important prerequisite for knowledge exchange and combination when creating new intellectual capital (Nahapiet & Ghoshal, 1998). However, more focused research is required to understand how social capital affects knowledge creation in the context of organisational cyber security risk related activities. Using qualitative data gathered from three cyber security threat modelling workshops, this paper examines how social capital enables conditions for exchanging and combining knowledge on cyber security threats. By comparing the empirical observations with Nahapiet and Ghoshal's (1998) model, this study identifies practical approaches that are used by threat modelling workshop facilitators to create conditions for effective knowledge exchange and combination. This study provides both cyber security scholars and professionals with an example on how to use knowledge creation related academic theories to analyse and further enhance cyber security risk management approaches by creating a connection between Nahapiet and Ghoshal's (1998) social capital model and cyber security threat modelling.

Keywords: social capital, knowledge creation, cyber security, workshop, threat modelling

1. Introduction

Organisational cyber security management focuses on protecting organisations' intellectual capital (Sallos et al, 2019). Threat modelling is a widely used approach for understanding cyber security related risks within existing and new software systems as well as the decisions made throughout the end-to-end software development lifecycle. The objective of threat modelling is to "analyse the potential attacks or threats to a system in a given context" (Uzunov & Fernandez, 2014, 734). The intended outcome of threat modelling is to establish a jointly agreed view on threats and their mitigation between participants (Shostack, 2014).

Successful threat modelling combines knowledge of the system's technical characteristics with an understanding of the security-related issues these characteristics and their implementation may generate (Uzunov & Fernandez, 2014). To support knowledge creation in threat modelling, various methods and guidelines have been created for teams and organisations (Uzunov and Fernandez, 2014). Some threat modelling methods and guidelines also help to identify the parties who possess relevant knowledge, and to facilitate knowledge sharing between different participants (Shostack, 2014). Knowledge exchange between different threat modelling participants can be supported for example by a dedicated facilitator who possesses understanding of the relevant threat modelling methods and guidelines (Ingalsbe et al, 2008).

However, identifying and involving relevant people in threat modelling activities or asking them to share their knowledge does not guarantee that adequate-level knowledge exchange takes place. Shostack (2014) mentions that the intended contributors may not want to share their knowledge, as they might for example feel strong ownership of the software they have created or might be concerned that threat modelling outcomes may increase their workload. To successfully model potential threats and attacks, organisations thereby also need to motivate and encourage knowledge sharing throughout threat modelling activities (Shostack, 2014).

While threat modelling methods and guidelines help to ensure that the most important aspects of threat identification and mitigation are covered, they seldomly address the social side of threat modelling activities, let alone the challenges that may prevent contributors from exchanging knowledge or agreeing upon the suggested mitigation activities. Yet, large number of stakeholders and their personal views and beliefs, together with other factors, such as political dynamics, create complexity that need to be considered when discussing cyber security knowledge management (Tisdale, 2015).

Sallos et al (2019, 592) suggest that "Cybersecurity-relevant organisational knowledge <…> is a function of the structure-mediated interactions between actors, their beliefs and the environment, which serve as a source of adaptation/calibration for further behaviour". This approach to knowledge is at the core of knowledge management research; knowledge is dynamic and evolves through continuous social interaction (Nonaka, 1994; Cook & Brown, 1999). An essential question is whether existing research on social aspects of knowledge creation can offer valuable insight that could be used to enrich cyber security related methods and approaches, such as cyber security threat modelling.

The objective for this research is to experiment whether the existing knowledge management research, more specifically the model describing the role of social capital in knowledge creation (Nahapiet & Ghoshal, 1998) could be used to understand the social aspects of knowledge creation in threat modelling workshops. First, the theoretical underpinnings of knowledge creation and social capital are introduced. Second, the research methodology is described. After this, empirical results are presented and discussed, followed by research limitations and conclusive remarks.

2. Theoretical background

2.1 Knowledge creation and social interaction

New knowledge is created in social interaction through continuous knowledge exchange and combination (Nahapiet & Ghoshal, 1998). Knowledge is continuously evolving through human interaction, as individuals involved in this interaction interpret the acquired knowledge in the light of the knowledge they already possess (Nonaka, 1994; Cook & Brown, 1999). Through human interaction, tacit knowledge is converted to explicit format and vice versa on individual and collective levels, and between these levels (Nonaka, 1994).

Knowledge management literature links social interaction to knowledge creation in several ways. Gupta and Govindarajan (2000) present that human interaction is characterized by the social ecology/social system that people are part of, and that this social ecology either facilitates or hinders all knowledge processes, including knowledge creation. Bhatt (2001) distinguishes prerequisites and enablers of knowledge creation; while the prerequisites include motivation, inspiration, experimentation and pure chance, knowledge creation is enabled by culture, organisational coordination, and information technology. Nahapiet and Ghoshal (1998) state that social capital is an organisational prerequisite for knowledge exchange and combination, as it facilitates knowledge exchange and combination.

Organisations can support knowledge creation by providing feasible conditions for it to take place. Grant (1996) suggests that organisations can intentionally facilitate knowledge creation by using integration and coordination mechanisms, and that common organisational knowledge is also needed to ensure aggregation of new knowledge to existing knowledge. Nonaka et al. (2000) describe how, in addition to human interaction, knowledge creation requires knowledge assets, a shared context for interaction and knowledge exchange ("Ba"), and managers who proactively generate conditions for organisational knowledge creation. Nahapiet and Ghoshal (1998) discuss collective knowledge creation, describing how shared interpretation between contributors is both a prerequisite and an outcome of knowledge exchange and combination in social entities. Additionally, they describe the relationship between social capital and knowledge creation as a continuum: whereas social capital is a prerequisite for knowledge creation, the evolving knowledge also modifies social capital within organisations. (Nahapiet & Ghoshal, 1998).

Cyber security management involves various stakeholders (Tisdale, 2015). Sallos et al (2019) emphasize the continuously evolving nature of cyber security related knowledge. According to them, organisations need to have a shared interpretation of this knowledge to support their cyber security related activities (Sallos et al, 2019). This thinking appears to be in line with the views of Nahapiet and Ghoshal (1998). What would then make Nahapiet and Ghoshal's model suitable for analysing knowledge creation in the context of threat modelling workshops?

2.2 Social capital and knowledge creation according to Nahapiet & Ghoshal (1998)

In their article "Social Capital, Intellectual Capital, and the Organisational Advantage", Nahapiet and Ghoshal (1998) suggest that social capital can both facilitate and inhibit generation of feasible conditions for knowledge creation in organisations. They state that all individuals and organisations possess social capital, consisting of networks of relationships and assets related to these networks, and identify three interlinked dimensions for

social capital in organisations based on previous literature: 1) *Structural dimension* that contains all network ties between actors, the qualities of different linkages and connections (network configuration) and how they are used (appropriable organisation); 2) *Relational dimension* that focuses on assets that are observable in personal relationships, such as trust, norms, obligations and identification, and that are forming the behaviour in organisations; and 3) *Cognitive dimension* that includes enablers, such as shared codes, language, and narratives that are required for creating a shared interpretation between actors. (Nahapiet & Ghoshal, 1998)

Nahapiet and Ghoshal (1998) also suggest that certain conditions need to exist before knowledge creation can take place. First, to be able to get engaged in knowledge creation, parties need to have an opportunity to do so, and this requires an access to potential sources of knowledge. Second, to get involved in knowledge exchange and combination, parties also need to anticipate some value from these activities. Third, they need to be motivated to get engaged in knowledge exchange and combination. These three conditions, *access to knowledge*, *anticipation of value*, and *motivation to create knowledge*, generate the momentum for knowledge creation. (Nahapiet & Ghoshal, 1998)

Three dimensions of social capital impact these three conditions in many ways. Structural dimension can either facilitate or hinder access to knowledge, as those aspects define the connections between different sources of knowledge. How these connections function in practice also impacts the anticipated value of parties involved in knowledge creation. The cognitive dimension (especially shared language and codes) may also facilitate or hinder access to knowledge, whereas the relational dimension, consisting of all the aspects embedded into personal relationships between people, may impact positively or negatively on all three conditions. (Nahapiet & Ghoshal, 1998)

In addition to having three conditions in place to create the momentum, parties involved in knowledge creation also need to be able to understand each other and to interact in terms of knowledge exchange and combination. Nahapiet and Ghoshal (1998) refer to this as the fourth condition, *combination capability*, describing the ability and means of the parties to exchange and combine knowledge while interacting with each other. Combination capability is strongly impacted by cognitive dimension of social capital; without shared language and codes, or shared narratives, the parties involved in knowledge creation lack means for both knowledge exchange and combination. (Nahapiet & Ghoshal, 1998)

Collective knowledge creation and self-enhancing nature of both social capital and collective knowledge described by Nahapiet and Ghoshal appears to be in line with the characteristics of organisational cyber security knowledge introduced by Sallos et al (2019) and to some extent also Tisdale (2005). Threat modelling workshops are relying on collective knowledge creation and forming shared interpretations (Shostack, 2014). Based on these remarks, it was considered worthwhile to test Nahapiet and Ghoshal's model in the context of threat modelling workshops.

3. Methodology

3.1 Research design

Research approach was based on a qualitative inquiry, and the scope consisted of three cyber security threat modelling workshops which took place within an organisation that utilized threat modelling as part of their cyber security-related activities. Each workshop was treated as a separate case, enabling both an individual and comparative analysis (Creswell 2013). Workshops included in the scope were jointly selected with information security professionals that acted as facilitators for the workshops, hence, purposeful sampling (Patton 2016) was applied. For each case, the primary research material consisted of non-participatory workshop observations, workshop recordings and four semi-structured interviews (with average duration of 47 minutes): the facilitator and the case owner were interviewed separately before and after the session. Research data was then deductively analysed using Nahapiet and Ghoshal's model (1998).

3.2 Data gathering and analysis

The purpose of individual interviews was to find out how the interviewees would describe the success factors and challenges for the threat modelling workshop they were involved with. Semi-structured approach including open ended discussion themes was applied for this purpose (Swaminathan et al, 2018). Workshop recordings and the related transcriptions were used as descriptive documentation of the interaction between workshop participants during threat modelling, and they were enriched by non-participatory observations which enabled

making additional remarks from the observer perspective on how the interaction took place (Gold, 1958; Swaminathan et al, 2018).

All three workshops and twelve interviews were conducted online, which enabled recording the audio and manually transcribing the content afterwards for analysis purposes. In addition to recordings, workshop observations involved taking field notes. For analysis purposes, all the material was anonymized due to confidentiality requirements, and technical details of the workshops were generalized.

First round of data analysis was done applying an inductive logic to identify passages related to tools and practices that were used for enabling and facilitating knowledge exchange and combination. Four conditions of knowledge creation from Nahapiet and Ghoshal's model (1998) were then used to go through the coded data and categorized using the four conditions of knowledge creation. Finally, the same data was also analysed using Nahapiet and Ghoshal's three dimensions of social capital (1998) and then compared with the previous analysis to identify links between the dimensions and the four conditions for knowledge creation.

4. Results and discussion

4.1 Results

Case organisation is a global software company with 1500+ employees. The company has a separate team of cyber security professionals to support other teams in their cyber security related activities, including threat modelling. Many of the company's software development teams do threat modelling as an integral part of their software development lifecycle, and threat modelling is also utilized by teams responsible for running the company's business operations. Empirical research material was collected from three separate threat modelling workshops (Workshops A, B and C).

Arrangements for all three workshop seemingly followed the same pattern: 1) A need for threat modelling was identified and recorded into work management system (WMS) using a work ticket; 2) Work ticket was analysed and a decision was made to contact security team for support (instead of doing threat modelling without support), and security team dedicated a facilitator for the workshop; 3) Scope, objectives, approach and participants for the workshop were agreed between the owner and the facilitator, and preparations were made; 4) The workshop was conducted; 5) Actions agreed during the workshop were recorded into WMS using work tickets, and other workshop outcomes (visualizations and notes) were included in the original work ticket.

Workshop facilitator and owner were jointly responsible for workshop preparations. As part of this, they agreed on the threat modelling scope and objectives, identified the participants needed for the workshop and selected the methods and tools to be used in the workshop. For all three cases, the method selected for threat modelling was STRIDE, originally developed at Microsoft Corporation (see, e.g., Shostack 2014), and the tools agreed to be used were data flow diagrams (for visualizing the scope and discussing the potential threats), Microsoft Teams (as a virtual meeting platform) and WMS (for sharing the documentation).

The workshops followed a four-step structure: 1) introducing the approach (including the objectives, scope, methods to be used and roles during the workshop), 2) drawing a description of the selected scope, 3) identifying threats related to the selected scope, and 4) summarizing the discussion. However, the emphasis of these steps varied based on the objectives and scope of each of workshop. During data gathering, it also became obvious that the three workshops selected for the research were different not only in terms of their context and scope, but also in terms of how well their objectives were met.

The person initiating Workshop A managed a third-party solution that the case company used for business management purposes. His team had been planning to start using threat modelling on a continuous basis during their solution management lifecycle, and they had contacted the security team for support. As a result, it had been agreed that a facilitated threat modelling workshop should be arranged to explain and showcase threat modelling methodology and approach for the team. Team lead assumed the owner role and based on the input from his team proposed selected functionalities to be threat modelled. It was decided that the whole team should participate in the workshop. During the 121-minute workshop, all five participants were actively contributing. Some of the tasks identified in the workshop required additional clarifications, and the owner took responsibility for these. It was also agreed between the owner and the facilitator that the facilitator would

continue supporting the solution team until they are comfortable with running their own threat modelling activities.

Preparations for Workshop B had started based on a change request initiated by an R&D team member who had been working with two different third-party solutions. In the change request, R&D team had suggested to add a direct interface between the two solutions. As a response for this request, teams managing these solutions had suggested using a facilitated threat modelling workshop to understand the impacts of the suggested change, and it was agreed that the R&D team lead would act as an owner for this workshop. After several meetings with various stakeholders, the facilitator proposed involving members from three separate teams: the R&D team and the teams managing the two third-party solutions. All three teams were able to decide their own participants, and during the 108-minute workshop, eight participants (40%) of the total twenty were actively participating. The outcome of the workshop was that the suggested change was even larger than first anticipated, and more thorough analysis should be conducted, as the changes would also impact on other teams than those who were represented in the workshop. Due to this, it was agreed that the facilitator would coordinate taking the discussion forward with all the relevant stakeholders.

Workshop C had been initiated by a software development team that normally did threat modelling on continuous basis but wanted to arrange a one-time workshop as they needed a facilitator to support them to understand a new interface. The team had a dedicated quality lead who acted as an owner for the workshop, while the team's product manager remained responsible for prioritizing and managing all activities arising from the workshop. All nine participants were from the same team, and during the 85-minute workshop, five participants (56%) were actively participating in the discussions. Based on the post-workshop interviews with the facilitator and the owner, workshop objectives were fulfilled, and follow-up was agreed to be done by the initiating team.

4.2 Observations regarding four conditions of knowledge exchange and combination

4.2.1 Access to knowledge

Without access to knowledge, the opportunity for knowledge creation does not exist (Nahapiet and Ghoshal, 1998). Individuals participating in threat modelling workshops seem to "bring their own knowledge" with them. Hence, identifying the right set of participants to be able to cover the selected scope appears to be crucial. Access to knowledge via participants was not an issue in Workshop C, and while few clarifications arose during Workshop A, those were not considered significant. In Workshop B, the participants did not possess all the required knowledge, and the objectives set for the work were not achieved. Based on the interviews, most threats are linked to such interfaces where technical or responsibility-related boundaries are crossed. Facilitators seemed to have wide knowledge on the company's overall technical architecture and potential threats within different types of interfaces, and they used this knowledge to identify relevant participants for the workshops.

4.2.2 Anticipation of value and motivation to contribute

People do not get involved in knowledge exchange and combination unless they anticipate that certain value is embedded in the interaction, and unless they are motivated to contribute (Nahapiet & Ghoshal, 1998). In each workshop, different factors seemed to impact how the participants got involved into the discussions. Workshop A facilitator and owner considered that the high activity rate (100%) was a result of the team's willingness to start threat modelling on a continuous basis to improve the security of their solution. This indicates that they anticipated value out of threat modelling activities and were motivated to get involved in reaching their goal of improving the security for their solution. Workshop B facilitator explained how a representative of one of the teams had forwarded the workshop invitation to additional people without anyone knowing, and that these additional participants attended the workshop just out of curiosity. Based on this they did not anticipate any value from contributing. Workshop C owner said that the inactive participants were not familiar with the new functionality and were attending only to educate themselves on the topic, meaning that they were there to receive rather than to create knowledge. Workshop C facilitator also mentioned that those participants who were responsible for the functionality in scope were the ones contributing, as they wanted to ensure that adding this functionality does not impact the overall product quality, which indicates they had high value expectations and high motivation to contribute.

4.2.3 Combination capability

Knowledge exchange and combination also requires combination capability that ensures that the parties can interact with each other (Nahapiet & Ghoshal, 1998). Regarding this research, this would mean the ability of participants to understand the selected scope on a required level and to be able to identify and mitigate the related threats. Based on workshop observations and interviews, facilitators were continuously enabling this by ensuring that shared language and codes were used. They selected the suitable methods and tools for the context in question based on their prior experience, and in each workshop, they first introduced these methods and tools and then continued by asking several clarifying questions to ensure the aspects of the selected approach were covered. They also seemed to know who would possess relevant information on each of the topics discussed and addressed some of the questions directly to these participants. In addition to this, they continuously explained why they were asking such questions.

4.3 The role of three dimensions of social capital in threat modelling workshops

4.3.1 The role of structural dimension

Structural dimension of social capital refers to the organisational patterns of connections, such as network ties, network configuration and the appropriability of the organisation, and it generates conditions to access knowledge, but also impacts the value anticipated from knowledge creation (Nahapiet & Ghoshal, 1998). Structural dimension had an observable impact especially on access to knowledge. First, it seems that established ties need to exist between the security team supporting threat modelling activities and the teams whose work is analysed for threat modelling purposes, and the quality of these connections seems to be important for such collaboration to succeed. Second, those who are responsible for the quality of threat modelling outcomes need to understand both the organisational and technical structure and related responsibilities to identify what kind of knowledge is required for threat modelling and where to get this knowledge. This includes the ability to identify the participants for the workshops as well as having access to these participants. This is also linked to organisational appropriability, as threat modelling may require establishing temporary connections across organisational boundaries in those cases where cross-team participation is needed (such as in Workshop B). Third, to ensure the condition for anticipated value is in place, the workshop initiators need to understand what the participants expect to achieve by participating in the workshop. Workshops B and C included participants who seemed more interested in gaining information and understanding how things work, rather than getting involved in identifying threats.

4.3.2 The role of relational dimension

Relational dimension of social capital drives access to parties but also anticipation of value and motivation (Nahapiet & Ghoshal 1998). Both the active participation during the workshops and the role of the facilitators as “trusted advisors” can be interpreted as signs of trust. On the other hand, they may also reflect the established norms of the organisation in question; the organisation seems to have rather established practices for threat modelling and cyber security management in general. Participant activity may also be linked to individual obligations; the active participants seemed somewhat obliged to contribute, as if they were automatically expected by fellow participants to express their opinions and insights.

4.3.3 The role of cognitive dimension

Cognitive dimension of social capital impacts on combination capability, and it includes resources that provide shared representations, interpretations, and meanings among parties (Nahapiet & Ghoshal, 1998). In all three workshops, methods, tools, facilitation, and documentation seemed to represent such resources. The workshop itself acted as a shared context for the participants, who were working towards a shared objective. Nahapiet and Ghoshal (1998) also point out the self-enhancing nature of social capital: when knowledge is created, it also further enhances all dimensions of social capital. Reflecting on this, threat modelling workshops can be viewed as part of knowledge creation continuum within the organisation; the collective knowledge created in the workshops contributed to both individual and collective knowledge within the case organisation.

4.4 Research limitations

Workshop observations and interviews produced plenty of material, but as Nahapiet and Ghoshal’s model was not used for steering the data gathering nor introduced to research participants, using it in a deductive manner included a risk of making wrong conclusions based on the available research material. To avoid this risk, only those parts of the data that were clearly referring to the elements in Nahapiet and Ghoshal’s model were included in the analysis. To avoid this in the future, the selected model should be used deductively from the

beginning of the research. Otherwise, the selected model seemed to suit well for qualitative inquiry; considering that Nahapiet and Ghoshal's model was introduced only after the research data had been collected, the way the model is structured helped categorizing the data and thereby fitting it into the model.

5. Conclusions

The objective of this research was to experiment whether collective knowledge creation in cyber security threat modelling workshops could be better understood with the help of Nahapiet and Ghoshal's (1998) model of social capital. Additionally, the intention was to evaluate, whether the selected model could be used to identify additional ways to support social interaction within the context of threat modelling. For this purpose, three threat modelling workshops were observed, and the owners and facilitators of these three workshops were interviewed before and after the workshops.

In their model, Nahapiet and Ghoshal (1998) focus on describing collective knowledge creation and shared interpretations. They also propose that social capital impacts on the conditions for knowledge creation, and that organisations can modify their social capital to promote feasible conditions for knowledge creation. Based on this research, the existence of these conditions, the approaches and practices facilitating these conditions as well as the impact of social capital were observable during threat modelling workshops and the related preparation and follow-up activities. In case the model would be used for similar purposes in the future, using the model deductively from the beginning of the research should be considered. Additionally, a follow-up inquiry with the organisation using this model to analyse their threat modelling practices would help understand whether the results have been useful.

References

Bhatt, G.D. (2001) "Knowledge management in organizations: examining the interaction between technologies, techniques, and people", *Journal of Knowledge Management*, Vol 5, No. 1, pp 68-75.

Cook, S.D.N. and Brown, J.S. (1999) "Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing", *Organization Science*, Vol 10, No. 4, pp 381–400.

Creswell, J. W. (2013) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches,* SAGE, Thousand Oaks, CA.

Gupta, A.K. & Govindarajan, V. (2000) "Knowledge Management's Social Dimension: Lessons From Nucor Steel", *MIT Sloan Management Review*, Vol 42, No. 1, pp 71-80.

Ingalsbe, J.A., Kunimatsu, L., Baeten, T. & Mead, N.R. (2008) "Threat Modeling: Diving into the Deep End*", IEEE Software*, January/February, pp 28-34.

Nahapiet, J. & Ghoshal, S. (1998) "Social Capital, Intellectual Capital and the Organizational Advantage", *Academy of Management Review*, Vol 23, No. 2, pp 242-266.

Nonaka, I. (1994) "A Dynamic Theory of Organizational Knowledge Creation", *Organization Science*, Vol 5, No. 1, pp 14-37.

Nonaka, I., Toyama, R. & Konno, N. (2000) "SECI, Ba and Leadership: a unified model of dynamic knowledge creation", *Long Range Planning,* Vol 33, pp 5-34.

Patton, M. Q. (2016) *Qualitative Research and Evaluation Methods*, SAGE, London.

Sallos, M.P., Garcia-Perez, A., Bedford, D. & Orlando, B. (2019), Strategy and Organisational Cybersecurity: A Knowledge-Problem Perspective", *Journal of Intellectual Capital*, Vol 20, No. 4, pp 581-597.

Shostack, A. (2014) *Threat modeling: Designing for security*. John Wiley & Sons, Inc.

Swaminathan, R. & Mulvihill, T.M. (2018). *Teaching Qualitative Research. Strategies for engaging emerging scholars*, The Guilford Press, New York, NY.

Tisdale, S. M. (2015) "Cybersecurity: Challenges from a Systems, Complexity, Knowledge Management and Business Intelligence Perspective", *Issues in Information Systems*, Vol 16, Issue III, pp 191-198.

Uzunov, A.V. & Fernandez, E.B. (2014) "An extensible pattern-based library and taxonomy of security threats for distributed systems", *Computer Standards & Interfaces*, Vol 36, pp 734–747

GeoSPARQL-Jena: Implementation and Benchmarking of a GeoSPARQL Graphstore

Taha Osman and Gregory Albiston
Department of Computer Science, Nottingham Trent University
taha.osamn@ntu.ac.uk
gregory.albiston@ntu.ac.uk

Abstract: This work presents an RDF graphstore implementation for all six modules of the GeoSPARQL standard using the Apache Jena Semantic Web library. Previous implementations have provided only partial coverage of the GeoSPARQL standard. There is discussion of the design and development of on-demand indexes to improve query performance without incurring lengthy data preparation delays. A supporting benchmarking framework is also discussed for the evaluation of any SPARQL compliant queries with interfaces provided for integrating additional test systems. This benchmarking framework is utilised to examine the performance of the implementation against two existing GeoSPARQL systems using the Geographica benchmark. It is found that the implementation achieves comparable or faster query responses than the alternative systems while also providing much faster dataset loading and initialisation durations.

Keywords: GeoSPARQL, , RDF, Apache Jena, geospatial, geospatial data, geospatial query language

1. Introduction

This work discusses the implementation of a geospatial graphstore complying with the OGC GeoSPARQL standard (Battle and Kolas, 2011). Previous works have partially implemented the GeoSPARQL standard and have generally extended relational databases rather than utilising an RDF graphstore. This work describes the design features of the implementation, investigation of parameter tuning and the development of a benchmarking framework for comparison with other GeoSPARQL implementations.

The increasing usage of location-aware devices such as smartphones, IoT devices and in-vehicle navigation, has led to an increasing range of applications and datasets reliant upon geospatial data. The interpretation of geospatial data and relations is an established field of study upon which the GeoSPARQL incorporates Semantic Web concepts and principles. The Semantic Web is intended to increase the access and sharing of data through the internet and presents the opportunity to enrich data through knowledge modelling, automated inferencing, and interconnection of datasets to provide deeper insights and experiences.

A key technology of the Semantic Web is the Resource Description Framework (RDF) (Schreiber and Raimond, 2014) which is a data structure standard based upon a directed labelled graph of subject-predicate-object triples. It is intended that any data can be represented using RDF's design principles and extended by vocabularies, e.g. GeoSPARQL, to allow consistent interpretation across datasets. The SPARQL query language (Harris, Seaborne and Prud'hommeaux, 2013) provides a query mechanism to explore, retrieve and modify RDF data. The GeoSPARQL standard extends SPARQL's query mechanisms and provides a vocabulary to allow users to conveniently access geospatial data.

There are several challenges relating to geospatial graphstores. There is no implementation of the GeoSPARQL standard stating full compliance across all six components. In addition, there is no benchmarking framework to investigate GeoSPARQL compliance and consider user quality of life aspects, such as mixed coordinate reference system datasets and inference of inferring geometry metadata.

The reviewed GeoSPARQL implementations use modified relational databases for persistent storage rather than a specialised RDF graphstore, which can present a set-up and environment configuration burden that is justifiable in production scenarios but limiting for prototype development and research. Therefore, the chief research question to be addressed in this paper is feasibility of a comprehensive implementation of the GeoSPARQL standard utilising a specialised RDF graphstore to optimise the performance of geospatial indexing and retrieval. The principal contributions of this work addressing the research challenge can be summarised as follows:

1. Full GeoSPARQL implementation of all six components, including automatic inferring geometry properties and query re-writing, using an RDF graphstore.
2. Benchmarking framework for GeoSPARQL and SPARQL queries with results and comparison of three GeoSPARQL systems.
3. Identification of areas for review and revision in future versions of the GeoSPARQL standard.

The remainder of this work is organised as follows. Section 2 overviews related works and section 3 discusses our implementation of the GeoSPARQL extension details the development of the corresponding Benchmarking Framework. Section 4 evaluates the results obtained upon comparing our GeoSPARQL implementation with two existing GeoSPARQL systems, Parliament and Strabon, using the developed benchmarking framework. The final section provides a summary of the findings of this work and identifies areas for future work.

2. Related Work

There are numerous implementations of RDF frameworks with many featuring geospatial and sometimes more specifically GeoSPARQL support. These RDF frameworks provide persistent storage through RDF graphstores, or relational databases adapted for RDF with a geospatial extension, e.g. PostgreSQL with PostGIS. While these frameworks refer to supporting GeoSPARQL it has not been possible to find any explicit statements of the implemented GeoSPARQL extensions and requirements compliance. As far as we are aware, there has not been any systematic research or compliance testing of the various RDF frameworks in their support for GeoSPARQL.

The following reviewed frameworks to illustrate the fragmented nature of GeoSPARQL support and different implementation approaches. AllegroGraph is a graph database that supports geospatial operations but takes a more generalised approach than the Simple Features or GeoSPARQL standards, with a set of functions focused upon points within a radius or polygons. Apache Jena (Apache Software Foundation, 2020) is a Java based Semantic Web and Linked Data framework that provides various tools for developing applications including persistent storage, SPARQL query engine, and inferencing. It has a spatial module that supports a small set of functions which are unrelated to the Simple Features or GeoSPARQL standards. Apache Marmotta (Apache Software Foundation, 2018) is a Linked Data platform which uses PostgreSQL with PostGIS backend and provides functions from the *Geometry Extension* and *Geometry Topology Extension*, but geospatial support has not been included in any public release due to "portability issues".

Stardog is an RDF data unification platform that supports a subset of non-topological GeoSPARQL functions along with their own geospatial functions. Virtuoso is SQL database with RDF and SPARQL extensions that includes some geospatial support related to the Simple Features standard but not explicitly supporting GeoSPARQL. Parliament integrates the Apache Jena framework with a Berkley DB persistent storage to provide temporal and GeoSPARQL compliant spatial support. However, the Parliament is dependent on deprecated components of Apache Jena and has not been updated to the latest major version. Strabon (Kyzirakos, Karpathiotakis and Koubarakis, 2012) is a spatiotemporal store that uses the RDF4J framework backed by PostgreSQL with PostGIS to support the *Core*, *Geometry Extension* and *Geometry Topology Extension* components of the GeoSPARQL and its own stSPARQL syntax.

3. Implementation of the GeoSPARQL-Jena and Benchmarking Framework

The GeoSPARQL standard is developed from the Simple Feature standard, which is widely used in SQL databases, but provides a wider definition of spatial relations and incorporates RDF concepts, such as URIs, namespaces and RDFS inferencing. The Simple Features standard is based upon a simplified spatial model where all coordinates are on a planar surface regardless of the Spatial Reference Systems (SRS) (Spatial Reference System, 2013), which manages the consistent interpretation of spatial coordinate information.

This section describes the design and implementation considerations of the GeoSPARQL-Jena system and the supporting benchmarking framework.

3.1 Implementing the GeoSPARQL Standard as an extension of Apache Jena

The primary focus of implementing the GeoSPARQL standard is to extend ARQ, the query execution mechanism of Apache Jena, to support all the extension modules. Filter and Property functions are registered with the ARQ query engine for use when matching function or property names are encountered within a SPARQL query.

The implementation was designed to minimise user configuration requirements and minimise pre-computation through on-demand processing of queried data. This on-demand processing means that initialisation periods are short, only calculations relevant to utilised functionality are performed, and new datasets can be incorporated quickly and with consistent query durations.

Implementing the GeoSPARQL Standard as an extension of Apache Jena allows all the existing functionality of Apache Jena, which closely complies with Semantic Web standards, to be utilised, e.g. RDF file handling, RDFS inferencing, HTTP endpoint and persistent storage. The GeoSPARQL class and property hierarchy are achieved by loading the published GeoSPARQL RDF schema into an RDFS inferencing model and applying the model to the target dataset. This allows user and version modifications to the schema to be made without requiring alteration to the implementation source code. Various configuration options for the use of the GeoSPARQL-Jena extension have been made available to the developer, such as index sizing and in-memory or persistent storage options.

The implementation workflow, shown in Figure 1, is activated when the ARQ query engine reaches a registered Filter or Property function name. The following describes the workflow with relevant diagram points indicated by parenthesis. The ARQ engine processes query by checking triples in the dataset and passing values to the corresponding function (1). A key concept of SPARQL querying is the reduction of the full dataset graph down to a subset which are true for the graph described by the query. The ARQ engine seeks to optimise execution for the quickest resolution. Therefore, a set of partial results for the wider query may have been obtained prior to passing to the function.

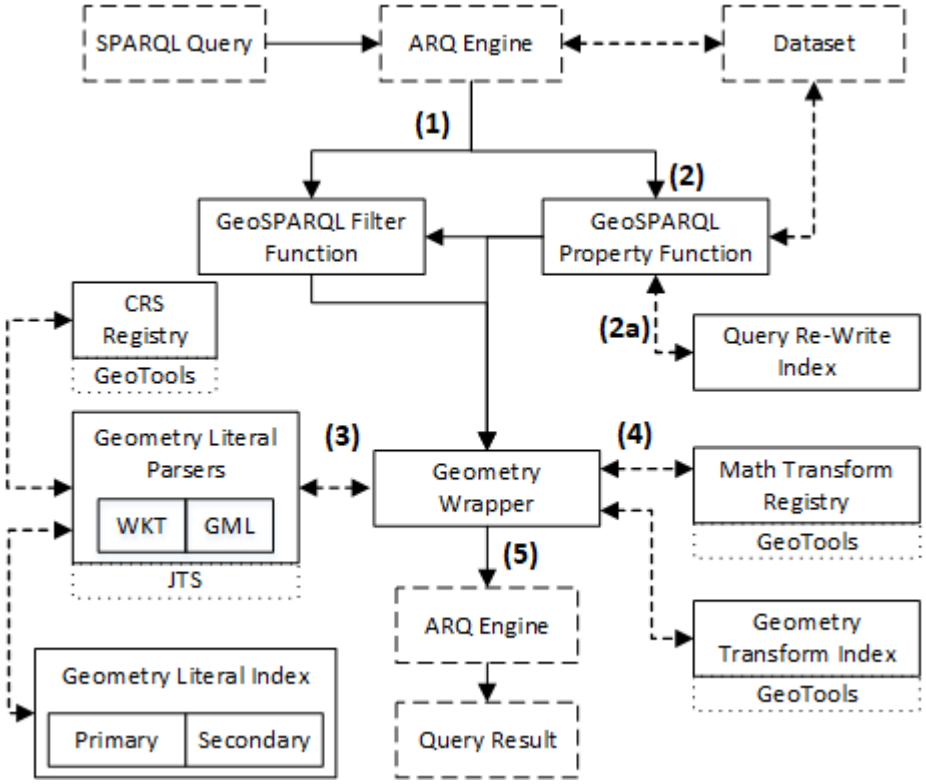


Figure 1: The GeoSPARQL-Jena query execution workflow from SPARQL query to result

GeoSPARQL Property Functions may retrieve additional values from the dataset (2). Many Property Functions in GeoSPARQL are syntactic sugar for a Filter Function which is used to perform the actual processing. The distinct Property Functions follow the same process as Filter Functions. The Query Re-Write Property Functions also checks for asserted Feature and Geometry relationships in the dataset to shortcut resolution, as required by the GeoSPARQL standard, followed by an additional check of the Query Re-Write Index (2a).

This index contains up to a maximum number of recently found relations between Geometry Literals. Each Geometry Literal pair could be involved in up to four Feature and Geometry relationships for each spatial relation, without considering that a single Geometry Literal could be used by multiple Features or Geometries.

Therefore, retaining recent results has been designed into the workflow to address the re-working behaviour of SPARQL query execution.

Geometry Literals are unparsed into Geometry Wrappers via relevant parsers (3). The Geometry Literal Index is checked for recently unparsed Geometry Literals to allow reuse between iterations through on-demand caching. Geometry Literals are immutable and so later extraction yields the same Geometry Wrapper. The Geometry Literal Index contains two indexes that relate to positions of function arguments which is likely to be consistent between query iterations and allows prioritising the index search. If the Geometry Literal is not present in the initial index, then the alternative index is checked before a new Geometry Wrapper is extracted from the Geometry Literal and added to the initial index. The CRS Registry similarly retains recently used CRS data for any future Geometry Literals with the same CRS.

The Geometry Wrapper handles all processing to resolve the request, e.g. spatial relations and functions, with one instance for each Geometry Literal (4). The spatial relations and functions leverage the JTS library (Eclipse Foundation, 2018), which is an implementation of the Simple Features standard, and has been extended to incorporate the additional concepts of the GeoSPARQL standard including multiple spatial reference systems, multiple units of measure, RCC8 and Egenhofer relation families (Egenhofer and Franzosa, 1991).

The functionality for CRS conversion is provided by the Apache SIS library (The Apache Software Foundation, 2019) which accesses coordinate transformations definitions provided by defining authorities. The outcome of the function is returned to the ARQ Engine (5) via the calling function to continue processing the query, potentially returning to step (1) for another function.

The retention of data in-memory can present issues when processing large datasets. To manage the sizes of the indexes and registries several strategies have been implemented. Firstly, the data retained within registries is common across multiple geometries and highly re-usable. Therefore, these have been not constrained in size or persistence and are intended to persist for the duration of the application. Secondly, to manage size the index contents expire after a fixed time-period (default: 5 seconds) which is refreshed whenever an item is retrieved. Checking for removals occurs in 1 second intervals. Therefore, memory usage will increase during periods of geospatial querying and then fall back during other activities.

3.2 Implementing the Benchmarking Framework

Similar to the common with the Geographica's approach, we implemented a Test System to integrate with the benchmarking framework (Figure **2**). However, in our approach new instances of the Test System are produced using a Test System Factory interface to create separate instances. The initialisation period of these instances is recorded as a separate duration from dataset loading and query execution. In contrast, in Geographica, the initiation duration is measured when a system is initially accessed via the Java API, which may be once, during start-up for production usage, or multiple times, such as during application execution or development.

The execution of queries is performed through a separate Query Task class, varying from Geographica, that is extended by each Test System to standardise the three stages of query execution, preparation, processing and closure, and recording of durations. This execution standardisation means that all target systems perform the same work and are monitored consistently. The Query Task is executed on a separate thread and is monitored for its duration to limit excessively long query executions.

The execution of the framework can be performed in four modes: Cold, Warm, Both and Dataload. In Cold mode, each iteration is a new instance of the Test System. The Warm mode, an initialising query is performed on a single Test System which is then re-used for the target iterations. The Both mode allows the Cold and Warm modes to be run consecutively. In the Dataload mode, a specified dataset is loading into the Test System's persistent storage for the target iterations with the storage being cleared after each iteration. These modes follow the principles described in the Geographica benchmarking paper (Garbis, Kyzirakos and Koubarakis, 2013).

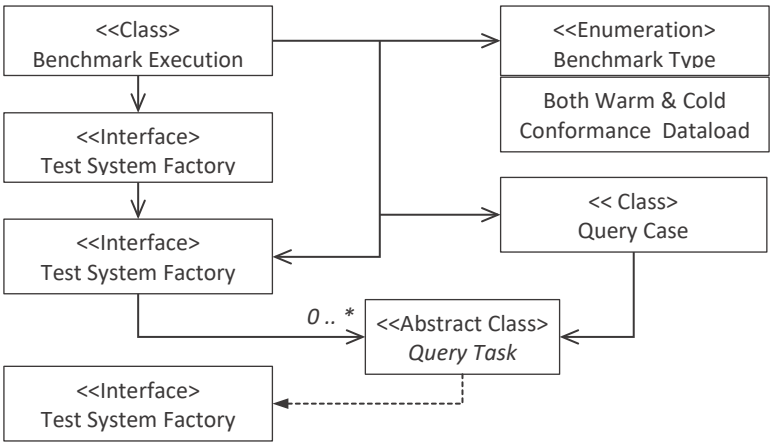


Figure 2: Class diagram of the main Benchmarking Framework classes and interfaces

4. Experimental Results and Discussion

This section outlines the evaluation, results, and analysis of this work's implementation of GeoSPARQL Jena against two existing GeoSPARQL systems, Parliament and Strabon. The first set of experiments analyses the effect of varying the size of indexes implemented in GeoSPARQL Jena. This is followed by an overview of the methodology and configuration of the benchmarking framework. The final sections discuss the results obtained for the three systems using the framework.

4.1 Experimentation configuration and methodology

All benchmarking experiments were performed on the same desktop computer which was a x64 Windows 10 operating system with Intel Core i7-4820K with 16GB and Samsung 850 EVO 500GB. Previously outlined is that all three test systems provide a Java API. Identical Java JVM settings were used for each target system with a maximum heap size of 3GB and parallel garbage collection enabled.

The framework measures the duration of each query execution with three values: query preparation, query processing and their sum for the total duration. For brevity the total durations are reported here, unless specified. A general observation is that the Apache Jena based test systems, Parliament and GeoSPARQLJena, perform more work during iteration over the results in the query processing stage while Strabon spent relatively longer periods in the query preparation stage. This highlights the different strategies deployed by the target systems and the importance of considering the whole execution duration of queries.

4.2 Dataset Loading and Initialisation

The six datasets published by Geographica have been used for the Microbenchmark and Macrobenchmark.

The target systems use their own persistent storage method with all supporting multiple graphs. Each dataset was loaded into their own graph within the storage. In the implementation the Apache Jena Java API loading mechanism was used and not the Bulk Loader for large datasets, which may provide faster results. Table 1. shows the data loading and initialisation durations for the target systems.

The loading durations include both the import of triples and any associated one-time spatial indexing setup. The initialisation duration is the duration required to initially access the dataset through the Java API. Therefore, in a production environment this may occur once but in an iterative development environment will be incurred at every execution. In all cases the operations were performed five times with arithmetic mean and standard deviations shown.

Table 1: Dataset loading and initialisation durations

	Loading		Initialisation	
Test System	mean (s)	sd	mean (s)	sd
GeoSPARQL Jena	90.694	7.401	0.047	0.003
Parliament	337.976	4.217	0.539	0.041
Strabon	374.439	6.194	80.317	1.882

The table demonstrates that the implementation, GeoSPARQL Jena, is noticeably quicker at both loading, 1.5 minutes compared to over 5 minutes, and initialising the datasets. This makes it very suited to a development environment when coupled with its minimal setup requirements. Parliament has a more prolonged setting up period when it is building its spatial indexes but is then quick to access prior to querying. Strabon takes longer to o load the datasets and requires an initialisation period of 80 seconds. This is incurred prior to any query execution and regardless of its data requirements. The loading overhead can be taxing if the application requires frequent restarts. The following sections discuss the query performance excluding the identified initialization periods.

4.3 Geographica Microbenchmark

The queries executed in this benchmark are those published by the Geographica project and follow the same numbering system. These utilise the non-topological query functions of the Geometry Extension and the filter functions of the Geometry Topology Extension for the Simple Feature relation family and therefore are a subset of potential queries for the GeoSPARQL standard. It was necessary to fix several namespaces in the published queries, but the body of the queries were unchanged. The queries Q6, Q28 and Q29 have been excluded as they contained spatial functions which are not defined in the GeoSPARQL standard and therefore only Strabon could execute.

The results of the microbenchmark are shown for Cold runs (Figure 3), Warm runs (Figure 4) and combined rankings (Table 2). Parliament did not complete any of the queries in the Spatial Joins section within the one-hour time limit. Results are shown in all cases for GeoSPARQL Jena and Strabon but in several cases results were achieved in less than a second. In all cases, except Q15, the number of results returned by all three systems were identical. Q15 uses the distance function to identify geometries within a radius of a fixed point. The difference in results may be attributable to precision of calculations and different approaches to handling the conversion of distance units in query. GeoSPARQL Jena is using the JTS library for calculations which does not reduce precision when other geospatial libraries may do so.

The query uses linear *metre* units for distance between two geometries. All geometries in the datasets are in CRS84, which is a geocentric SRS using non-linear *degree* units. In GeoSPARQL Jena, the handling of linear units with non-linear SRS geometries is achieved by temporarily transforming the geometries to a linear SRS. This is necessary as the ratio of *metres* to *degrees* is not fixed and varies according to the latitude of the coordinates. Alternative approaches may use a fixed ratio and tolerate the error as latitude varies.

Another query of note is Q18 which tests for the Simple Features *equals* relation. Strabon is noticeably quicker and completes this in less than 1 second when GeoSPARQL Jena requires just under 4.5 minutes and Parliament times out. This query checks the spatial equality between two graphs numbering 7,551 and 21,993 geometry literals to produce 166 million combinations. Therefore, the speed of processing this scale of combinations by Strabon is noticeable. Further investigation suggests that Strabon is not checking for spatial equality but only lexical equality by matching strings.

A final query of note is Q26 where GeoSPARQL Jena completes in less than 4 seconds while Strabon requires approximately 11 min and Parliament times out. This query tests the Simple Feature *touches* relation, where the boundaries of two geometries align but do not cross into each's interior. The two graphs used are the same graph that contains 325 complex multi-polygon geometries for 105 thousand combinations. GeoSPARQL Jena on demand indexing makes these geometries readily available and the optimisations for this relation, e.g. bounding boxes around the complex shapes, allow for the cases can be rejected quickly. Similar optimisations can be applied in Q25 and Q27 and could explain why GeoSPARQL Jena is noticeably quicker than Strabon.

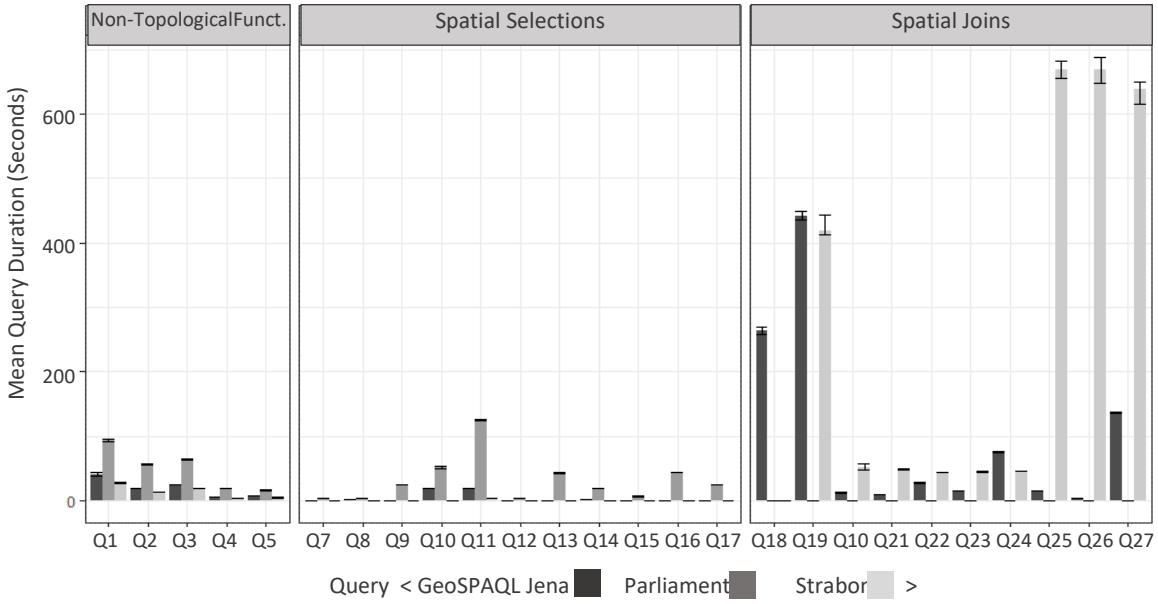


Figure 3: Mean Query Duration (seconds) by test system microbenchmark in Cold run. Error bars show min/max. Parliament timed out in Q18-Q27

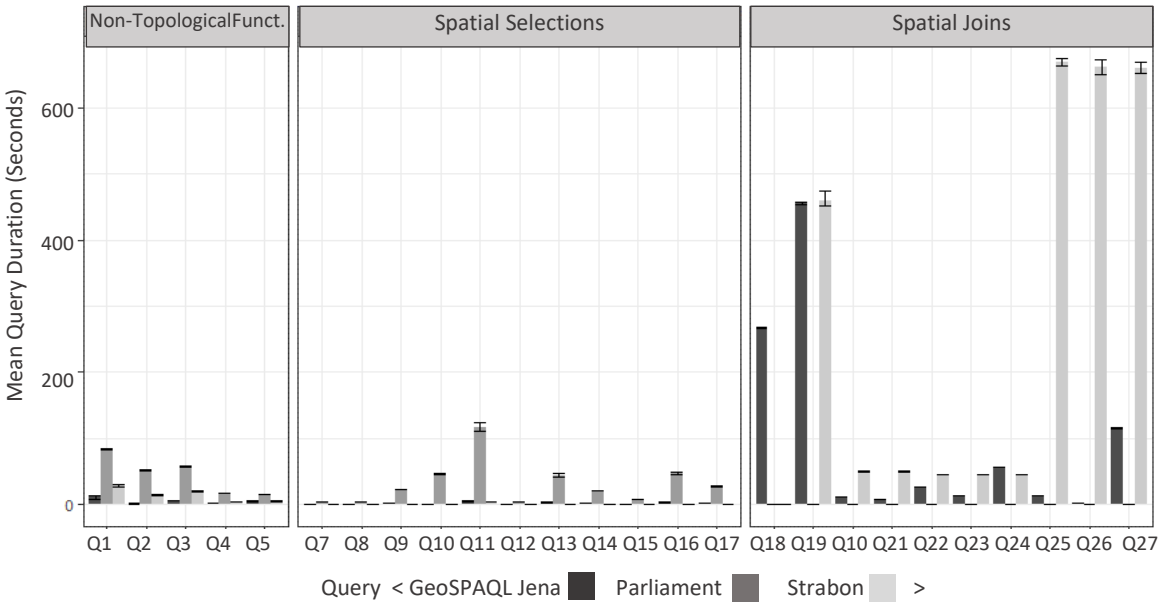


Figure 4: Mean Query Duration (seconds) by test system microbenchmark in Warm run. Error bars show min/max. Parliament timed out in Q18-Q27

Table 2 shows that Strabon achieves the most frequent fastest completion times in the Cold runs but GeoSPARQL Jena is more often fastest in the Warm runs. This reflects the on-demand indexing implemented in GeoSPARQL Jena. Parliament is consistently the slowest performer and did not complete one set of queries in the time limit. Strabon is quicker in the Non-Topological Functions and Spatial Selections queries. These queries utilise a single graph dataset while the Spatial Joins require geometries from two separate graph datasets. This suggests that Strabon is performing optimisations for intragraph operations during the lengthy initialization period, that may not be possible or tractable intergraph, i.e. the *Curse of Dimensionality* (Köppen, 2000).

Table 2: Microbenchmark test system rankings for Cold and Warm runs

	1st		2nd		3rd	
Test System	Cold	Warm	Cold	Warm	Cold	Warm
GeoSPARQL Jena	8	16	18	10	0	0
Parliament	0	0	0	0	26	26
Strabon	18	10	8	16	0	0

Although it would be expected that the Warm runs complete quicker than the Cold runs a comparison between the mean completion times finds this is not always the case with GeoSPARQL Jena 6 cases, Parliament 5 cases and Strabon 10 cases. In many cases the differences are fractional or less than a couple of seconds but the largest are exhibited by Strabon in Q19 and Q27 and GeoSPARQL Jena in Q19. It should also be noted that GeoSPARQL Jena is only marginally slower than Strabon in many queries, expect Q10 and Q11 and Q18 discussed earlier, while there is a noticeably lengthy difference in many queries in the Spatial Joins section for Strabon.

4.4 Geographica Macrobenchmark

The queries executed in this benchmark are those published by the Geographica project and follow the same numbering system. In keeping with the Geographica approach there is variation between query iterations. Each block of queries within a set uses related data but the data selected varies between iterations, e.g. MS0, MS1 and MS2 have consistent data in the first iteration but a different set of data is used in the second iteration. The same resulting queries have been used across each of the test systems to allow direct comparison. This variation between iterations can be seen in Figure 5 where there is more noticeable variation in maximum to mean completion durations (error bars show min/max). This can partly be attributed to many iterations returning zero results and resolving very quickly.

The query uses linear *metre* units for distance between two geometries. All geometries in the datasets are in CRS84, which is a geocentric SRS using non-linear *degree* units. In GeoSPARQL Jena, the handling of linear units with non-linear SRS geometries is achieved by temporarily transforming the geometries to a linear SRS. This is necessary as the ratio of *metres* to *degrees* is not fixed and varies according to the latitude of the coordinates. Alternative approaches may use a fixed ratio and tolerate the error as latitude varies.

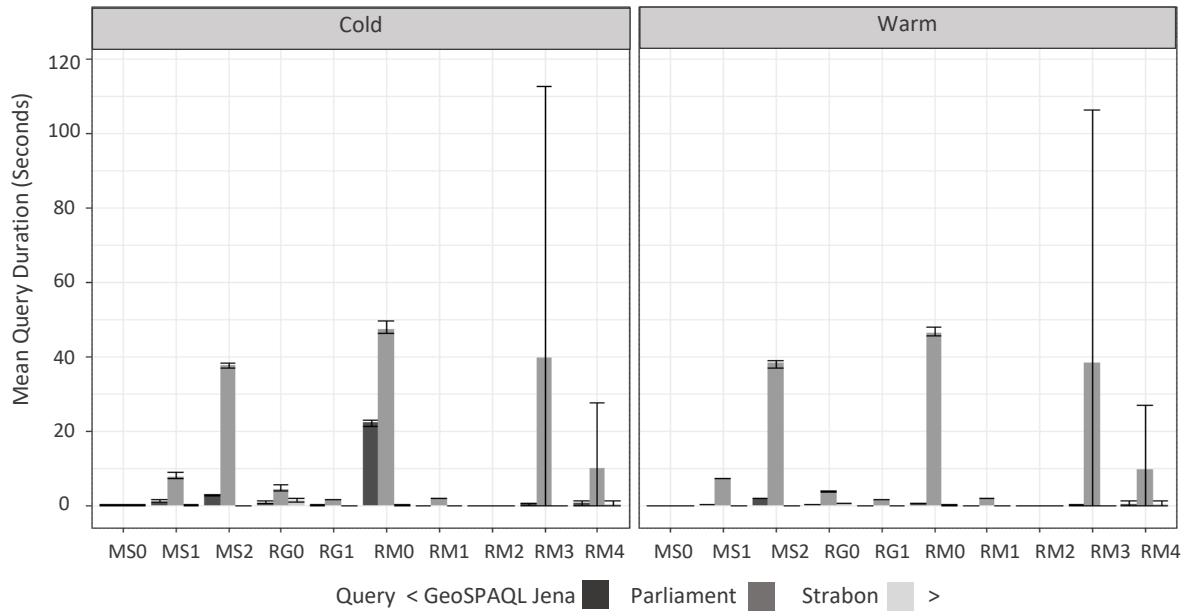


Figure 5: Mean Query Duration (seconds) by test system for both macrobenchmark runs

There is consistency in the number of results returned in all but two queries. Strabon returns zero results in four iterations of MS0 when Parliament and GeoSPARQL Jena both return a single result. The second case is MS2 where there is a difference in result count for the only non-zero iteration between Parliament and GeoSPARQL Jena. Strabon did not complete, repeatedly, this iteration and so no completion duration is reported. Strabon also did not complete all the iterations for RM3 and RG1. In all cases where Strabon did not produce results the

other test systems had non-zero result counts and Strabon produced an error rather than timing out, suggesting an issue with the processing of results within Strabon.

Parliament timed out after one hour in the RM5 query. This was also the most intensive query for GeoSPARQL Jena and required approximately 30 minutes in each iteration. The RM5 query uses two *intersection* filter functions and a geometry *difference* function with data from two graph datasets. In all iterations GeoSPARQL Jena required a similar duration to complete, even when no results were returned. Strabon was able to resolve the zero results in less than 1 second and only took 15 seconds for the non-zero result iteration. The i*ntersection* filter function is also used in microbenchmark Q19 and both test systems achieved similar results. This suggests that Strabon's query optimisation selected a resolution strategy which reduced the problem space much quicker than GeoSPARQL Jena.

The rankings across the three test systems in Table 3 show that GeoSPARQL Jena achieves the fastest results in the majority of queries. These rankings do not consider the discussed query manipulation for RM5 so Strabon is still ranked as faster than GeoSPARQL Jena in that case. Strabon achieves very quick results in certain cases but did not complete all iterations for three queries. Parliament did not resolve one query and is generally the slowest to complete.

Table 3: Macrobenchmark test system rankings for Cold and Warm runs

	1st		2nd		3rd	
Test System	Cold	Warm	Cold	Warm	Cold	Warm
GeoSPARQL Jena	6	7	5	4	0	0
Parliament	1	1	3	3	7	7
Strabon	4	3	3	4	4	4

5. Conclusion

This work sets out the design of a fully compliant implementation of the GeoSPARQL standard utilising an RDF graphstore. Previous implementations have achieved partial compliance of a sub-set of extensions. The examined implementations have generally provided geospatial and RDF functionality by extending relational databases requiring additional configuration and setup. Additional design points that have been achieved were Semantic Web standards compliance, minimal configuration, and a short initialisation period. This means that the implementation would be suited to both development and production environments.

An on-demand indexing approach was designed and implemented to retain geospatial and supporting data for improved performance. Experimentation was performed to consider the impact of controlling index size and retention periods on query duration. This innovative approach of short- and long-term caching of key data has been demonstrated to reduce query completion times by up to 20% without incurring initialisation delays. This on-demand indexing also has general utility for other SPARQL applications that require repeated processing of datatypes that are computationally expensive to de-serialise.

To understand the implementation's performance capabilities, a benchmarking framework has also been designed and implemented to perform a comparison with two existing GeoSPARQL systems: Strabon and Parliament.

The design of this framework is based upon importing, processing, and reporting on SPARQL queries, rather than a hardcoded queries as developed in the Geographica benchmarking framework for GeoSPARQL. Therefore, it has utility for benchmarking SPARQL queries broader than GeoSPARQL. This approach also provides transparency in the query content and data being benchmarked while variant queries can be easily written and processed. Queries can also be benchmarked on alternative datasets.

The reported benchmarking results show several advantages of the GeoSPARQL Jena implementation over the two benchmarked systems. The dataset loading and initialisation of the implementation are noticeably quicker. In the alternative systems, pre-query spatial index preparation is undertaken that is not incurred by the GeoSPARQL Jena implementation. Despite this, the benchmarking process has demonstrated that the GeoSPARQL Jena implementation has query times comparable or better than the alternative systems in all but one query case (RM5). The GeoSPARQL Jena implementation also completed all the GeoSPARQL benchmarking queries of the Geographica query set.

It has also been identified that minor manipulations to the benchmarking queries can trigger dramatic improvements in query resolution. This was found in the single query case (RM5) where GeoSPARQL Jena was dramatically slower than the Strabon test system. The application of two structural changes to the query, without altering content, reduced query time from 30 minutes to 8 seconds and overtook Strabon's performance.

This demonstrates that SPARQL query writing and optimisation can be very specific to the query engine being utilised. This highlights the challenge in preparing benchmarking queries which do not over accentuate the performance of a specific test system. It further emphasises the need for benchmarking frameworks to be adaptable in processing alternative versions of queries supplied by the user as designed and implemented in the benchmarking framework.

References

Apache Software Foundation. (2020) *Apache Jena* [online]. Available at: http://jena.apache.org/ [Accessed 2/2/2022].

Apache Software Foundation. (2018) *Apache Marmotta* [online]. Available at: http://marmotta.apache.org/kiwi/geosparql.html [Accessed 2/2/2022].

The Apache Software Foundation. (2019) *The Apache SIS library* [online]. Available at: https://sis.apache.org/ [Accessed 2/2/2022].

Battle, R. and Kolas, D. (2011) *Geosparql: enabling a geospatial semantic web*. Semantic Web Journal, 3(4), pp.355-370.

Butler, H., et al. (2016) *The geojson format*. Internet Engineering Task Force (IETF).

Eclipse Foundation. (2018) *Locationtech Java Topology Suite* [online]. Available at: https://projects.eclipse.org/projects/locationtech.jts [Accessed 2/2/2022].

Egenhofer, M.J. and Franzosa, R.D. (1991) *Point-set topological spatial relations. International Journal of Geographical Information System, 5 (2), 161-174.*

Garbis, G., Kyzirakos, K. and Koubarakis, M. (2013) *Geographica: A benchmark for geospatial RDF stores* (long version). In: International semantic web conference, Springer, pp. 343-359.

Harris, S., Seaborne, A. and Prud'hommeaux, E. (2013) *SPARQL 1.1 query language*. W3C Recommendation. (21 (10), 778.

Köppen, M. (2000) *The curse of dimensionality*. In 5th online world conference on soft computing in industrial applications (WSC5) (Vol. 1, pp. 4-8).

Kyzirakos, K., Karpathiotakis, M. And Koubarakis, M. (2012) *Strabon: a semantic geospatial DBMS*. *In: International Semantic Web Conference,* Springer, pp. 295-311.

OGC. (2020. *Simple Feature Access - Part 1: Common Architecture* [online]. Available at: https://www.ogc.org/standards/sfa [Accessed 2/2/2022].

Open Source Geospatial Foundation. (2020. *GeoTools The Open Source Java GIS Toolkit* [online]. Available at: https://geotools.org/ [Accessed 2/2/2022].

Schreiber, A.T. and Raimond, Y. (2014) *RDF 1.1 Primer*.

Spatial Reference System [online]. (2013) Available at: https://spatialreference.org/ [Accessed 2/2/2022].

Data Analytics in Organic Farming: Impact on Environmental Sustainability

Cristhian Paz[1], Josune Sáenz[1] and Ana Ortiz-de-Guinea[2]
[1]Deusto Business School, University of Deusto, San Sebastián, Spain
[2] HEC Montréal, Montreal, Canada
cristhianpaz@deusto.es
josune.saenz@deusto.es
ana.ortiz-de-guinea@hec.ca

Abstract: The production of healthy food while preserving the environment constitutes one of the main challenges of the 21st century. Along these lines, organic farming has emerged as a farm management and food production system that encourages environmental sustainability. To enhance such sustainability, data analytics both as an asset and as a capability could play a substantial role. Indeed, data analytics could be used to interpret the past and predict the future and to make more timely or accurate decisions regarding the use and protection of natural resources. Using survey data from 119 Spanish organic farms whose digitization degree as reported by the farmer is above 0, and structural equation modeling based on partial least squares to test research hypotheses, we found that even though data analytics in organic farming is clearly underdeveloped, it still contributes to enhancing farms' environmental sustainability. Thus, investments in environmental data analytics appear to pay off.

Keywords: Documented knowledge, Data analytics, Environmental sustainability, Agriculture, Organic farming

1. Introduction

According to the European Commission (2022a), food systems cannot be resilient to crises such as the COVID-19 pandemic if they are not sustainable. Today, such systems account for nearly one-third of global greenhouse gas emissions, consume large amounts of natural resources, result in biodiversity loss, and provoke negative health impacts (European Commission 2022a). Therefore, the production of healthy food while preserving the environment constitutes one of the main challenges of the 21st century. Along these lines, organic farming has emerged as a farm management and food production system that encourages responsible usage of energy and natural resources; maintenance of biodiversity; preservation of regional ecological balances; enhancement of soil fertility; maintenance of water quality; and high standards of animal welfare (European Commission 2022b).

Data analytics (i.e., analyzing raw data to identify trends and draw conclusions that help decision making) could play a substantial role in ensuring organic farms' environmental sustainability. In 2019, the EU Member States signed a cooperation declaration entitled "A Smart and Sustainable Digital Future for European Agriculture and Rural Areas", which states that rural digitalization has the potential to increase efficiency on the farm, improve production, and contribute to making agri-food systems more sustainable from an economic, social, and environmental perspective. Regarding the latter aspect, a systematic literature review by Sharma et al (2020) found that machine learning—which usually enables data analytics functionality—could help manage soil properties; make irrigation decisions; detect pest infestations, diseases, and weeds before actual outbreaks; and manage site specific nutrients, among other applications.

Analytical tools, however, could range over very different degrees of sophistication. For instance, Carlos et al (2021), reported a situation in which, at the outset, a family-owned farm's foreman recorded crop irrigation attributes (such as field, crop, meter readings, on and off dates, etc.) with paper and pencil from the fields and then stored the data in physical binders. Such data was then transferred at the end of each week and each season from the written notes to a Microsoft Excel sheet for further analysis and archival. A step forward from this rather rudimentary and not real-time procedure involved implementing a water tracking system that collected field-specific irrigation data via a Google form on the foreman's mobile, then synchronized with other relevant crop data specific to the farm in a spreadsheet, synchronized with external weather data from the regional irrigation management and information system, and then updated the visualizations in the Excel workbook to help decision making.

Today, machines equipped with sensors and cameras offer further possibilities by capturing minute field-level data like soil moisture, leaf greenness, temperature, and yield, among others (Pham & Stack 2020) that could be

analyzed with specific tools to obtain natural resource management insights. These new technologies pave the way to move farming's organizational culture away from experience-based management towards data-based management (Janc et al 2019), or at least towards a more balanced type of management.

Although different papers exist that describe existing technologies and recent developments that enable data collection and analysis, as well as their potential benefits in the agricultural domain (e.g., Bacco et al 2019; Moysiades et al 2021), research that assesses the degree of implementation of data analytics in organic farming for the management of natural resources (i.e., soil, water, plants, and energy) and its impact on environmental sustainability is missing. This constitutes an important research gap since farmers and government institutions need evidence on the effectiveness of these tools to make investment decisions.

This paper tries to overcome this gap by analyzing the degree of implementation of environmental data analytics both as an asset (i.e., up-to-date and easily accessible data records regarding key environmental aspects for farm management, whether digitized or not) and as a capability (in this case, the capability to align or realign—i.e., manage—natural resources based on the analysis of available and digitized data by means of software applications) and their impact on environmental sustainability in organic farming.

2. Theoretical background and hypothesis development

2.1 Theoretical background

Data analytics constitutes a knowledge resource and as such is part of the intellectual capital of the firm (Subramaniam & Youndt 2005; Peñalba-Aguirrezabalaga et al 2020). It involves both an asset and a capability dimension. As an asset, data analytics refers to collected data stored in documents and/or databases. The latter adds to the firm's structural capital as data remains in the company even though employees may leave (Bontis 1998). However, data analytics as a capability refers to the ability to analyze collected data using software to generate relevant knowledge for running the business (Grover et al 2018). It connects both with structural and human capital, as it depends both on the available software (i.e., structural capital) and on the individual's ability to use the software, interpret the results obtained, and make decisions (i.e., human capital).

This paper focuses on environmental data analytics or data analytics for the specific purpose of natural resource management in organic farming, with data availability and data digitization representing the asset dimension, and data analytic enabled environmental nature resource management representing the capability one. More precisely, data availability is the extent to which there are up-to-date and easily accessible records regarding the quality, use, and protection of (i.e., treatments applied to) natural resources, while digitization deals with the fact that such data could be digitized or not, as described in the example shown in the introduction section. On the other hand, environmental data analytics as a capability refers to the extent to which analytical software applications are used by organic farmers to generate diagnosis and recommendations regarding the use and protection of the farm's natural resources. As such, it constitutes a dynamic capability as it facilitates decision-making regarding changes in the natural resource base of the farm (Helfat et al 2007) based on insights and recommendations generated by the data analytic software.

To theorize about the relations of the elements of data analytics among themselves (i.e., data availability, data digitization, and data analytic enabled environmental data analytic capability), as well as with environmental sustainability, we take an information value chain theory perspective. This perspective provides mechanisms to tease apart the value added by each data analytic element in the information chain (Coiera 2019). Thus, this paper argues that data turns into environmental value (i.e., environmental sustainability) by following a set of steps, each adding value, that include data collection and storage, data digitization, and data analytic enabled knowledge generation for decision making regarding the organic farm's natural resources. In this context, the 'end' value of the chain is environmental sustainability, which according to the natural-resource-based view of the firm (Hart 1995; Hart & Dowell 2011), involves (a) pollution prevention (i.e., reducing waste and residues to a minimum); (b) product stewardship (i.e., lower product life cycle cost by minimizing natural resource consumption); and (c) sustainable development (i.e., producing in a way that can be maintained indefinitely into the future by protecting natural resources). This is summarized in Figure 1 in the form of a research model of which hypotheses are explained next.

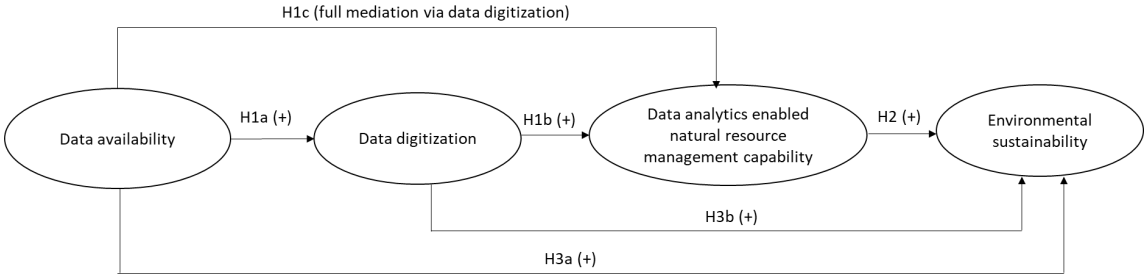


Figure 1: Research model

2.2 Hypothesis development

The capability to make decisions on natural resource usage and protection through the application of analytical software (i.e., data analytics enabled natural resource management capability) cannot be deployed without data. In other words, the insights generated by the application of data analytic tools is dependent upon the available data (Popovič & Habjan 2012). As pointed out in the introduction section, data may be collected manually and then stored on a physical device (e.g., a folder or binder) before being uploaded into a computer system for analysis or may be directly uploaded into an information system via sensors, thus digitally stored from the very outset. Accordingly, the following hypotheses can be formulated:

H1a: Data availability is positively related to data digitization.
H1b: Data digitization is positively related to data analytics enabled natural resource management capability.
H1c: The relationship between data availability and data analytics enabled natural resource management capability is fully mediated by data digitization (in other words, the direct relationship between data availability and data analytics enabled natural resource management capability is non-significant, while the indirect relationship is positive and significant).

Insights gained through data analytics regarding the quality, use, and protection of (i.e., treatments applied to) natural resources (i.e., soil/plants, water, and energy) would result in decisions that contribute to the enhancement of farms' environmental sustainability. For instance, soil and nutrient management software should lead to fertilization decisions that help preserve soil quality parameters while being in line with good environmental care; applications for identifying and controlling crops' pests and diseases should facilitate treatment decisions that help keep them under control; irrigation software should facilitate reducing water consumption to the strict minimum; likewise, energy management software exists that tracks peak energy usage and demand charges down to the meter and thus facilitates energy savings; finally, waste management applications are available that help reduce the amount of waste produced of different types and foster such waste to be reused. Based on the above, the following hypothesis is formulated:

H2: Data analytics enabled natural resource management capability is positively related to environmental sustainability.

Finally, the last two hypotheses acknowledge that documented and stored data (whether digitized or not) can also contribute to environmental sustainability without the need for digitization nor data analytic enabled resource management capability. The farmer can still be making good decisions regarding the farm's natural resources based on his/her assessment of non-digitized data, thus contributing to the environmental sustainability of his/her farm. Likewise, digitization is likely to also facilitate environmental sustainability without the need for the data analytic enabled capability. Therefore, the following hypotheses are suggested:

H3a: Data availability is positively related to environmental sustainability.
H3b: Data digitization is positively related to environmental sustainability.

3. Research methods

We analyze the degree of implementation of environmental data analytics and its influence on environmental sustainability using survey research data from a set of family-owned organic farms in Spain. Spain is the second European country with the largest area dedicated to organic agriculture behind France (2.5 million hectares vs. 2.4 million, respectively) (IFOAM 2022). The target population of the research was identified by means of the

REGOE (*Registro General de Operadores Ecológicos de España*), which is the Spanish General Register of Organic Operators. In all, 28,883 vegetable producers were identified whose farms were family-owned. From this population, a sample of 406 producers was obtained that respected regional and gender proportions. The choice was then made to focus on those producers whose main production was crop-based (358 producers) and that had all the elements to be analyzed in the research model (119 producers). Here, the main constrain referred to data digitization. As explained, only 119 producers were found that had digitized data (i.e., the data digitization degree as reported by the farmer was above 0 only in 119 cases), which represents just one third of the producers whose main production is crop-based.

A questionnaire was designed to gather information about the variables included in the research and was administered by phone by a specialized company. Total anonymity was guaranteed, and personalized reports of results were offered to encourage participation. All questionnaires were answered by people who actively participated in the management of the farm. Of these, 96 people (80.7%) were owners of the farm, and the remaining 23 (19.3%) while not being owners, were actively involved in decision making, planning and organization of day-to-day activities. Each farm had 1.78 permanent employees on average.

Measures corresponding to research variables (i.e., data availability, data digitization, data analytics enabled natural resource management capability, environmental sustainability, and control variables—size of the farm or agricultural production unit, and age of agroecological practices) are shown in Table 1. The data availability construct is formed by 5 indicators referring to data inputs regarding quality parameters of natural resources, natural resource usage, and resource protection (i.e., treatments applied). Consistent with this, data digitization measures the extent to which the above data is digitalized. On the other hand, data analytics enabled natural resource management capability is measured by 7 items capturing the extent to which the software allows the farmers to generate several types of diagnosis and decision recommendations regarding the natural resources of the farm. Finally, environmental sustainability encompasses 7 indicators that correspond to the 3 dimensions considered within the context of the natural-resource-based view (Hart 1995; Hart & Dowell 2011), as already explained in the theoretical background section.

In this case, indicators build up (or define) the conceptual variables. In other words, each research variable is conceived as a combination of different elements that make it up and that may not necessarily correlate. When this is the case, a composite measurement model applies (Henseler 2017). In composite measurement, latent variable scores are linear combinations (i.e., weighted composites) of the indicators making up the variables without error term. Two possibilities exist to estimate indicators' weights: mode "A" (i.e., correlation-based) and mode "B" (i.e., ordinary least squares regression-based) (Rigdon, 2016). According to Sarstedt et al (2016), mode "A" estimation performs better when sample sizes are small and R^2 values are small to medium, as is the case in this research for some of the dependent variables (see Table 2). Thus, mode "A" estimation was used.

Giving the emerging/formative nature of research variables, research hypotheses were analyzed using Structural Equation Modelling based on Partial Least Squares (SmartPLS 3.3.5 software) (Ringle, Wende, & Becker 2015).

4. Research findings

4.1 Descriptive analysis

Prior to evaluating the measurement and the structural model, a descriptive analysis was carried out to portray the degree of development of data analytics in the organic farms under study. As can be observed in Table 1, and as far as data analytics as an asset is concerned, on a scale from 0 to 10, digitization of environmental data tends to be 1 point below its documentation degree (i.e., data availability in any form), except for soil quality parameters and treatments applied, where the difference between documented data and digitized data is almost 2 points. Moreover, it should be noticed that data regarding treatments applied constitutes the only item in which the degree of documentation and digitization is well above 5. Therefore, it can be concluded that environmental data documentation and digitization tend to be quite low. The same happens with data analytics enabled natural resource management capability: on a scale from 0 to 10, average scores for each item are well below 5, although it should be noticed that standard deviations tend to be quite large, both in the case of data analytics as an asset and in the case of data analytics as a capability. Environmental sustainability items, however, are clearly above 5 in all cases.

4.2 Measurement model evaluation

In composite measurement, traditional assessment methods aimed at proving that the indicators chosen to operationalize the concepts derive from the same underlying phenomenon are not applicable. In this case, concepts emerge as the combination of the different elements included in the definition and thus measurement model assessment should guarantee that the indicators capture the essence of the conceptual variables (i.e., "conceptual fidelity").

As can be observed in Table 1, indicators chosen for both data availability and data digitization (i.e., environmental data analytics as an asset) include quality, usage, and protection parameters regarding main natural resources used in the farm (i.e., soil/plants, water, and energy), while the indicators chosen for data analytics enabled natural resource management capability include different diagnosis aspects and decision recommendations regarding the same natural resources which are facilitated by agricultural analytical tools available in the market. Thus, in the case of these variables, conceptual fidelity is quite straightforward. Finally, as far as environmental sustainability is concerned, as already explained, indicators included correspond to the three dimensions suggested by the natural-resource-based view: (a) pollution prevention (i.e., reducing waste and residues to a minimum: ENVSUST7); (b) product stewardship (i.e., lower product life cycle cost by minimizing natural resource consumption: ENVSUST1 and ENVSUST2); and (c) sustainable development (i.e., producing in a way that can be maintained indefinitely into the future by protecting natural resources: ENVSUST3, ENVSUST4, and ENVSUST5).

Collinearity between indicators (measured in terms of VIF values) is another aspect to be analyzed. However, this is only relevant in mode "B" (i.e., regression-based) estimation, as in such case collinearity (i.e., VIF values being above 3) can affect indicator's weights and could cause reversed signs. When this is the case, the researcher should consider replacing mode "B" estimation with mode "A", which is not affected by collinearity (Rigdon, 2016). In our case, such decision has been made beforehand, due to the rather small level of variance explained (i.e., R^2) of some of the dependent variables (see Table 2) and the relatively small sample size (119 producers). Such choice involves that indicators' weights are calculated in terms of their absolute relevance instead of in terms of their relative relevance vis-à-vis other indicators in the same construct when it comes to making up the latent variable score to maximize the amount of variance explained of the dependent variables.

Table 1: Measurement model evaluation

Constructs and measures	*Item wording*	*Mean (or %)*	*STDEV*	*VIF*	*Weight*	*p-val.*
Data availability (ENVDAV) Mode "A" composite	Please rate from 0 to 10 (0 = Not at all; 10 = Very much) the degree to which the agricultural production unit of reference has up-to-date and easily accessible records on the aspects listed below:					
ENVDAV1	The evolution of soil quality parameters.	4.983	4.079	1.764	0.286	0.000
ENVDAV2	The evolution of water quality parameters.	3.958	4.204	1.912	0.339	0.000
ENVDAV3	Irrigation statistics: irrigation days, irrigation time, water consumption...	4.697	4.378	1.576	0.289	0.000
ENVDAV4	Energy consumption statistics.	3.832	4.163	1.524	0.266	0.000
ENVDAV5	Treatments applied: dates, actions carried out, doses applied...	8.456	2.887	1.159	0.181	0.000
Data digitization (ENVDDIG) Mode "A" composite	Please rate from 0 to 10 (0 = Not at all; 10 = Completely) the degree to which the information records previously assessed are digitized:					
ENVDDIG1	The evolution of soil quality parameters.	3.269	4.293	1.960	0.262	0.000
ENVDDIG2	The evolution of water quality parameters.	2.840	4.019	1.996	0.292	0.000
ENVDDIG3	Irrigation statistics: irrigation days, irrigation time, water consumption...	3.353	4.269	1.529	0.308	0.000
ENVDDIG4	Energy consumption statistics.	2.882	4.061	1.526	0.300	0.000
ENVDDIG5	Treatments applied: dates, actions carried out, doses applied...	6.538	4.107	1.276	0.186	0.000
Data analytics enabled natural resource	Please rate from 0 to 10 (0 = Not at all; 10 = Very much) the degree to which the computer applications and tools available in the agricultural production unit allow you to:					

Constructs and measures	*Item wording*	*Mean (or %)*	*STDEV*	*VIF*	*Weight*	*p-val.*
management capability (ENVRAC) Mode "A" composite						
ENVRAC1	Identify nutritional deficiencies in crops (i.e., lack of substances necessary for proper plant development).	3.042	3.842	3.365	0.126	0.000
ENVRAC2	Assess the impact of pests and diseases.	3.218	3.887	4.492	0.154	0.000
ENVRAC3	Make care and treatment decisions.	3.739	4.047	4.084	0.159	0.000
ENVRAC4	Perform calculations regarding energy efficiency and energy savings.	3.731	3.995	4.400	0.195	0.000
ENVRAC5	Evaluate irrigation practices and calculate water efficiency and water footprint.	3.445	4.045	5.636	0.201	0.000
ENVRAC6	Generate recommendations on water consumption and management.	3.126	3.888	5.476	0.214	0.000
ENVRAC7	Calculate carbon footprint.	2.000	3.259	2.124	0.109	0.000
Environmental sustainability (ENVSUST) Mode "A" composite	Please rate from 0 to 10 (0 = Strongly disagree; 10 = Strongly agree) your degree of agreement or disagreement with the following statements regarding the agricultural production unit of reference:					
ENVSUST1	Our energy consumption has reached an optimum level: there is no other technique or action that will allow us to reduce it further.	6.227	3.211	1.314	0.003	0.490
ENVSUST2	Our water consumption has reached an optimal level: there is no other technique on the market or type of action that will allow us to reduce it further.	7.042	3.281	1.480	0.197	0.017
ENVSUST3	Our fertilizer supply to the soil is always in line with the requirements of good environmental care.	9.286	1.540	1.263	0.163	0.108
ENVSUST4	We have a good soil quality: all parameters are at adequate levels.	8.025	2.392	1.831	0.334	0.000
ENVSUST5	Pests and/or diseases are adequately controlled.	7.403	2.522	1.638	0.299	0.000
ENVSUST6	The biodiversity of our agricultural production unit is very high.	7.798	2.693	1.682	0.309	0.000
ENVSUST7	The volume of waste and residues generated is minimal.	8.529	1.913	1.517	0.152	0.058
Control variables						
Size of the agricultural production unit (SIZE)	Natural logarithm of the number of hectares of the agricultural production unit.	74.84*	395.54	N/A	N/A	N/A
Age of agroecological practices (AGE)	Year of introduction of agroecological practices.	2,010	6.35	N/A	N/A	N/A

*Average number of hectares devoted to crops and pastures.

4.3 Structural model evaluation

To test the significance and strength of the research hypotheses, we used a one-tailed 5,000 subsample BCA bootstrap (Hair et al 2017). Table 2 shows the results obtained.

Table 2: Structural model evaluation

	Effects	*STDEV*	*t statistics*	*p-values*	*10%*	*90%*
Direct relationships regarding data digitization (R^2 = 63.8%)						
Size	**0.109**	**0.054**	**2.031**	**0.021**	**0.040**	**0.176**
Data availability	**0.788**	**0.041**	**19.302**	**0.000**	**0.727**	**0.834**
Direct relationships regarding data analytics enabled natural resource management capability (R^2 = 15.5%)						

	Effects	*STDEV*	*t statistics*	*p-values*	*10%*	*90%*
Size	-0.086	0.083	1.032	0.151	-0.195	0.020
Data availability	0.067	0.151	0.442	0.329	-0.126	0.261
Data digitization	**0.340**	**0.155**	**2.201**	**0.014**	**0.125**	**0.522**
Direct relationships regarding environmental sustainability (R^2 = 13.5%)						
Size	-0.057	0.118	0.479	0.316	-0.207	0.097
Age of agroecological practices	-0.032	0.119	0.267	0.395	-0.164	0.139
Data availability	**0.352**	**0.168**	**2.091**	**0.018**	**0.090**	**0.510**
Data digitization	-0.134	0.181	0.741	0.230	-0.347	0.094
Data analytics enabled natural resource management capability	**0.194**	**0.095**	**2.046**	**0.020**	**0.042**	**0.287**
Indirect relationship between data availability and data analytics enabled natural resource management capability						
Indirect relationship via data digitization	**0.268**	**0.124**	**2.166**	**0.015**	**0.101**	**0.414**
Total degree of association between data availability and data analytics enabled natural resource management capability (Direct + Indirect)	**0.335**	**0.088**	**3.804**	**0.000**	**0.209**	**0.435**
Indirect relationships between data availability and environmental sustainability						
Indirect relationship via data digitization (1)	-0.105	0.145	0.725	0.234	-0.279	0.072
Indirect relationship via data analytics enabled natural resource management capability (2)	0.013	0.034	0.385	0.350	-0.019	0.063
Indirect relationship via data digitization and via data analytics enabled natural resource management capability (3)	**0.052**	**0.038**	**1.367**	**0.086**	**0.012**	**0.107**
Total indirect relationship (1+2+3)	-0.040	0.140	0.289	0.386	-0.222	0.124
Total degree of association between data availability and environmental sustainability (Direct + Indirect)	**0.312**	**0.101**	**3.074**	**0.001**	**0.116**	**0.400**
Indirect relationship between data digitization and environmental sustainability						
Indirect relationship via data analytics enabled natural resource management capability	**0.066**	**0.048**	**1.381**	**0.084**	**0.015**	**0.135**
Total degree of association between data digitization and environmental sustainability (Direct + Indirect)	-0.068	0.179	0.337	0.353	-0.288	0.157

As can be observed in Table 2, data availability is positively and significantly related to data digitization (β = 0.788), while the latter is also significantly and positively related to data analytics enabled natural resource management capability (β = 0.340). However, there is no direct significant relationship between data availability and natural resource management capability facilitated by data analytics, meaning that environmental data availability facilitates natural resource management capability based on data analytics inasmuch it allows ulterior data digitization, as the positive and highly significant indirect relationship via environmental data digitization points out (β = 0.268). Hence, hypothesis H1a, H1b, and H1c are supported.

On the other hand, data analytics enabled natural resource management capability is positively and significantly related to environmental sustainability (β = 0.194). Therefore, hypothesis H2 is supported. Furthermore, data availability is directly and positively related to environmental sustainability (β = 0.352), meaning that hypothesis H3a is supported. Thus, natural resource management capability based on documented data and personal judgement appears to have a greater effect on environmental sustainability than data analytics enabled natural resource management capability. However, there is no direct relationship between data digitization and

environmental sustainability, but only indirect. As a result, hypothesis H3b is not supported. Figure 2 provides a visual summary of the results.

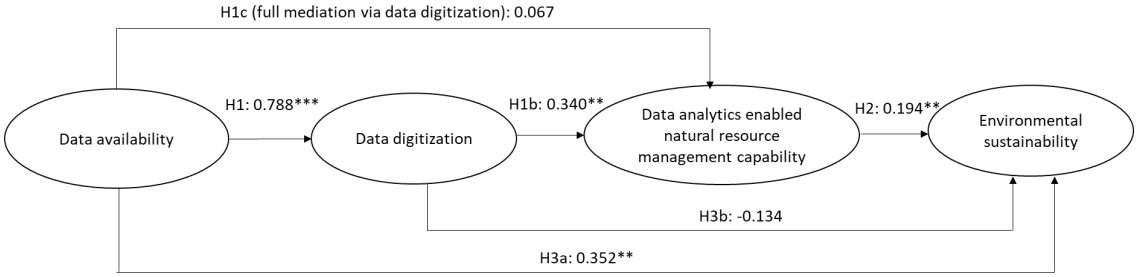


Figure 2: Results of the structural model

5. Discussion and conclusions

The research carried out analyzed the degree of implementation of environmental data analytics in family-owned organic farms in Spain and its influence on environmental sustainability. In this regard, the results indicate a positive relationship between data analytics and environmental sustainability, even though the mere fact of having environmental documented data that allows decision making based on personal judgement appears to be more influential than natural resource management capability based on ICT tools for data analytics. The prominent role of documented data that informs decision making and improves performance (in this case, environmental sustainability) is in line with the long tradition of studies in the intellectual capital domain that analyze the structural capital-performance link. However, it is not negligible that despite the low implementation of data analytics the relationship between data analytics enabled natural resource management capability and environment sustainability proved to be positive and significant, which makes think that this relationship could become stronger in the future, as the degree of implementation of data analytics increases.

Several reasons may explain the low levels of data analytic adoption by organic farms. While a clear one is the small size of the farms in the sample, others might be related to the demographics of the farmers (for instance, the average age of respondents was 51) and to infrastructure connectivity issues in rural areas. Moreover, the compatibility of digitalization with approaches such as organic farming is a matter of debate among farmers (Plumecocq et al 2018; Van Hulst et al 2020). One farmers' concern is the loss of technological sovereignty: while agriculture, peasant livestock, and artisanal fisheries have always produced and shared their own technologies, most new technologies are generated outside the system in which they are applied. This implies that those who use them must invest part of their income to pay for them. Furthermore, the types of commercial relationships established are often not punctual, but tie the producers down after the initial investment with ongoing costs of purchasing materials, software updates, maintenance services, etc. (Oteros-Rozas 2020).

Finally, this study has some limitations that warrant future research. For example, while our research method (i.e., survey) allowed us to find a low level of digitization among organic farms, qualitative methods such as case studies could help in explaining this finding. Furthermore, qualitative case studies could also be used to deepen into the specific tools used for data analytics by family-owned organic farms, the benefits they obtain from them, and the difficulties they face.

Acknowledgements

This paper is part of the NERSO project (Nuevos Modelos de Negocio para un Entorno Rural Sostenible / New Business Model for a Sustainable Rural Environment) which has been funded by the Science and Innovation Ministry of the Spanish Government (project reference: PID2020-114658RB-I00).

References

Bacco, M., Barsocchi, P., Ferro, E., Gotta, A. and Ruggeri, M. (2019) "The Digitisation of Agriculture: A Survey of Research Activities on Smart Farming", *Array*, Vol 3-4, pp 1-11.

Bontis, N. (1998) "Intellectual Capital: An Exploratory Study That Develops Measures and Models", *Management Decision*, Vol 36, No. 2, pp 63-76.

Carlos, A., Salinthone, X., Nguyen, M. and Jacobs, A. (2021) "Sustainable Agriculture Through Data Analytics", *The CSU Journal of Sustainability and Climate Change*, Vol 1, Article 2, pp 1-12.

Coiera, E. (2019) "Assessing Technology Success and Failure Using Information Value Chain Theory", *Studies in Health Technology and Informatics*, Vol 263, pp 35-48.
European Commission (2019) *Declaration – A Smart and Sustainable Digital Future for European Agriculture and Rural Areas*, Brussels.
European Commission (2022a) "Farm to Fork Strategy for a Fair, Healthy and Environmentally-Friendly Food System)", [online], https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en.
European Commission (2022b) "Organics at a Glance", [online], https://ec.europa.eu/info/food-farming-fisheries/farming/organic-farming/organics-glance_en.
Grover, V., Chiang, R. H., Liang, T. P. and Zhang, D. (2018) "Creating Strategic Business Value from Big Data Analytics: A Research Framework", *Journal of Management Information Systems*, Vol 35, No. 2, pp 388-423.
Hair, J. F., Hult, G. T. M., Ringle, C. M. and Sarstedt, M. (2017) *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (2nd ed.), Sage Publications, Thousand Oaks.
Hart, S. L. (1995) "A Natural-Resource-Based View of The Firm", *Academy of Management Review*, Vol 20, pp 986-1014.
Hart, S. L. and Dowell, G. (2011) "A Natural-Resource-Based View of the Firm: Fifteen Years after", *Journal of Management*, Vol 37, No. 5, pp 1464-1479.
Helfat, E., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J. and Winter, S. G. (2007) *Dynamic Capabilities: Understanding Strategic Change in Organizations*, Blackwell Publishing, Oxford.
Henseler, J. (2017) "Bridging Design and Behavioral Research with Variance-Based Structural Equation Modeling", *Journal of Advertising*, Vol 46, No. 1, pp 178-192.
IFOAM (2022) "New Organic Data: Growth Continued in 2020 but Policy Support on Statistics and CAP Essential to Reach EU targets", [online], https://www.organicseurope.bio/news/new-organic-data-growth-continued-in-2020-but-policy-support-on-statistics-and-cap-essential-to-reach-eu-targets/.
Janc, K., Czapiewski, K. and Wójcik, M. (2019) "In the Starting Blocks for Smart Agriculture: The Internet as a Source of Knowledge in Transitional Agriculture", *Wageningen Journal of Life Sciences*, Vol 90-91, pp 1-12.
Moysiadis, V., Sarigiannidis, P., Vitsas, V. and Khelifi, A. (2021) "Smart Farming in Europe", *Computer Science Review*, Vol 39, pp 1-22.
Oteros-Rozas, E. (2020) "Digitalización y Revolución Agraria: Un Debate Complejo", Soberanía Alimentaria, Biodiversidad y Culturas, Vol 39, https://soberaniaalimentaria.info/numeros-publicados/75-numero-39/805-digitalizacion-y-revolucion-agraria-un-debate-complejo.
Peñalba-Aguirrezabalaga, C., Sáenz, J. and Ritala, P. (2020) "Marketing-Specific Intellectual Capital: Conceptualization, Scale Development, and Empirical Illustration", *Journal of Intellectual Capital*, Vol 21, No.6, pp 947-984.
Pham, X. and Stack., M. (2018) "How Data Analytics Is Transforming Agriculture", *Business Horizons*, Vol 61, pp 125-133.
Popovič, A. and Habjan, A. (2012) "Exploring the Effects of Information Quality Change in Road Transport Operations", *Industrial Management & Data Systems*, Vol 112, No. 8–9, pp 1307–1325.
Plumecocq, G., Debril, T., Duru, M., Magrini, M. B., Sarthou, J. P. and Therond, O. (2018) "The Plurality of Values in Sustainable Agriculture Models: Diverse Lock-in and Coevolution Patterns", *Ecology and Society*, Vol 23, No. 1., https://doi.org/10.5751/ES-09881-230121.
Rigdon, E. E. (2016) "Choosing PLS Path Modeling as Analytical Method in European Management Research: A Realist Perspective", *European Management Journal*, Vol 34, No. 6, pp 598-605.
Ringle, C. M., Wende, S. and Becker, J.-M. (2015) *SmartPLS 3*, Bönningstedt: SmartPLS GmbH.
Sarstedt, M., Hair, J. F., Ringle, C. M., Thiele, K. O. and Gudergan, S. P. (2016) "Estimation Issues with PLS and CBSEM: Where the Bias Lies!", *Journal of Business Research*, Vol 69, No. 10, pp 3998-4010.
Sharma, R., Kamble, S. S., Gunasekaran, A. and Kumar, V. (2020) "A Systematic Literature Review on Machine Learning Applications for Sustainable Agriculture Supply Chain Performance", *Computers and Operations Research*, Vol 119, pp 1-17.
Subramaniam, M. and Youndt, M. A. (2005), "The Influence of Intellectual Capital on the Types of Innovative Capabilities", *The Academy of Management Journal*, Vol 48, No. 3, pp 450-463.
Van Hulst, F., Ellis, R., Prager, K. and Msika, J. (2020) "Using Co-Constructed Mental Models to Understand Stakeholder Perspectives on Agroecology", *International Journal of Agricultural Sustainability*, Vol 18, No. 2, pp 172-195.

Knowledge Management in Chile: An Analysis of 10 years of Initiatives in the Public and Private Sector

Gregorio Pérez-Arrau
Universidad de Santiago de Chile
gregorio.prezarrau@usach.cl

Abstract: Knowledge management is a discipline that seeks to rationalize the use of knowledge and information in organizations. Since its origins in the nineties, it has developed mainly in countries of the global north, with few contributions from and to developing countries, such as Chile. In recent years, concept of knowledge management in Chile has been used increasingly within economic, administrative, and business environments. However, despite these advances, the scarce existing research in this field does not allow us to clearly visualize the state of development of these initiatives, their characteristics, or their results. Consequently, this study seeks to contribute to the understanding of this new area of development for organizations through the qualitative analysis of twenty-four cases of knowledge management initiatives carried out in public and private organizations in Chile, between 2010 and 2020. It describes the motivations that originated the initiatives, the tools used, some of the difficulties encountered, and other aspects of interest for disciplinary development. Finally, the article concludes with an analysis of the state of development of knowledge management in Chile and a proposed typology to situate the state of progress of organizations in this area.

Keywords: Knowledge management, emerging economies, Latino America, Chile

1. Introduction

Scientific and technological advances of the last decades in Chile are transforming the technical organizational scenario and the relative weight of productive factors in the economy, making knowledge the preponderant and differentiating resource of organizations and a source of competitive advantage for companies and countries (Obeso and Sarabia, 2018; Perez-Arrau, 2015). This trend, far from waning, seems to be gaining even more strength with the arrival of the so-called fourth industrial revolution, suggesting even more radical changes in the way we will organize and work in the coming years (Schwab, 2017). In this context, a growing number of professionals and academics in Chile have become interested in understanding the nature, behavior, and use of organizational knowledge and its rational management as a productive resource.

In simple terms, knowledge management can be understood as "The ability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in its products, services and systems." (Nonaka and Takeuchi, 1995, p.viii). In its development, this discipline has received contributions from diverse areas of knowledge , such as philosophy, database technologies, collaborative technologies, decision support systems, web technologies, artificial intelligence, technical writing, cognitive science, social sciences, information sciences, archive and library science, engineering, human resources management, defense, health, and engineering, among others. (Dalkir, 2017; Girard and Girard, 2015). The diversity of ideas, methods, and objective phenomena, as well as its multifaceted origin, based on varied resources and a diversity of disciplinary languages, have resulted in a disciplinary field that is not always entirely coherent (Spender, 2015). However, despite the above, today knowledge management is considered an established discipline in the field of management, with a robust body of knowledge and a permanent academic community (Serenko and Bontis, 2013).

2. Knowledge management in Chile

Although Chile, like other Latin American countries, does not present great advances in the field of knowledge management, evidence shows that during the last decade a number of initiatives linked to knowledge management have been developed in public organizations and private companies (Pérez Arrau, 2016, 2015; Liberona and Ruiz, 2013). These initiatives arise from the need of organizations to find new strategies to deal with an increasingly complex and competitive environment, a natural consequence of the country's economic development in the last four decades, with knowledge and learning as fundamental resources for innovation, change, and adaptation (Obeso and Sarabia 2018).

Studies on knowledge management in the Chilean context include various topics, such as the importance and challenges of Chilean companies in the knowledge economy (Rojas Pescio and Roa, 2018; Torres, 2018); the role of leadership in knowledge management in SMEs (Rodriguez-Ponce et al. 2010); knowledge management of

workers in the wine industry (Perez-Arrau, 2010); strategic direction and knowledge management (Pedraza-Rejas, Rodríguez-Ponce and Rodríguez-Ponce, 2006; Rodríguez-Ponce, 2007); the implementation of knowledge management programs and tools in companies in the country (Liberona and Ruiz, 2013); case studies of the application of a knowledge management strategy in a number of Chilean companies (Griffiths and Arenas, 2013; Arenas and Griffiths, 2014); international comparative study on the acquisition of knowledge management practices in a group of OECD countries (Liberona and Fuenzalida, 2014); the knowledge management process in the Chilean port industry (Cordoba, Duran and Galindo., 2015); the instruction of knowledge management policies and practices in the public sector (Perez- Arrau, 2016); the perception of university executives regarding knowledge management (Araneda-Guirriman et al., 2017); analysis of variables related to innovation, learning, and knowledge transfer in Chilean organizations, using data from the World Bank (Obeso and Sarabia 2018); and, finally, knowledge management applications and tools applied to specific economic sectors (Segarra et al., 2017; Ñuñez et al., 2018; Araya-Guzman, 2019; Pizarro Varas-Madrid, 2019; Araya-Guzman et al, 2021).

Despite the mentioned incipient (and unarticulated) contributions, there is some degree of evidence on the existence of knowledge management practices in Chile. For example, the exploratory study carried out by Liberona and Fuenzalida (2013) on a total of 100 companies indicates that on average companies in Chile use 50.58% of the 17 knowledge management tools defined by the OECD (2001), of which the use of the internet to obtain information the most commonly used tool (74.82%). The study points out that small companies are at a clear disadvantage in the use of these technologies, and that one third of the respondents indicated that they do not have a formally established organizational policy in this regard. Likewise, the study shows that, in general, companies in Chile do not define a long-term strategy; therefore, they are unlikely to develop knowledge management policies.

The study by Perez- Arraus (2016) describes seven knowledge management projects carried out in the public sector, all in different stages of development. These projects were not always labeled as or associated with knowledge management; instead, some were treated as specific initiatives or tools, without greater strategic pretensions. As there are knowledge management practices that are not labeled as such, a reasonable doubt arises as to how many other organizations could be implementing knowledge management tools and practices, without being considered as knowledge management per se.

This study also found that the main motivation for generating these projects was the imminent loss of knowledge due to the imminent retirement of a staff member or the need to ‘‘reproduce’’ the critical knowledge of an organization in the short term. It was also found that the initiatives were driven by the vision of a highly motivated leaders who saw knowledge management as a development potential for their institution.

Studies by Liberona and Fuenzalida (2014) and Perez- Arrau (2016) provide some insight on the existence of organizations developing knowledge management policies and practices in Chile, under the same or similar denominations. This progress is, however, embryonic and, to some extent, delayed, especially considering the importance of knowledge for a country that aspires to take part of the fourth industrial revolution. This is because most of the above-mentioned research barely addresses relevant issues such as the objectives, the resources used, or the organizational and/or cultural barriers that must be overcome by the executors during their implementation and development, which are fundamental aspects for the successful implementation of future projects. Moreover, very little is known about the degree of success or failure of these initiatives, or how the results were evaluated. All these questions remain unanswered, and this research aims to address them.

3. The study

This study seeks to learn about the knowledge management initiatives that were carried out in medium and large organizations in Chile between 2010 and 2020. In the study, a series of aspects of each of the initiatives are identified and described to recognize the process from its origin, the decisions, and their rationale, the actions taken, the barriers and, in general, the most significant aspects of each project carried out.

The methodological approach of this proposal is purely qualitative and is framed in the tradition of multiple case studies (Baxter, P., and Jack, 2008; Vasilachis de Gialdino, 2006). A case study methodology was chosen for two reasons. First, because, as an unprecedented research in Chile, it was important to know in detail the why and how of each of the experiences, in a less structured way; in such a way that it would allow inquiring into aspects not known in the literature or that escaped the researcher’s background. Second, because of the importance

of the context and the specific circumstances in which these initiatives were generated, which could give a specific and unique meaning to the actions carried out, which differ greatly from the cases described in traditional literature. Both conditions make the case methodology particularly appropriate for this type of research.

In total, 24 cases of public and private organizations, from different economic sectors, ownership, and sizes were constructed and analyzed (see Annex 1). The sample of companies by theoretical convenience, rather than statistical criteria, through the Knowledge Community, alumni of the diploma program in knowledge management, and other contacts of the researcher. The analysis of the cases was carried out through qualitative examination and the development of emerging categories with the support of NVIVO software.

4. Origin of the initiatives and objectives

Within the organizations studied, a common cause that explains the origin of knowledge management initiatives was the need to ‘‘preserve’’ the critical knowledge in the possession of a worker or group of workers, when they are about to retire or be absent for a long period of time. The first of these situations tends to occur mainly in public sector organizations (or companies that were public in the past) in which job permanence is generally of many years and, therefore, people accumulate a large amount of specific and contextual tacit knowledge. Thus, the departure of a key officer can become a considerable threat to an institution by jeopardizing the proper performance of operations in an area. For example, among the organizations studied, we found that the warning signal about the need for a knowledge management system to support critical knowledge started when one of the people who knew best how to operate a large electricity generating machine was recruited by the competition, exposing the dramatic dependence of the organization on this person’s unique knowledge. In the words of the person in charge of the knowledge management project, ‘‘*...a worker like that puts together and takes apart a turbine like someone who puts together and takes apart a household blender at home*’’ and then pointed out how difficult it would be to find a replacement in the short term.

Likewise, the knowledge of a public service inspector who detects anomalous or illegal situations in a procedure was described by one of the interviewees as ‘‘exceptional’’ in terms of identifying signals that lead to inspecting this type of situation. In this sense, the inevitable loss of a significant number of inspectors as a result of their upcoming retirement set off alarms in that organization regarding the possible loss that this would entail in their performance, triggering the decision to initiate a knowledge management plan oriented towards knowledge transfer. In the specific case of this institution, a unit was created whose purpose was to identify the "knowledge" and fundamental competencies of the organization to subsequently create a course curriculum on these subjects, taught mainly by the institution's most experienced employees. In addition, the institution developed a map of experts; a training plan for trainers; an e-learning system; and the creation of discussion and exchange groups among officials who are experts in specific subjects, like the so-called communities of practice.

In another of the organizations studied, a small digital marketing agency, knowledge management emerged as a response to an unexpected situation of prolonged absence of two female staff members performing the same work, the two of them being the only ones responsible for that work in the entire organization. The two people would take their pre- and post-natal leave in the near future, producing a complicated knowledge gap that would be difficult to replace in the short term. It was only after this situation that the organization became aware of the risk involved in concentrating critical knowledge in a few hands, and so it was decided to start a project to identify critical knowledge, which would later reveal other vulnerable areas in this field.

A second origin of the knowledge management initiatives encountered was the search for higher quality in management and products. The idea was to improve processes based on the experience of its collaborators, both successes and failures, through the development of instances of collaborative dialogue. The idea was to create instances of learning and continuous improvement through collaboration and synergy between units. These instances included geographically dispersed units, even across borders. This is the case of an engineering company with operations in Chile and Brazil, which developed a knowledge management project that included the identification of critical knowledge in both countries, and then managed its transfer and adoption.

Thirdly, many companies developed knowledge management practices with the purpose of innovating through the ideas and proposals of their collaborators. Although innovation can be seen as part of the continuous quality

improvement process, it is presented here separately because in some of the organizations studied it was explicitly proposed as a different objective from quality. For example, in one digital marketing company studied, knowledge management was associated with data research to bring offers to the customer, through dissemination in digital media. Similarly, a large pharmaceutical company developed several innovations from leveraging the knowledge of its experts, with some of these innovations receiving international recognition for their originality and usefulness.

Another objective frequently mentioned by interviewees was learning. In many of the organizations, learning was seen as the desired outcome of knowledge management policies and practices, which in turn could be used as an input for innovation, continuous quality improvement and better decision making. Among the organizations studied that had this purpose as a priority was a higher education institution whose objective was to preserve the learning gained through the implementation of a large educational quality improvement project. The leadership team was convinced that the implementation of the project would bring with it many valuable experiences, worthy of analysis and use as learning resources for the institution.

Likewise, a public service linked to the judiciary developed knowledge management practices that sought to analyse and learn from past mistakes in which its own professionals had participated. The fact that this organization carried out reviews of the actions and decisions made during a judicial process, with a critical and learning perspective, deserves to be highlighted, considering that the characteristics of the Chilean organizational culture are not a favourable scenario for criticism (Hojman and Perez-Arrau, 2005). Lastly, the research was informed about the case of a construction company that developed retrospective analysis processes of the after-action reviews type, oriented to the review of actions taken and decisions made in a given construction project. Here, the objective was to learn from the experience by creating an environment of respect and tolerance, in which problems and difficulties could be openly exposed.

Another objective found among these initiatives was to improve decision-making based on the deployment of tools linked to the use of information. In the projects that were initiated with this objective, the intention was to rationalize the use of valuable data or information using digital tools for this purpose. This is the case of a Santiago law firm that decided to initiate a knowledge management project oriented to the systematization of information, and its deployment in a more rational way, to facilitate the construction of more effective legal proposals through the analysis of past reports, jurisprudence, rulings, etc.

It was also found that some organizations started their knowledge management project from a traumatic experience, for example, a costly procedural error. In response, the organizations created original mechanisms to seek, at least partially, the best use of knowledge and/or information in their unit.

5. Unit in charge of executing the initiatives and start year

The question of the structural location of knowledge management professionals and projects is not trivial, especially considering that most organizations in Chile do not have an administrative area dedicated to this subject, and the fact that it is a relatively new discipline in search of an identity. Moreover, considering the diverse and at the same time controversial origin of knowledge management, and its initial tendency to adopt the technical perspective of information management (Hislop, 2010), it is worth asking which organizational areas have taken on the challenge of leading these initiatives.

Of the 24 initiatives studied, 14 of them, i.e., 58% of the cases, were led by the human resources area. In 4 cases, i.e., 17% of the total, it was a knowledge management unit per se, and in 6 cases, i.e., 25%, it was another unit or department (e.g., quality management, operations, etc.). This is not surprising, considering that many of the organizations studied came to knowledge management because of the imminent loss of critical human resources and, therefore, it is to be expected that these same areas will be the ones concerned with developing systems, policies, and practices to help avoid problems of this nature. Perhaps more interesting, from the research point of view, is the fact that there are four cases of organizations whose knowledge management executing unit is called “knowledge management” itself, in a context in which this discipline has had a relatively slow advance in terms of its popularization in academia and the organizational environment. Thus, the fact that some organizations incorporate a unit devoted exclusively to the field of knowledge management generates some degree of optimism regarding the future of this discipline in the world of business administration.

6. The present of knowledge management in Chile

A first analysis of the results of this research indicates that, although knowledge management is a subject of growing interest, it is still a little explored area in organizations. Proof of this is the difficulty encountered by the author of this research to find organizational experiences of knowledge management carried out in the past or in the present. Considering that, in addition, this study did not use probabilistic techniques for the identification of cases but reached each one through personal contacts and specific groups, it is even more evident that knowledge management is not a common practice in the world of administration in the country. On the contrary, as will be explained below, the effort to carry out these initiatives or to disseminate them in the professional or academic field tends to be concentrated in a handful of people, a few companies, or institutions, who have been developing knowledge management in Chile for years.

Secondly, knowledge management tends to emerge as a reaction, rather than from a long-term vision. This is because, unlike other proposals for organizational change, which emerge in advance as part of a medium- or long-term strategic proposal, the knowledge management initiatives encountered generally respond to problems that were already present or imminent, which negatively affected the organization. Moreover, in most cases, knowledge management was adopted in a rather timid way, sometimes with modest "pilot" initiatives, to which more resources were later allocated as they were able to demonstrate good results. Many of them started with a single person in charge, and later included more people in the team. Thus, it seems that knowledge management is not on the list of priorities of company directors and senior executives.

Third, this study found that organizations are increasingly concerned with learning from past experiences and transforming them into a resource for change and innovation, including the recognition of failures, waste, and human error. This trend is interesting in that it represents a countercultural behaviour that moves away from the traditional authoritarianism and paternalism of Chilean organizational culture (Rodríguez and Gómez, 2009).

On the other hand, the most popular knowledge management tools found in these initiatives were: lessons learned, communities of practice, corporate universities, knowledge bases, after action review (AAR), document management and mentoring. The organizations included in the study tended to have more than one tool in place and they are generally implemented one at a time.

An interesting aspect found in this study was the participation of the consulting firm Catenaria (now Knowledge Work) in almost all the cases included in the study. With almost 20 years of presence in Chile, this company has led knowledge management in most of the organizations that have carried out initiatives in the country, taking part from the origin (diagnosis) to the development and evaluation of the projects. In this sense, we could speak of the “catenarization” of knowledge management in Chile. This particularity in the way in which knowledge management arrived and developed in the country could have consequences that would be worth exploring in future research.

1. It was also found that most of the initiatives described in this research originated in the last five years, which confirms the findings in the literature that knowledge management is a relatively recent phenomenon in the Chilean organizational environment.
2. It was found that the main barriers to carry out these initiatives coincide, to a large extent, with some of the characteristics of Chilean culture and society described in the literature of organizational studies, such as: lack of trust; great power distance in labour relations; lack of communication skills; paternalistic organizational culture, to mention a few (Hojman and Perez-Arrau, 2005; Rodriguez and Gomez, 2009). Also, the problematic measurement of the results of knowledge management initiatives and the lack of training of managers in knowledge management techniques and tools were other adverse factors.
3. Finally, as previously mentioned, there were significant differences among the organizations studied, in relation to their state of development in knowledge management. While some were timidly initiating their first practice oriented to knowledge management, with evident insecurity regarding the steps to follow and uncertainty regarding the results, others showed clear objectives, a defined structure and prepared professionals. This study proposes a classification scheme based on the characteristics found.

7. Conclusions

This research is a significant contribution to the understanding of a recent organizational phenomenon, which is the arrival of knowledge management in Chilean public and private organizations. Understanding that, to date, has been incipient and fragmented; among other causes, due to the incipient state of research on the subject in

universities and research centres in the country, and because of the low number of initiatives carried out in organizations.

Secondly, this article highlights the fact that it describes in depth twenty-four cases of organizations, private companies, and public institutions, that have implemented knowledge management projects between 2010-2020, being one of the most comprehensive studies published so far in the country.

In addition, the fact that this study was conducted using the qualitative methodology of multiple cases, contributes to a greater understanding of the experiences lived and the meanings attributed to it by the professionals in charge of these initiatives, thus allowing a better understanding of their actions, decisions, adversities and even results obtained in the execution of these initiatives. Likewise, the methodology used allows a better understanding of the complex nature and influence of the context in the origin and development of these initiatives, a dimension that is increasingly relevant to the understanding of organizational phenomena.

Thirdly, this study proposes a system for classifying the state of development of knowledge management in an organization, based on the characteristics found in the companies studied, whose value could be to provide future researchers with a perspective for evaluating progress in this field.

Finally, the results presented in this research allow creating a moderate state of optimism among those interested in this topic, since, although it shows that there are successful knowledge management initiatives in Chile at present, a community of stakeholders, and even a handful of academics and researchers in the field, it also shows the embryonic state of this field in the country and the theoretical aspects that still need to be known.

References

Araneda-Guirriman, C., Rodríguez-Ponce, E., Pedraja-Rejas, L., Baltazar-Martínez, C., and Soria-Lazcano, H. (2017). 'La gestión del conocimiento en instituciones de educación superior del norte de Chile'. *Revista de Pedagogía,* 38(102), 13-30.

Araya-Guzmán, S., Bravo, C. H., Ramírez-Correa, P., and Salazar, A. B. (2019). 'Explorando la relación entre gestión del conocimiento y el rendimiento organizativo en instituciones de educación superior universitaria'. *Revista Ibérica de Sistemas e Tecnologias de Informação*, (E17), 947-959.

Araya-Guzmán, S., Palacios-Fuentealba, E., and Salazar-Concha, C. (2021). 'Explorando la relación entre Gestión del Conocimiento y el Rendimiento Organizativo en Instituciones de Educación de Fuerzas Armadas'. *Revista Ibérica de Sistemas e Tecnologias de Informação*, (E42), 438-451.

Arenas, T., & Griffiths, P. (2014). 'Analysing the Relationship Between Components of Knowledge Orientation Strategy in Chilean Enterprises'. In *International Conference on Knowledge Management in Organizations* (pp. 337-346). Springer, Cham.

Baxter, P., and Jack, S. (2008). 'Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, 13(4), 544-559

Dalkir, K. (2017). *Knowledge management in theory and practice*. MIT press.

Girard, J., and Girard, J. (2015). 'Defining knowledge management: Toward an applied compendium. *Online Journal of Applied Knowledge Management*, 3(1), 1-20.

Griffiths, P. and Arenas, T. (2014) ENTEL: A Case Study on Knowledge Networks and the Impact of Web 2.0 Technologies. *Electronic Journal of e-Learning* 12.4 .

Hislop, D. (2010). 'Knowledge management as an ephemeral management fashion?'. *Journal of Knowledge Management*, 14(6), 779-790.

Hojman, D. E. and Pérez Arrau, G (2005) 'Cultura nacional y cultura organizacional en tiempos de cambio: la experiencia chilena' ('National Culture and organizational culture in time of changes: the Chilean experience'). *Revista Latinoamericana de Administración*, No 35, pp 87-105.

Johns, G. (2018). 'Advances in the treatment of context in organizational research'. *Annual Review of Organizational Psychology and Organizational Behavior*, 5, 21-46.

Liberona, D. and Fuenzalida, D. (2014) Comparing knowledge management application in Chile and other OECD countries. In *The 8th International Conference on Knowledge Management in Organizations* (pp. 165-178). Springer, Dordrecht.

Liberona, D. and Ruiz, M. (2013) Análisis de la implementación de programas de gestión del conocimiento en las empresas chilenas. *Estudios Gerenciales*, 29, (127), pp. 151160

Nonaka, I., and Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.

Obeso, M., and Sarabia, M. (2018). 'Knowledge and enterprises in developing countries: evidences from Chile. *Journal of the Knowledge Economy*, 9(3), 854-870.

Perez Arrau, G. (2020) Gestión del conocimiento en el sector público chileno. In Ferreira Batista, F. ed. *Experiências Internacionais de Implementação da Gestão do Conhecimento no Setor Público*. Brasilia: IPEA (47-68)

Perez-Arrau (2010) *Managing knowledge workers: The case of the Chilean oenologists.* Doctoral dissertation, Doctoral dissertation. University of Liverpool Management School.

Pérez-Arrau, G.. (2015). 'Knowledge management in the context of developing countries: the case of Chile'. In European Conference on Knowledge Management. UK: Academic Conferences International Limited. pp. 1011.

Pizarro, S. C. A., and Varas-Madrid, C. P. (2019). 'Atributos determinantes de la transferencia del conocimiento: una revisión de la situación de las pymes del sector industrial de Coquimbo, Chile.' *Revista Facultad de Ciencias Económicas: Investigación y Reflexión*, 27(1), 107-124.

Rodriguez, J. K. and Gomez, C. F. (2009) 'HRM in Chile: the impact of organisational culture'. *Employee Relations*, 31(3), pp.276-294.

Rodríguez-Ponce, E. R. (2007). 'Gestión del conocimiento y eficacia de las organizaciones: Un estudio empírico en instituciones públicas. Interciencia', 32(12), 820-826.

Rodríguez-Ponce, E., Pedraja-Rejas, L., Delgado, M., & Rodríguez-Ponce, J. (2010). 'Gestión del conocimiento, liderazgo, diseño e implementación de la estrategia: un estudio empírico en pequeñas y medianas empresas. Ingeniare'. *Revista chilena de ingeniería*, 18(3), 373- 382

Rojas Pescio, H. G., and Roa Petrasic, V. A. (2018). Productivity of Chilean Micro and SMEs in the knowledge economy. *Revista Gestion De Las Personas y Tecnologia*, 11(32), 68-85.

Schwab, K. (2017). *The fourth industrial revolution*. Currency.

Segarra, L., Herrera, R. F., Alarcón, L. F., and Pellicer, E. (2017). 'Knowledge management and information flow through social networks analysis in Chilean architecture firms'. In *Proc. of the 25th Ann. Conf. of the Int'l Group for Lean Construction*. Heraklion, Greece. pp. 413-420

Serenko, A. (2021), 'A structured literature review of scientometric research of the knowledge management discipline: a 2021 update', *Journal of Knowledge Management*, 25 (8), pp.1889-1925

Serenko, A., and Bontis, N. (2013). 'Global ranking of knowledge management and intellectual capital academic journals': Journal of Knowledge Management. 3 (1), pp. 4-15

Vasilachis de Gialdino, I. (coord.) (2006). Estrategias de una investigación cualitativa. Buenos Aires: Editorial Gedisa.

Spender, J.C. (2015). *Knowledge Management: Origins, History, and Development*. In: Bolisani, E., Handzic, M. (eds) Advances in Knowledge Management. Knowledge Management and Organizational Learning, vol 1. Springer, Cham. https://doi.org/10.1007/978-3-319-09501-1_1

Appendix

	LIST OF ORGANIZATIONS INCLUDED IN THE STUDY	
N°	**ACTIVITY/ECONOMIC SECTOR**	**CASE FOCUS/KNOWLEDGE AREA**
1	Mining	Mineral exploration/geology
2	Retail	Continuous quality improvement
3	Education	Learning – Continuous improvement
4	Occupational health	Learning-Innovation
5	Public services	Emergency management
6	Legal study	Legal case studies - Decision making
7	Mining	Production process improvement
8	Pharmaceutics	Process and product innovation
9	Energy	Critical knowledge retention
10	Energy	Distribution of critical knowledge-competencies
11	Services	Organizational intelligence - Distribution of critical knowledge
12	Public service	Critical knowledge retention and distribution
13	Public service	Critical knowledge retention and distribution
14	Public service	Critical knowledge capture and distribution
15	Public service	Learning
16	Public service	Learning
17	Public service	Critical knowledge retention and distribution
18	Public service	Distribution of critical knowledge-teaching
19	Sanitary water	Continuous improvement - cost reduction
20	Public service	Decision making
21	Forestry sector high R+D technology company	Innovation
22	Public sector	Process innovation - continuous improvement - critical knowledge retention and distribution
23	Digital marketing services	Critical knowledge retention and distribution - client service improvement
24	Engineering projects services	Innovation, quality improvement, costs.

Management of Consumer Payment Determined by Gender During the COVID-19 Pandemic

Luiza Piersiala
Częstochowa University of Technology, Faculty of Management, Częstochowa, Poland
luiza.piersiala@pcz.pl

Abstract: The article discusses the subject of the consumer's gender and factors that affect shopping, and more specifically whether there is a relationship between gender and preferred means of payment in times of the COVID-19 pandemic. I explore the relationship between cash and other payment instruments using the outbreak of the COVID-19 pandemic as a natural experiment exogenously affecting both the payment industry and consumers' habits. This article sheds more light on changing the payment habits of consumers since the beginning of the pandemic. The purpose of this article is to examine the styles of payment-related decision making and to identify differences and similarities in this regard according to gender. Women are different from men in every activity they perform, and therefore also in shopping styles. Consumer behaviour is an area in which the diversity of behaviour between men and women is very clear. The author conducted an empirical study in the period of January-February 2022 among the students of the University of the Third Age. The study participants were women and men over 55 years of age. The basic research method was the PAPI (Paper and Pencil Interview) method, based on a questionnaire. In the first part of the article, it was attempted to present some theoretical aspects of payment methods by consumers in Poland and in Europe, based on the analysis of literature sources. Then, the gender-dependent differences in consumer behaviour are presented. The next section describes the procedure of empirical research, as well as the most important conclusions of the research.

Keywords: cash, cashless payments, consumer intention, debit and credit cards, COVID-19 pandemic, management

1. Introduction

The topic of consumer behaviour related to payments is important for the economy and the efficiency of the payment system (Kapler, 2014; Rahman, Ismail, Bahri, 2020; Humphrey et al, 2006; Zhang et al, 2019). However, the choice of the payment method depends on various factors (see: Arango, Huynh, Sabetti, 2015; van der Cruijsen i van der Horst, 2019; Khan, Belk, Craig-Lees, 2015). It is also a geographically diverse choice (Liñares-Zegarra i Willesson, 2021; Arango-Arango et al, 2018 and Bounie, Camara, Galbraith, 2020). It seems, however, that the COVID-19 pandemic and the measures imposed by governments to stop it seem to have had a significant impact on consumer behaviour related to payments. This is most evident in the rapid increase in the acceptance of non-cash payments, despite the general decline in consumer spending. This also applies to the changes in payment methods made by older people (55+).

In addition to the current trends in the payment services industry, the COVID-19 pandemic has been an unprecedented shock to the global economy since the beginning of 2020 and has affected the behaviour of businesses and consumers, including their payment habits. As a result of the restrictions introduced, customers had to wear masks and maintain physical distance between one another in shops. They were also asked to pay with a card as often as possible. According to the information from Auer, Corneli, Frost (2020) and Panetta (2020) there is no research evidencing that banknotes are the main source of infections. Nevertheless, WHO recommended hand washing after contact with banknotes and coins (Pal and Bhadada, 2020). The decline in cash transactions was due to both fear (of cash-borne infections) and new habits developed during the enforcement of security measures.

In its study, the European Central Bank (2020) indicated that around 40% of respondents in the Euro zone reduced their use of cash, and 38% declared that the main incentive to change their payment behaviour was the possibility of being infected by using banknotes. Studies by Kim, Kumar and O'Brien (2020) show similar conclusions, further noting that some risky sellers have stopped accepting cash as a means of payment. According to Visco (2020), there has been an upward trend in the use of digital sales channels and online shopping. The pace of digital banking services has increased, including the number of contactless payments. The limits of cashless payments were increased in many countries during the pandemic, eliminating the need to enter the PIN for most transactions at the point of sale (Mastercard, 2020). It can be pointed out that the pandemic was a "game-changer" in the process of replacing cash and other traditional means of payment by introducing innovative payment solutions in merchant business models.

2. Literature review

Consumer payment behavior has been a burgeoning field of research since the 1980s, starting with the seminal work of Boeschoten and Fase (1989). Trade in economic sciences is defined as a branch of the national economy, which is distinguished in the social division of labour, and its task is to move material goods between entities in the area of production to the area of consumption by means of commodity exchange, carried out by acts of purchase and sale. Therefore, trade is a buy-sell transaction, the consumer (buyer) receives a certain item, paying the seller for it with cash. There are many trade-related tasks. The basic aspect is to conclude a purchase and sale agreement and its implementation. On the other hand, the other tasks of trade are: meeting the needs of consumers, researching and analysing the market, collecting and maintaining inventories. It is also important to have a trade information function that shows consumers and other shoppers information about the products, their use and the conditions and methods of sale (Andrzejczak et al, 2010).

Bouhdaoui and Bounie (2012) stated that one of the priorities of each central bank is to increase the effectiveness retail payment systems. The technological progress observed in the recent years has a significant impact on shopping strategies, and thus sales strategies. With progress in financial innovation, payments have shifted to secure digital platforms, achieving economies of scale and increasing the relative costs of paper-based payment instruments (Callado-Muñoz, Hromcová, Utrero-González, 2018; Beijnen and Bolt, 2009; Bolt and Humphrey, 2007). Innovations in online banking, new payment technologies such as contactless, mobile and instant payments are used more often. Many factors influence the choice of the payment method by consumers. Monetary costs associated with the use of a given method, speed of transaction, ease of use and loyalty programmes associated with selected payment instruments are important. However, despite large investments in technological innovations such as debit cards (Bounie, François, Waelbroeck, 2016), prepaid cards (Shy and Tarkka, 2002), contactless cards (Fung and Halaburda, 2015) and mobile payments (Liu, Beng, Zhang, 2019), cash is still the main payment instrument used to pay at points of sale in most developed economies (Arango-Arango et al, 2018) and consumers ultimately decide which instruments they actually use. Recently, the President of the European Central Bank (2020) has stated that more than three quarters of all point-of-sale payments in the Euro zone are made in cash.

According to Kapler (2014), the majority of Poles own payment cards (66%). The results of the research indicate that demographic characteristics allow to differentiate the Polish society into groups with a significantly different profile of cash and debit card use. In general, more cash transactions are made by people living in the countryside, elderly people, single, less educated and treating new technologies with great caution. Card payments are mainly made by women, younger people, living in cities, married, with a higher level of education and using the Internet. Consumers are encouraged to use their cards frequently due to promotions, such as the possibility of refunding part of the value of their card purchases, loyalty programmes and discounts, exemption from the fee for keeping an account and a card in exchange for a certain number of card payments per month. Due to the short time required for the transaction, Polish people have been increasingly more often using contactless cards. The main reasons for not using cards by their holders are: the belief that cash payment is more convenient, better control of expenses, lack of trust in card payments and fear of losing the card. It is important for Poles to have a high sense of anonymity in cash transactions, which is not ensured by card payments. Only 7% of Poles who have payment cards but do not pay with them indicated that the reason is the lack of acceptance of payment cards in shops. The absence of cards in the wallet is another reason for the dominance of cash. The key reason for not possessing cards is the belief that you can pay significantly faster with cash. The lack of need to own a card is equally as important. Other reasons include high fees for holding and issuing a card and the belief that card payments are too complicated.

According to a study from Elavon (2020), customers in all age groups prefer to pay by card and contactless cards, but non-cash payments are most popular among young people aged 25-34 (63%) and 45-54 (62%). Those who prefer to pay in cash are between 25 and 34 years old (13%). However, this age group is already almost five times more likely to use digital payment methods: cards or contactless payments (63%) than using banknotes and coins. On the other hand, surveys conducted by the National Bank of Poland (2020) show that 65% of respondents indicated that due to the COVID-19 pandemic, their consumer habits did not change, and 0.9% of respondents were unable to determine the impact of the pandemic in this regard. The remaining 34.1% of respondents declared that due to the COVID-19 pandemic they changed their consumer behavior. Among this group of respondents, the vast majority of people (79.8%) indicated that they shop less often in physical retail and service outlets, but if they do, they try to plan purchases with a bigger value. On the other hand, 28.7% of

respondents indicated that they shop online more often (with 10% of respondents pointing to using both strategies at the same time), while 1.5% of respondents changed their consumer behaviour in a different way.

Based on research (research sample covering 5373 people) carried out by Kotowski and Polasik (2021), how the use of cash before the outbreak of the pandemic influenced the payment behaviour of consumers during the pandemic, it can be pointed out that 47.9% of the sample indicated a shift towards a larger number of non-cash payments, and 6.7% on cash payments. 45.4% of respondents did not change their payment-related behaviour. Consumers who made non-cash payments before the outbreak of the pandemic have often done so more often since then, while those who preferred to pay in cash have mostly continued to do so. This may indicate problems with financial inclusion. For instance, people without non-cash instruments may find it difficult to adapt to the new situation within the limits imposed. Secondly, the change in payment standards in response to the pandemic varies from one European country to another. The above suggests an important role for country-specific factors. Based on data from various countries (Kraenzlin, Meyer, Nellen, 2020 and Bounie et al, 2020), it can be stated that the volume of non-cash payments increased in Switzerland, Italy and France during the pandemic, despite the general decrease in consumption expenses. Research related to payments conducted in the Netherlands by Jonker et al. (2020) shows an increase in the use of debit cards from the moment the pandemic has started. However, this increase is mainly attributable to government restrictions imposed to counteract the pandemic, as well as cultural differences. An important barrier in the development of card payments are the preferences of the society, which wishes to remain anonymous when making payments.

3. Specifics of consumer behaviour for women and men

The variation of messages in terms of gender is gaining importance, although it should be kept in mind that women still constitute 3/4 of the audience of all mass marketing communication and make about 90% of purchasing decisions. The marketing message addressed to women and men should be adapted to different types of personalities. We all devote a lot of our time to shopping, visiting shops, viewing products. A lot of space is taken to talk to friends about products, watch ads and think about shopping. It is known that the processes related to shopping, the attitude towards shopping - willingness to do it or not, the joy of going to shops and watching shop displays, or treating shopping as an obligation, may depend on gender. Stereotypical opinions about consumers indicate that women are the "queens" in shops, they love to buy, try on clothes, look at things, touch products. When making a decision on a given product, women fall into a kind of trance. They are very involved in searching, comparing and imagining how a given product will look (Piersiala, 2014). Women devote significantly more time to shopping than men, and the act itself is not the most important in buying, but the overall pleasant experience associated with it (Kitlińska, 2012). It is a common opinion that men are the opposite of women in this regard. They treat shopping as the "necessary evil", they do not want to walk around shops and all they want to enter the shop, buy a selected thing and leave. They do not like to try on clothes, talk to sellers, choose from many types of products (Wiśniewski, 2013). It is widely believed that men pay more attention to the price of the purchased product, as well as to the physical and functional characteristics of it, while women are driven by emotions when choosing products. Therefore, in the area of communication, there is not only a need, but also a necessity to take into account the specificity of gender in the purchasing behaviour on today's market.

4. Empirical research

The proper research was carried out on a group of 128 respondents aged 55+ years in the period from 18 January to 28 February 2022, i.e. during the COVID-19 pandemic, which additionally allowed to examine the impact of the epidemiological threat and the restrictions introduced in business trade on the manner of making transactions. The implementation of the survey part was based on the PAPI method (Paper and Pencil Interview). Questions contained in the questionnaire were closed and multiple choice questions. Several questions consisted in the respondent taking a positive or negative position on a given issue. The questionnaire was anonymous and was preceded by a cover letter addressed to the surveyed consumers, in which the basic issues related to the research were explained. The research related to payments at physical points of sale and services. In the first stage of empirical research, the key methodological assumptions were built. It was assumed that the research group consisted of students of the University of the Third Age in Częstochowa, in Poland. Currently, the majority of the U3A participants are people with higher education who, after retirement, strive to fill their free time and look for the meaning of further life. The educational offer of U3A is very broad. In addition to lectures focused on general topics, there are also lectures on the history of art, the history of the Church, the history of Silesia, psychology, as well as foreign language classes. In addition, as part of physical activities, rhythmic

gymnastics, rehabilitation gymnastics, gymnastics in water, gymnastics in music, swimming, European dances, Pilates, yoga are organized. Every year there are also computer classes for beginners and advances users. As part of the research procedure, it was assumed that students of the University of the Third Age are the respondents. In the population covered by the survey, it was found that among the respondents the majority were women. 97 of the respondents were women, which constitutes 76% of the entire surveyed population, while in 31 analysed cases the decision-maker was a man, which constitutes 24% of the total surveyed sample. In terms of place of residence, the most numerous group were people living in Częstochowa (75.4%). Residents of small towns constituted 15.6% of the respondents, while residents of villages constituted 9.0%.

The article puts forward the hypothesis that it is more convenient for women to pay with cash, and for men with a credit and debit card. Both women and men do not like to pay using contactless payments. Table 1 contains a comparison the convenience of using different means of payment depending on the gender.

Table 1: Relationship between genders and payment methods

Variable	Gender	Average importance score	Standard deviation	Average ratios difference	t ratio	df	Relevance (double-sided)
Payment by debit card	Male	2,920	0,784	- 0,400	- 3,618	148	0,001
	Female	3,320	0,549				
Payment by credit card	Male	2,333	0,827	0,373	2,973	144	0,003
	Female	1,960	0,706				
Cash payment	Male	3,413	0,902	- 0,027	- 0,192	148	0,848
	Female	3,440	0,793				
Contactless payment	Male	1,333	0,723	0,053	0,523	148	0,602
	Female	1,280	0,508				

When analyzing this research area, it should be noted that there are no significant (α=0.05) differences when it comes to cash and contactless payments. However, in the case of a credit card and a debit card, there is a relationship with gender. Table 2 presents an analysis of the average values for different means of payment in the group of men and women.

Table 2: Convenience of using different means of payment

Payment methods	N	Average importance score	Standard deviation
Debit card	128	3,120	0,704
Credit card	128	2,147	0,790
Contactless payment	128	1,307	0,623
Cash payment	128	3,427	0,846

Descriptive statistics show that there are differences between particular means of payment. According to the data obtained, the respondents stated that cash comes first in terms of convenience of use, then a debit card, while a credit card comes third. On the other hand, cashless payments proved to be by far the least convenient form of payment. When analysing cash payments, it should be stated that this is the most convenient form of payment for both women (59%) and men (64%). Then, 60% of women and 50% of men rated the debit card as a convenient method. The credit card was rated as inconvenient by 62% of the surveyed women and 53% of the surveyed men. Contactless payments were rated as the least comfortable by 78% of women and 78% of men. Table 3 shows the relationship between means of payment according to gender.

Table 3: Relationship between means of payment depending on gender

Gender	Payment methods	t ratio	df	Relevance (double-sided)
Men	Debit card - Cash payment	3,013	74	0,004
	Debit card - Credit card	-3,987	74	0,001
	Credit card - Contactless payment	-6,917	74	0,001
Female	Debit card - Cash payment	0,838	74	0,405
	Debit card - Credit card	-13,627	74	0,001
	Credit card - Contactless payment	-5,390	74	0,001

According to the t-test for dependent samples, the hypothesis that the there are no differences in the convenience of using different means of payment for the consumer depending on the gender cannot be rejected in all cases when it comes to the statistical significance α=0.05. For men, each of the means of payment used is

significantly different. In the case of women, there is no significant difference in the convenience of using cash and debit cards. You can also see that contactless payments are the least convenient form of payment for both men and women.

Regarding the convenience of using different forms of payment, respondents agreed that they were reluctant to use contactless payments – they did not think that such a method of payment was convenient for them. Cash turned out to be the most convenient, while debit cards are slightly less convenient and credit cards were rated even lower. Although for men each of the means of payment used is significantly different, for women the convenience of using cash and debit cards is at the same level. This means that women do not see the difference between paying with a debit card and cash, while men still treat "plastic money" as less convenient.

The conducted research confirms that there are differences between the choice of the payment method by older people depending on gender. Despite the research conducted during the COVID-19 pandemic, cash was still the most popular payment method, which is also confirmed by the research carried out by Kotowski and Polasik (2021). Certainly, this is due to cultural differences and indicates that younger people will be more likely and willing to choose electronic payments than people in older age groups. It also results from the level of Poles using banking services, which was much lower than the average in the group of people aged 65 and over. The structure of card ownership depending on age shows similar trends as in the case of using banking services (NBP, 2020).

5. Conclusion

Non-cash societies and technological innovations are becoming increasingly popular worldwide (Visco, 2020). Non-cash payments are financial transactions in which consumers make financial transactions in the absence of physical cash (Liu, Beng, Zhang, 2019), mainly using cards or electronic methods. Non-cash payment systems are used significantly more intensely in some countries, such as the Netherlands, Germany, Switzerland and, above all, in the Nordic countries (Kraenzlin et al, 2020 and Bounie et al, 2020; Sreenu, 2020). Cheque usage worldwide decreased by 13.4%, and the ratio of debit cards to credit cards, interestingly, has changed from 59:41 to 90:10 in the last ten years (World Payments Report, 2018). Non-cash transactions worldwide are expected to grow at a total annual growth rate of 10.9% between 2015 and 2020 (World Payments Report, 2020), while growth in emerging Asia is expected to increase by 30.9% due to continued digital innovation and the adoption of digital payments for financial inclusion (Research and Market, 2020).

Based on the analyzed data, it can be concluded that Poles are most likely to pay in cash, even if they own payment cards and shops have terminals. The education of the society on the security of non-cash transactions, awareness of the high cost of cash as a payment instrument, savings in both the duration of the transaction and the time needed to obtain cash (withdrawal at a bank or ATM) can contribute to changing the consumer behaviour.

It should be noted, however, that although Wiśniewski et al. (2021) showed that the change in shopping behaviour and the fear of using cash due to COVID affected both payment behaviour during the pandemic and the intention to continue using non-cash payments after the pandemic. It is not obvious whether these changes will continue. This is an interesting topic for future research.

References

Andrzejczak, D., Mikina, A., Rzeźnik, B. and Wajgnert, M. (2010) *Podstawy działalności handlowej. Sprzedawca*, Wydawnictwa Szkolne i Pedagogiczne S.A., Warszawa.

Arango-Arango, C., Bouhdaoui, Y., Bounie, D., Eschelbach, M. and Hernandez, L. (2018) "Cash remains top-of-wallet! International evidence from payment diaries", *Economic Modelling*, Vol 69, pp 38-48.

Arango, C., Huynh, L. and Sabetti, L. (2015) "Consumer payment choice: merchant card acceptance versus pricing incentives", *Journal of Banking & Finance*, Vol 55, pp 130-141.

Auer, R., Corneli, G. and Frost, J. (2020) "COVID-19, cash, and the future of payments", *BIS Bulletin*, Vol. 3,

Beijnen, Ch. and Bolt, W. (2009) "Size matters: Economies of scale in European payments processing", *Journal of Banking & Finance*, Vol. 33, Issue 2, pp 203-210.

Boeschoten, W.C., and Fase M.M.G. (1989) "The Way We Pay with Money", *Journal of Business & Economic Statistics*, Vol. 7(3), pp 319–326.

Bolt, W. and Humphrey, D. (2007) "Payment Network Scale Economies, SEPA, and Cash Replacement", *Review of Network Economics*, Vol. 6, Issue 4, pp 453-473.

Bouhdaoui, Y. and Bounie, D. (2012) "Modeling the Share of Cash Payments in the Economy: An Application to France", *International Journal of Central Banking*, Vol. 8, Issue 4, pp 175-195.

Bounie, D., Camara, Y. and Galbraith, J.W. (2020) *Consumers' mobility, expenditure and online- offline substitution response to Covid-19: evidence from French transaction data*, CIRANO Working Papers.

Bounie, D., François, A. and Waelbroeck, P. (2016) "Debit card and demand for cash", *Journal of Banking and Finance*, Vol. 73, pp 55-66.

Callado-Muñoz, F. J., Hromcová, J., and Utrero-González, N. (2018) "Effects of institutional environment and technology development on payment choice", *Technological and Economic Development of Economy*, Vol. *24*(1), pp 81–107.

Elavon (2021), [online], https://www.elavon.pl/artykuly/badanie-metod-platnosci.html

European Central Bank (2020) "Study on the payment attitudes of consumers in the euro area (SPACE)", [online], https://www.ecb.europa.eu/pub/pdf/other/ecb.spacereport202012~bb2038bbb6.en.pdf

Fung, B.S.Ch. and Halaburda, H. (2016) *Central Bank Digital Currencies: A Framework for Assessing Why and How*, Bank of Canada.

Humphrey, D.B., Willesson, M., Bergendahl G. and Lindblom, T. (2006) "Benefits from a changing payment technology in European banking", *Journal of Banking & Finance*, Vol 30, pp. 1631-1652.

Jonker, N., van der Cruijsen, C., Bijlsma, M. and Bolt, W. (2020) "Pandemic payment patterns", *DNB Working Papers*, Vol. 701, Netherlands Central Bank, Research Department.

Kapler, M. (2014) "Analiza decyzji zakupowych polskich konsumentów, uwarunkowanych wyborem formy płatności", *Zeszyty Naukowe. Organizacja i Zarządzanie*, Vol. 68, pp 29-39.

Khan, J., Belk, R.W. and Craig-Lees, M. (2015) " Measuring consumer perceptions of payment mode", *Journal of Economic Psychology*, Vol. 47, pp 34-49.

Kim, L., Kumar, R. and O'Brien, S. (2020) "Consumer Payments & the COVID-19 Pandemic: A supplement to the 2020 Findings from the Diary of Consumer Payment Choice", Federal Reserve Bank of San Francisco.

Kitlińska, E. (2012) „Kobiety lubią pewne miejsca", *Marketing w Praktyce*, Vol. 10, pp 47–48.

Kotkowski, R., Polasik, M. (2021) "COVID-19 pandemic increases the divide between cash and cashless payment users in Europe", NBP Working Paper, Vol. 339.

Kraenzlin, S., Meyer, C. and Nellen, T. (2020) "COVID-19 and regional shifts in Swiss retail payments", *Swiss Journal of Economics Statistics,* Vol. 156.

Liñares-Zegarra, J.M., Willesson, M. (2021) "The effects of negative interest rates on cash usage: Evidence for EU countries", *Economics Letters*, Vol 198.

Liu, Z., Ben, S. and Zhang, R. (2019) "Factors affecting consumers' mobile payment behavior: a meta-analysis", *Electronic Commerce Research,* Vol. 19, pp 575–601.

Mastercard (2020) "Mastercard enables Contactless limit raise across 29 countries and champions permanent increase", [online], https://newsroom.mastercard.com/eu/press-releases/mastercard-enables-contactless-limit-raise-across-29-countries-and-champions-permanent-increase/

NBP (2021), "Payment habits in Poland in 2020. Key results of the survey", [online] https://www.nbp.pl/en/system_platniczy/Payment-habits-in-Poland-2020.pdf

Pal, R. and Bhadada, S.K. (2020) "COVID-19 and non-communicable diseases", *Postgraduate Medical Journal*, Vol. 96, pp 429-430.

Panetta, F. (2020) "Beyond monetary policy-protecting the continuity and safety of payments during the coronavirus crisis" [online], European Central Bank, https://www.ecb.europa.eu/press/blog/date/2020/html/ecb.blog200428~328d7ca065.en .html

Piersiala, L. (2014) "Strategie zakupowe konsumentów uwarunkowane płcią", *Zeszyty Naukowe. Organizacja i Zarządzanie*, Vol. 68, pp 93-102.

Rahman, M., Ismail I. and Bahri S. (2020) "Analysing consumer adoption of cashless payment in Malaysia", *Digital Business*, Vol 1.

Research and Market (2020), "Global cards & payments market insights 2015–2019 & 2019–2023*",* [online], https://www.globenewswire.com/news-release/2020/04/16/2017151/0/en/Global-Cards-Payments-Market-Insights-2015-2019-2019-2023.html

Shy, O., and Tarkka, J. (2002) "The Market for Electronic Cash Cards", *Journal of Money, Credit, and Banking*, The Ohio State University Press, Vol. 34 (2), pp 299-314.

Sreenu, N. (2020) "Cashless payment policy and its effects on economic growth of India: An exploratory study", *ACM Transactions on Management Information Systems*, Vol. 11 (3), pp 1-10.

Wiśniewski, M. (2013) „Chcą pachnieć i pić whisky", *Marketing w Praktyce*, Vol. 11, pp 26.

Wiśniewski, T.P., Polasik, M., Kotkowski, R. and Moro, A. (2021) "Switching from cash to cashless payments during the COVID-19 pandemic and beyond" *NBP Working Papers*, Vol. 337.

World Payment Report (2020), "Non-cash payments volume", [online], https://worldpaymentsreport.com/non-cash-payments-volume-2/

Word Payments Report (2018), "Non-cash transaction analysis", [online], https://worldpaymentsreport.com/wp-content/uploads/sites/5/2018/10/World-Payments-Report-2018.pdf

Zhang, Y., Zhang, G., Liu, L., De Renzis, T. and Schmiedel, H. (2019) "Retail payments and the real economy", *Journal of Financial Stability*, Vol 44.

van der Cruijsen, C., van der Horst, F. (2019) "Cash or card? Unravelling the role of socio-psychological factors", *De Economist*, Vol 167, pp 145-175.

Visco, I. (2020) "The Governor's Concluding Remarks for 2019", [online], Bank of Italy, https://www.bancaditalia.it/pubblicazioni/interventi-governatore/integov2020/encf_2019.pdf?language_id=1

Model for Innovation Management and Continuous Improvement at EFIGAS

Mónica Posada[1], Manuel Tamayo[1], Carlos Carmona[1], Beatriz Osorio[1], Carlos Marulanda[2] and Mauricio Arbeláez[3]
[1]EFIGAS S.A. E.S.P. Research group researcher PIENSA, Manizales, Colombia
[2]Universidad de Caldas, Faculty of Engineering, Manizales, Colombia. Universidad Nacional sede Manizales, Department of Management, School of Management, Manizales, Colombia
[3]Universidad de Caldas, Faculty of Engineering, Manizales, Colombia
mposada@efigas.com.co
mtamayo@efigas.com.co
ccarmona@efigas.com.co
beosorio@efigas.com.co
cemarulandae@unal.edu.co
mar@ucaldas.edu.co

Abstract: The uncertainty of today's world, the complexity of the problems faced by organizations and the number of actors involved from different perspectives, lead companies like EFIGAS S.A.E.S.P. of Colombia (a company that distributes and commercializes GAS), to see in collaborative innovation a solution to the challenges and constant questions. EFIGAS, with its research group PIENSA (triple helix research group) and from a qualitative research, with a descriptive, explanatory and correlational approach based on holistic and integrative development, has created a model for the management of collaborative innovation and continuous improvement in its value chain, based on the involvement of mission contractors, leveraged on the contractor development program MISSION + and permeating the organization, supporting the process in the existing organizational structure. The starting point was organizational pillars such as focus and needs, implementation, results, management and follow-up, and the culture of innovation and improvement, which aim at continuous improvement; and it is from these that an innovation model was formulated that contemplates four pillars: Good practices to innovate, generation of a culture of innovation, knowledge and mentoring in innovation and relationship with the R&D&I ecosystem. The model was subjected to validation with 228 observations and with the results an exploratory factor analysis was performed, assessing the reliability and uniformity of the model from the indicators of each variable and obtaining a result of 0.971, which demonstrated the consistency of the model and the reliability of the measurement scale. The correlation analysis tool was then used and it was found that the variables have a correlation between moderate and high, which ratifies the validity of the model and subsequently a confirmatory factor analysis was performed, for which the goodness of fit test of the model was used, with the chi-square tool and values equal to 0 were found, which showed a perfect agreement between the observed and expected frequencies. With the design and validation of the model it is expected to contribute to the organizational development of the company and of the companies of the public services sector in the country.

Keywords: Innovation, continuous improvement, collaboration

1. Innovation

In a world as changing as today's, where we live a permanent uncertainty in all aspects of our personal, organizational and social life, perhaps a way to stay active and evolving is through innovation, which is directly related to the use of the capabilities you have, to face situations differently, to change, to compete, to win, with higher productivity, higher profitability, higher profits, among others.

Innovation can be defined as another way of doing things, or how to create or improve a product or service, or how to use another material, another design, another process, in short, it is related to a constant change that aims to meet the needs of people, organizations and companies. "Innovation is a broad concept that encompasses a wide range of activities and processes: markets, business activities, networks and competition, but also skills and organizations, creativity and knowledge transfer" (OECD, 2013, p. 17). Corma (2013) points out that innovation is understood as the conversion of ideas and knowledge into improved products, processes or services for the market, thus meeting the needs of citizens, businesses and public administrations.

Innovation is the process by which an organization uses its skills and resources to develop new and better goods and services or new production and operating systems in order to better respond to the needs of its customers (Burgelman and Maidique, 1988). Organizations that in many cases are bureaucratic, rigid and mechanistic, must give way to intelligent, proactive, dynamic, creative and decentralized organizations. It emerges as a possibility

to evolve approaches to business administration and innovation management within the framework of a new rationality that promotes the development of the human organization from the perspective of creative and transformative thinking (Petit, et al., 2012).

Innovation which according to him (Oslo-Manual, 2018), is classified into 4 recurring types in organizations: (1) product innovation: refers to important or significant changes in the characteristics of the product or service, including new products and those that have been substantially improved, (2) process innovation: refers to significant changes in the methods of production or distribution; that is, the change or improvement in the development of a product or the steps taken to deliver a product or service to the final consumer, is called process innovation; (3) business process innovation with emphasis on administration and management: is the application of new organizational methods or changes in business practices and in the company's external relations; finally, (4) commercial innovation: includes the implementation of new commercial methods that may involve changes in product design, presentation, promotion or pricing methods; (5) business process innovation with emphasis on administration and management: is the application of new organizational methods or changes in business practices and in the company's external relations; and (6) commercial innovation: includes the implementation of new commercial methods that may involve changes in product design, presentation, promotion or pricing methods..

2. Innovation models

Regarding the models analyzed, we consider what is stated by (Landazury and Ferrer, 2016), who, after a company implements the management model according to the characteristics that produce competitive advantages, it becomes a reference for other companies, which generates an accumulation of lessons learned that awakens, either within the same sector or in a different one, the interest in building their own management models based on innovation, in order to obtain, in this way, the benefits that are achieved by consolidating an environment that simultaneously promotes innovation within the company and in the productive sector in which it is located. However, (Ramírez-Alujas, 2012), found abundant evidence on the elements that would allow enhancing innovation in the public utilities sector and it can be summarized in five fundamental aspects:1. 3. Process improvement. 4. Involvement of the private and/or voluntary sector (or Third Sector). 5. Empowerment of communities, users/citizens or public officials.

Likewise, they mention (Palacio and Gaviria, 2016), "the competitive environment of companies makes them look for new ways to organize their internal processes, and design their relationships with external processes, with which they can share risks and resources, based on innovation models such as: 1. Linear models: they contemplate the development of the innovation process through the causality that goes from science to technology. 2. Stage models: they consider innovation as a sequential activity of linear character. 3. Interactive or Mixed Models: this is seen as a sum of forces, since research and society can equally drive Research, Development and Innovation (R&D&I). 4. Integrated Models: these push companies to establish all kinds of strategic alliances. 5. Network Models: This highlights the inside of companies and between companies and suggests that innovation is generally a distributed networked process. 6. Innovation Model: This model is based on knowledge and connectivity, focusing on exploiting existing resources and maintaining tacit knowledge as a means for company growth. Open Innovation Models: defined as the practice of using intellectual property developed outside the organization to accelerate innovation within the organization, share internally developed products, and know how to help others outside the company.

In parallel, (Acosta-Prado and Fischer, 2013) proposed an explanatory model composed of three interrelated perspectives or blocks. The first perspective identifies the conditions of knowledge management. It starts from the resource-based approach focused on the analysis of the attributes that resources must possess to achieve business results, as well as the processes by virtue of which organizations acquire, develop, transfer and exploit those resources and capabilities. The second perspective studies the strategic considerations of innovation capability, recognizing that both the availability of knowledge and the existence of capability are a potential source of superior results. The third perspective studies the achievement of business results, based on the impact and congruent effect between the previous perspectives, that is, the relationship established between the conditions of knowledge management and innovation capability, and the way in which this relationship affects the development of exploration and exploitation processes.

Likewise, the literature review found innovation models such as the following: (Lopez, et al., 2016), created a model based on the following dimensions: Follow-up (guided practice), market orientation, strategic alliances, research and development, new product design, training and educating personnel in all areas and levels of the company in order to acquire the abilities, knowledge, skills and aptitudes that support the innovation proposal and maintain an efficient relationship with customers, identifying their needs and the degree of satisfaction that the innovation produces for them.

Also as defined by (Kai-Jo and Teng-Wen, 2019), who in terms of the growing need for efficiency and effectiveness by governments around the world a large body of research confirms that innovation can play a key role in introducing changes in public services. They propose a model with the following dimensions: The first dimension of service innovation is the new service concept, which involves more intangible characteristics of existing services and competition. New concept innovation suggests that changes in underlying mental models drive the actions of the organization in question. The second dimension of service innovation is a new customer interface between governments and their citizens. More and more service delivery is being commercialized in the public sector, with a greater focus on establishing a good connection in a specific way with the customer. The third dimension is a new service delivery system, indicating a suitable organizational structure and management to help service employees perform their new tasks well.

Similarly, the model of (Flores, et al., 2018), which has three dimensions that stand out for their efficiency are: competition, added value and new services and customer satisfaction, Technology and is that of new ideas. Or the model of (Velázquez-Castro and Vargas-Martínez, 2015), who explain that the innovation process is composed of: 1) Diagnosis. Of the factors involved in the operation of the organization; with the purpose of developing a short or medium-term forecast based on the existing trend or the forecast of future changes. 2) Identification of opportunities. For the development of procedures, products or services according to the needs detected in the previous phase. 3) Technical and administrative capacity of the company to satisfy that need. Process of transformation of the knowledge and technology acquired by the company. Or the model of (Garcia, et al., 2014), which is characterized by: customer-oriented innovation capacity, market-oriented innovation capacity, and technology-oriented innovation capacity with innovative, financial and non-financial performance.

According to the models analyzed, there is a clear trend towards integral models that holistically consider the needs of each organization, based on the particularities reflected in the organizational culture and stakeholder involvement.

3. Collaborative Innovation

As a response to the various forms, models, techniques or methodologies of innovation, the concept of collaborative innovation arises, which focuses on the grouping of people, business areas, companies, organizations, sectors or regional, national and international clusters, with the purpose of collaborating in a network, taking advantage of resources and capabilities and enhancing the development of synergy, as one of its foundations. Paraphrasing (Preciado-Hoyos, 2020), collaborative innovation forces to connect and integrate in a wide range of activities and enables process managers to design collaborative strategies in a networked world, with greater access to the Internet and, in general, to technologies. It makes it possible to create shared organizational value and proposes that the advantages and gains be appropriated by the company and stakeholders on equal terms, at all stages of the process. Now, the innovation model for the EFIGAS company considers the elements presented by the authors cited in this document and that contribute from their creations, classifications and definitions, the essential elements for the development of innovation in this company. Within this framework, it could be said that the theoretical construct that underlies the design of the model is a reflection of what has been proposed by the related authors.

4. Innovation Model

Based on the elements defined in the theoretical construct of the previous sections and taking into account the characteristics of the EFIGAS company, an innovation model was designed considering the following components of the model:

1. Its approach and needs: From the identification of those elements that originate innovation needs, such as strategic planning, performance results of goals and indicators, own initiatives, performance of management systems, feedback and organizational guidelines to innovate and improve.

2. Implementation: To put into action or materialize solutions with the formation of multidisciplinary work teams that generate ideas and solutions whose structuring or formalization can be translated into projects, action plans or optimization and operational efficiency initiatives.
3. Results: Reflecting the expected findings with the fulfillment of objectives and goals of the processes, as well as in the fulfillment of the value proposition and commitments with stakeholders.
4. Direction and Follow-up: From the illustration of the actors and instances that join the model with responsibilities to direct, promote, stimulate and follow up the different innovation dynamics.
5. Culture of Innovation and Improvement: Based on change management, leadership, knowledge management and development of competencies for innovation, performance management, fluid and permanent communication and the application of incentives and recognition.

The above components are inspired by the evaluation criteria of the excellence models of the Quality Corporation (national award for excellence and innovation in management), which recommends consistency and harmony among three elements: Approach, implementation and results. This model was consolidated in the relationship of four fundamental pillars as shown in figure 1.

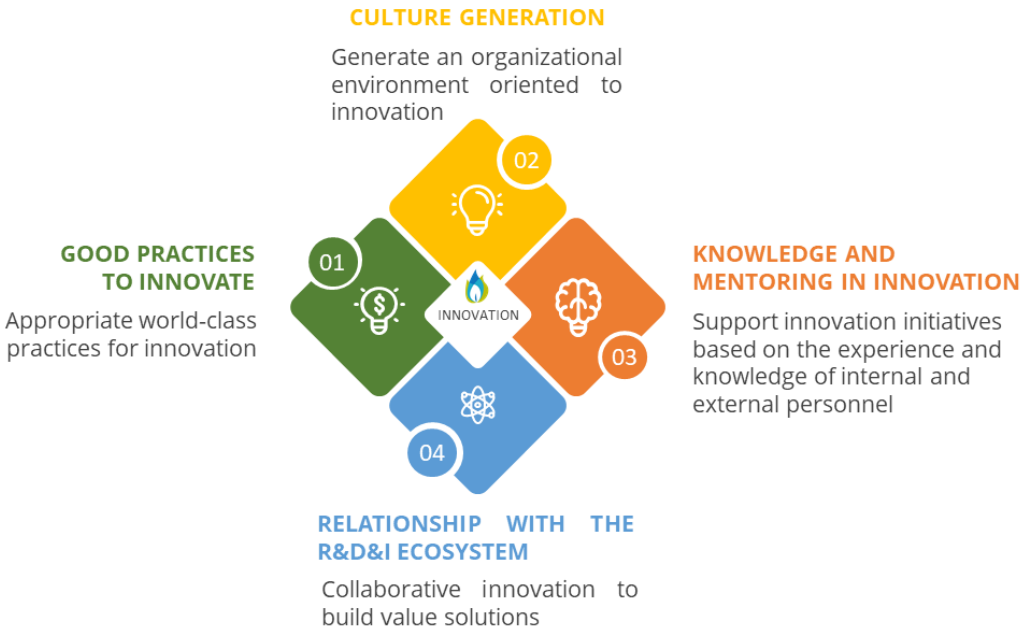


Figure 1: EFIGAS innovation model

Each pillar is explained as follows:

Good practices to innovate: Related to appropriate world-class practices for innovation. Practices that, according to (El-Kassar, et al., 2022), help companies to increase productivity and profitability, as well as to gain competitive advantages over their rivals.

Generation of a culture of innovation: To generate an organizational climate oriented to innovation. Which according to (Ida and Tumelero, 2021), can enable the company to obtain additional benefits, such as the expansion of intellectual capital, interdepartmental cooperation, the creation of routines to implement innovative ideas, the generation of a sense of belonging, the stimulation of creativity, and learning from mistakes, among others.

Knowledge and mentoring in innovation: With the exploration of new business models and products with a vocation towards the radical or disruptive. Which according to (Amaka-Ijeoma, et al., 2021), is a management tool used to complement organizational learning, which is, of course, the ideal way to acquire the necessary knowledge and skills in these new models and products.

Relationship with the R&D&I ecosystem: Innovate with others to build value solutions. Which according to, (Schroth and Häußermann, 2018), brings new challenges, especially with regard to the generation and dissemination of knowledge, as a dynamic and collaborative-intensive process

The aforementioned pillars then group the variables corresponding to the theoretical construct, and are explained as shown in Table 1.

Table 1: Pillars and variables of the model

PILLARS	VARIABLES	ACRONYMS
BEST PRACTICES Adapted from (Suñe, et al., 2012)	Innovation: Innovation as a core element of the misión.	BPINNOV
	Socialization: Taking into account the existence of an innovation strategy and socialization of the ecosystemic innovation model.	BPESTSOC
	Communication: From an adequate and fluent open communication.	BPCOMU
	Orientation: Enable innovation from customer orientation.	BPCLIEN
	Leadership: Based on a leadership approach and practice towards innovation.	BPLIDINN
	Non-monetary incentives: Non-monetary incentive systems.	BPINCENT
	Ideas: within the framework of creativity and idea management in the innovation ecosystem.	BPIDEA
	Projects: From an approach that allows working by projects.	BPPROYEC
	Teams: Within the framework of creating and maintaining multidisciplinary teams for the exercise of innovation.	BPEQUIP
	Committee: Considering the creation of an innovation committee to provide guidelines and rules of the game for innovation.	BPCOMIT
	Models: The application of management excellence models.	BPMODEL
CULTURE FOR INNOVATION Adapted from (Robles-León, et al., 2016) and (Pérez, 2019)	Promotion: Within the framework of an organization that makes it possible to promote the culture of innovation.	CUINNO
	Experience: From the knowledge and experience in the field of innovation of the organization's managers.	CUKEXP
	Thinking: From a viewpoint that considers creative thinking and the generation of ideas of value by managers.	CUCREADI
	Responsibility: Considering the existence of a manager or team in charge of organizational innovation management.	CURESP
	Training: Availability of personnel trained in innovation.	CUPERSCAP
	Training: Taking into account the existence of programs, plans or actions of integral training for creativity and innovation.	CUPLAN
	Incentives: Within the framework of the existence of a strategy of incentives for the generation of creative ideas.	CUINCEN
	Systems: Existence of information systems for innovation.	CUSINNO
	Budget: Considering the existence of a budget allocated for investment in business innovation.	CUPRESU
	Customers: Within the framework of knowing and analyzing the needs and expectations of current and potential customers in relation to innovation.	CUCLIENT
	Process: Taking into account the existence of processes to promote the generation of creative ideas.	CUPROCES
	Sources: Have sources and real access to information at hand.	CUINFO
	Technology: Knowledge of and access to technology.	CUTECNO
	Knowledge: Possibility of managing the company's knowledge.	CUGC
	Property: From protecting the intellectual property of the company's creations and inventions either internally or externally.	CUPI
	Participation: In encouraging the participation of collaborators and allies through: contests, challenges, innovation fairs or others.	CUPART
MENTORING Adapted from (González-Candía, et al., 2014)	Alliances: Considering strategic alliances linked to innovation, either with universities or other organizations.	MEALIAN
	Evaluation: From an approach that allows ideas to be evaluated and measured in the organization.	MEEVAL
	Filtering: Considering that the innovative ideas received are filtered based on their applicability and customer focus.	MEFILTR
RELATIONSHIP	Rules: Laying down clear rules for intellectual property rights.	REPROP
	Research: Relying on strategic alliances for research, development and innovation.	REALIAN
	Transfer: From advising and consulting in technology transfer and innovation.	REASECONS

PILLARS	VARIABLES	ACRONYMS
	Training: Providing specific training to other organizations in the sector or other sectors.	RECAPAOT
	Publication: Considering the publication of research articles and papers in national and international indexed journals.	REPUBLIC

5. Model Validation

The innovation model was subjected to validation with the employees of the company EFIGAS S.A. E.S.P. in the city of Manizales, Colombia (228 observations), corresponding to a non-probabilistic sample with the characteristics presented in Table 2:

Table 2: Descriptives of sample

Linkage in years		Frequency	Percentage
Valid	1-5	115	50,4
	11-15	31	13,6
	16-20	14	6,1
	21-25	15	6,6
	6-10	53	23,2
	Total	228	100,0

Gender		Frequency	Percentage
Valid	Female	128	56,1
	Male	100	43,9
	Total	228	100,0

Age group		Frequency	Percentage
Valid	21-30	49	21,5
	31-40	113	49,6
	41-50	51	22,4
	> de 51	15	6,6
	Total	228	100,0

Location		Frequency	Percentage
Valid	Caldas	147	64,5
	Quindío	31	13,6
	Risaralda	50	21,9
	Total	228	100,0

This is an exploratory model with a quantitative approach, with an analysis based on PLS-SEM (Partial least squares), appropriate for social and management studies among others, where causal relationships between constructs are analyzed using analysis of variance (Chawla & Joshi, 2019). In this approach latent variables are structured, in this particular case mentoring, good practices, relationship and innovation culture, which are constituted in constructs of reflective type, that is, the set of items of the questionnaire produces a variable that emerges when obtaining the measurement of the proposed variables. Three hypotheses are put forward in the model: H1. Mentoring has a positive influence on innovation culture; H2. Good practices have a positive influence on innovation culture; and H3. Relationship building has a positive influence on innovation culture, as can be seen in Figure 2.

To evaluate the proposed model, the techniques of internal consistency, the reliability indicator, and discriminant validity were applied. To determine the internal consistency of the model, Cronbach's Alpha, the Correlation coefficient (rho_A), the composite reliability and the average variance extracted were used (Table 3). All constructs met the minimum values required for each test.

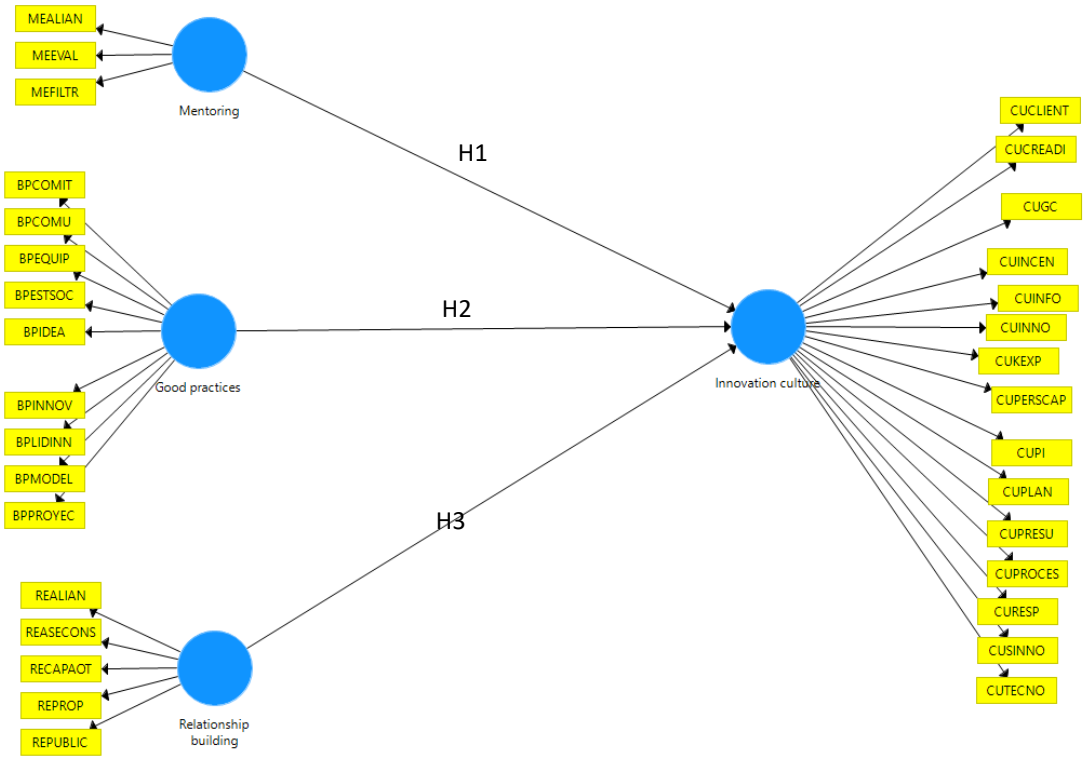


Figure 2: Model and hypothesis

Table 3: Construct validity and reliability

Categories	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Best Practices	0.915	0.918	0.930	0.596
Culture	0.964	0.965	0.968	0.669
Mentoring	0.763	0.777	0.863	0.677
Relationship	0.889	0.903	0.918	0.694

Discriminant validity was evaluated using cross-loadings, the Fornell and Larcker criterion and the Heterotrait-monotrait criterion. The cross-loadings measure the weight of each question with respect to its latent variable, as shown in Table 4.

Table 4: Cross loads

Variables	Best practices	Culture	Mentoring	Relationship
BPCOMIT	0.710	0.626	0.556	0.544
BPCOMU	0.743	0.604	0.536	0.499
BPEQUIP	0.728	0.623	0.473	0.559
BPESTSOC	0.814	0.648	0.550	0.535
BPIDEA	0.817	0.726	0.603	0.621
BPINNOV	0.719	0.548	0.491	0.438
BPLIDINN	0.837	0.641	0.542	0.519
BPMODEL	0.816	0.718	0.609	0.686
BPPROYEC	0.750	0.606	0.547	0.509
CUCLIENT	0.663	0.812	0.685	0.642
CUCREADI	0.685	0.829	0.641	0.690
CUGC	0.707	0.840	0.735	0.738
CUINCEN	0.639	0.782	0.646	0.604
CUINFO	0.673	0.860	0.684	0.734
CUINNO	0.681	0.741	0.621	0.513
CUKEXP	0.660	0.831	0.732	0.663
CUPERSCAP	0.687	0.803	0.615	0.588
CUPI	0.672	0.802	0.733	0.752
CUPLAN	0.768	0.814	0.684	0.576

Variables	Best practices	Culture	Mentoring	Relationship
CUPRESU	0.663	0.821	0.677	0.634
CUPROCES	0.670	0.819	0.691	0.678
CURESP	0.628	0.777	0.612	0.597
CUSINNO	0.690	0.857	0.699	0.696
CUTECNO	0.699	0.868	0.731	0.744
MEALIAN	0.636	0.788	0.853	0.708
MEEVAL	0.596	0.624	0.815	0.445
MEFILTR	0.508	0.621	0.799	0.488
REALIAN	0.702	0.769	0.654	0.882
REASECONS	0.653	0.753	0.598	0.893
RECAPAOT	0.493	0.585	0.531	0.808
REPROP	0.621	0.661	0.561	0.842
REPUBLIC	0.457	0.553	0.460	0.728

With respect to the Fornell and Larcker (1981) criterion, the square root of the mean variance extracted must be greater than all the correlations between each pair of constructs. Finally, in the HTMT criterion, which is of more recent application, the ratio between correlations between indicators of the same construct must be greater than the correlations between indicators measuring different constructs. The model complied with all the tests mentioned above, so that discriminant validity is met. The model was developed in SMART-PLS software version 3.3.7. In a first run of the model the variables BPCLIEN, BPINCENT and CUPART were eliminated. After this adjustment the model met the discriminant validity, which was verified. The model obtained an r2 value of 0.848 and the values of each variable with respect to the latent variable are shown in Figure 3.

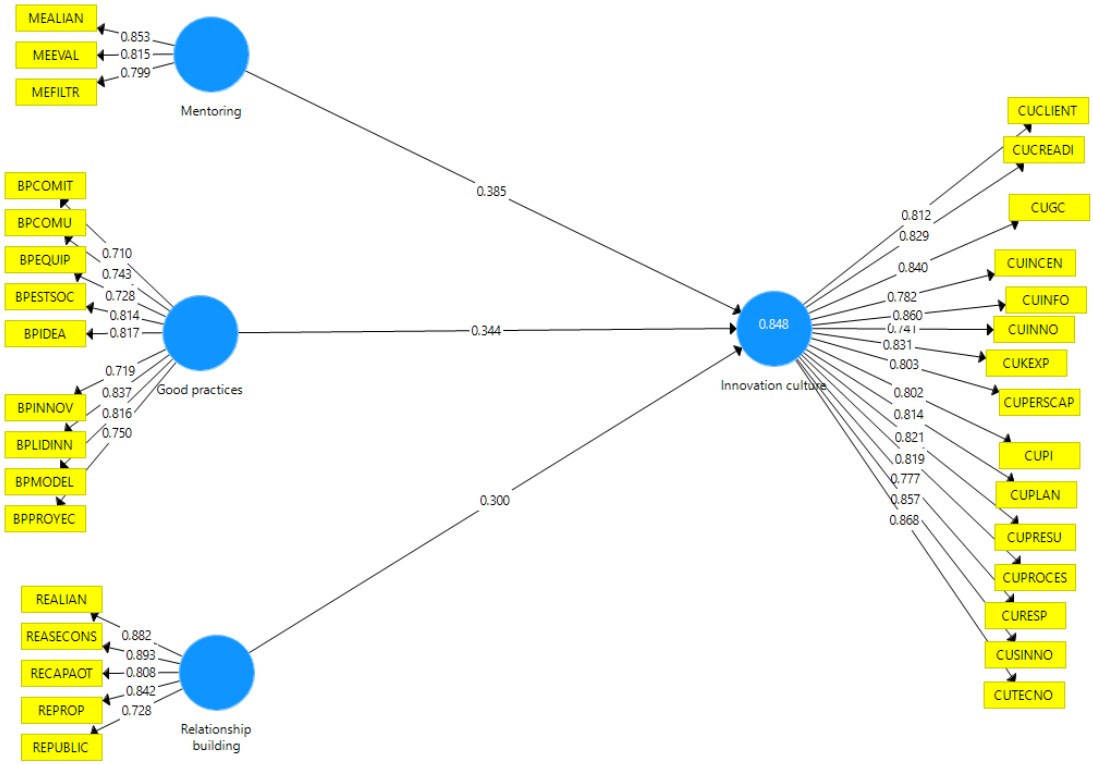


Figure 3: Validated model

The values presented allow then to validate an innovation management model for EFIGAS S.A.S., which, finally, includes 4 pillars and 32 variables.

6. Conclusions

The innovation and collaboration model for continuous improvement proposed by the group of experts of EFIGAS, is based on the relationship of pillars and variables that have a direct impact on the organization, thus,

this model is characterized by the integration of good practices, culture, mentoring and relationship, as a particular and specific way of seeking to advance and improve in the processes of business innovation.

From a theoretical construct, as the basis of the model and the possibility of defining it, it is necessary to validate it, and in this case, the development of statistical tools was sought to ensure the reliability, uniformity and consistency of the model, which after this exercise, can be applied in any company or context that requires the implementation of business innovation.

References

Acosta-Prado, J. and Fischer, A. (2013) "Knowledge management conditions, innovation capacity and business performance", *Pensamiento & Gestión,* Issue 35, pp. 25-63.

Amaka-Ijeoma, O., Williams, O. and Edwinah, A. (2021) "Mentoring and organizational survival of deposit money banks in rivers state", *International Journal of Advanced Academic Research,* 7(10), pp. 1-14.

El-Kassar, A.-N., Dagher, G., Lythreatis, S. and Azakir, M. (2022) "Antecedents and consequences of knowledge hiding: The roles of HR practices, organizational support for creativity, creativity, innovative work behavior, and task performance", *Journal of Business Research,* Vol 140, pp. 1-10.

Flores, J. and others. (2018) "Innovation model of a hotel organization in cajeme, mexico", R*evista latino americana de turismologia,* 4(2), pp. 33-50.

García, O., Quintero, J. and Arias-Pérez, J. (2014) "Innovation capabilities, innovative performance and organizational performance in service sector companies", *Cuadernos de administración,* 27(49), pp. 87-108.

González-Candía, J., García-Coliñanco, L., Caro, C. and Romero-Hernández, N. (2014) "Innovation strategy and culture, resource management and idea generation: practices for managing innovation in companies", *Pensamiento & Gestión,* Issue 36, pp. 109-135.

Ida, L. and Tumelero, C. (2021) "Boosting technological innovation and innovation culture from", *International Journal of Innovation - IJI,* 9(3), pp. 474-495.

Kai-Jo, F. and Teng-Wen, C. (2019) "Toward an Integrative Framework of Dynamic Capabilities in Innovation-based Public Services: Empirical Analysis in Taiwan", *Chinese Public Administration Review,* 10(1), pp. 1-17.

Landazury, L. and Ferrer, F. (2016) "Innovation as a transversal axis of business models in organizations, a review of the theoretical construct.", *Rev. esc.adm.neg,* Issue 81, pp. 129-148.

López, M., González, N. and Vásquez, M. (2016) "Model of innovation for SMEs based on guided practice", *Revista Global de Negocios,* 4(7), pp. 27-39.

Oslo-Manual. (2018) "Guidelines for the collection and interpretation of innovation information". [On line] Available at: https://www.uam.es/personal_pdi/economicas/palomas/Traduccion%20%20espanola%20del%20Manual

Palacio, C. and Gaviria, P. A. (2016) "Open Innovation Models, a literature review with a focus on SMEs.", *International Journal of Information,* 3(2), pp. 19-39.

Pérez, C. (2019) "Business innovation at the service of micro and small enterprises in nortesantandereana: for regional competitiveness", *Económicas CUC,* 40(1), pp. 91-104.

Petit, E. Abad, R., López, M. and Romero, R., (2012) "Innovative Organizational Development: a new management approach for Latin America", *Opción,* Issue 67, pp. 173 - 205.

Preciado-Hoyos, Á. (2020) "Propositional framework of relationships between open collaborative innovation and strategic communication: application to a group of companies from Antioquia.", *Palabra Clave,* 23(2), p. e2326.

Ramírez-Alujas, Á. (2012) "Innovation in public organizations and services: The missing link? Bases for the transition to an open and collaborative innovation model.", *Revista Chilena de Administración Pública,* Issue 19, pp. 5-50.

Robles-León, P., Alabart-Pino, Y. and Rodríguez-Caguana. (2016) "Organizational culture and its influence on the innovative behavior of the Empresa Pública de Parques Urbanos y Espacios Públicos de la provincia del Guayas (Public Company of Urban Parks and Public Spaces of the province of Guayas).", *Comhumanitas: Revista Científica de Comunicación,* 7(2), pp. 76-91.

Schroth, F. and Häußermann, J. (2018) "Collaboration strategies in innovation ecosystems: An empirical study of the German microelectronics and photonics industries", *Technology Innovation Management Review,* 8(11), pp. 4-14.

Suñe, A., Bravo, E., Mundeta, J. and Herrera, L. (2012) "Good innovation practices: an exploratory study of technology companies in the Spanish audiovisual sector.", *Investigaciones Europeas de Dirección y Economía de la Empresa,* Volumen 18, pp. 139-147.

Velázquez-Castro, J. and Vargas-Martínez, E. (2015) "From innovation to eco-innovation. Service management in hotel companies", *Revista Venezolana de Gerencia,* 20(70), pp. 268-281.

Knowledge Gains and Losses to Organizational Resilience, from Intellectual Capital

Lídia Neumann Potrich, Jaime Miranda Junior, Paulo Maurício Selig, Denilson Sell and José Leomar Todesco
Universidade Federal de Santa Catarina, Florianópolis/SC, Brasil
lidia.potrich@gmail.com
jaimemjunior@gmail.com
pauloselig@gmail.com
denilsonsell@gmail.com
titetodesco@gmail.com

Abstract: Understood that knowledge loss is an imminent risk to organizations as it occurs when employees with valuable knowledge leave the organization, when there are problems with codified knowledge or when the organization does not properly manage knowledge. In this context, organizational resilience can be affected, since intangible resources enable organizational responses to the unexpected. Considering that the aspects that generate losses can be common to organizations, it is also important to identify what are the possible gains that the system has, as a result of these situations. Thus, the objective of this article is to understand the state of the art under knowledge loss in the context of organizational resilience and to identify the possible gains arising from these critical situations. As a proposal, a classification according to the concept of Intellectual Capital based on the three main dimensions: Human Capital, Structural Capital and Relational Capital. Thus, a literature review was carried out in order to identify the impacts of the loss of knowledge on resilient responses, as well as the gains for the organizational system. This theoretical study aimed to contribute to the scientific advancement of knowledge loss, to the advancement of organizational resilience aspects, as well as to Intellectual Capital. Also, it was proposed to advance in the understanding of knowledge gains, since regular aspects to organizations such as turnover, waste of knowledge, low volume of specialists and absences from work generate risks to critical knowledge. These, in turn, affect the resilience and structures of the IC. Presenting knowledge vulnerabilities makes it possible to identify possible positive impacts, in order to ensure proper knowledge management, in favor of organizational resilience and its sustainability. As a result, the study showed that the loss of knowledge is mainly from Human Capital, however there are direct and positive impacts on the structural and relational capital of the organization, as loss mitigation strategies lead to strategies for strengthening relationships and internal improvements in its structure. Furthermore, the creation of unlearning and organizational learning environments can contribute to the resilience of the system.

Keywords: Organizational resilience; Knowledge loss; Knowledge waste; Knowledge gain; Intellectual capital

1. Introduction

In recent years, a new approach to the focus of operational safety management has proposed replacing failure-based analysis with a more systemic perspective, redefining successful or failed performance as a complex and emergent event rather than a conclusion of singular errors or root causes. This new paradigm, called Safety II, was theorized and instrumentalized by resilience engineering (Hollnagel et al., 2006; Leveson et al., 2006; Dekker et al., 2008; Hollnagel, 2015; Patriarca et al., 2017; Slim & Nadeau, 2020).

In this sense, resilience engineering seeks ways to increase the resilience potential of systems, giving them the ability to preserve operations even in the face of threats. The resilience of sociotechnical systems depends on how well they can adjust to the specific context around them. In other words, verification and validation of approximate fits, which is the second security principle, play vital roles in the design of resilient sociotechnical systems (Hirose & Sawaragi, 2020).

One of the ways to build and/or develop security is to obtain a resilient organization. Some organizational practices and routines involving the knowledge resource, such as the focus on values of cooperation, communication and learning, as well as knowledge sharing, can be strategies adopted and used in order to increase the level of security (Storseth, Tinmansvik). & Oien, 2010).

Intangible assets, such as knowledge, are valuable resources for creating value, and also act as a determining factor for organizational success and sustainability (Nonaka & Takeuchi, 1995; Sveiby, 2001; Arisha & Ragab, 2013). Therefore, it makes sense that they are applied and exploited to raise the level of organizational security.

In this way, the main objective of this work is to contribute to the scientific advance of knowledge loss, to the advancement of aspects of organizational resilience, as well as to Intellectual Capital. Also, it was proposed to advance in the understanding of knowledge gains, since regular aspects to organizations such as turnover, waste of knowledge, low volume of specialists and absences from work generate risks to critical knowledge. These, in turn, affect the resilience and structures of the IC. Presenting knowledge vulnerabilities makes it possible to identify possible positive impacts, in order to ensure proper knowledge management, in favor of organizational resilience and its sustainability.

It is important to highlight that the main assumption that permeates this article is that the loss and waste of knowledge impact organizational resilience, since knowledge is a resource for the system to respond to expected or unexpected threats. However, when analyzing the impacts of the loss, it is important to understand the negative effects - to mitigate them - but also the gains to the organizational system, in order to highlight them and also use them as mitigation resources.

2. Concepts

2.1 Resilience

The origin of the term resilience comes from the Latin, “resiliere”, and means “to recover.” This definition applies to several areas of knowledge, such as: materials science, psychology, ecology, among others (Hosseini, Barker & Ramirez-Marquez, 2016) The more technical areas of knowledge, such as engineering and safety management, work with the term resilience applied to systems.

With the introduction of digital technology, with the information revolution and the complications of society, systems have become increasingly complex (Hirose & Sawaragi, 2020). According to Folke (2006), the complexity of systems, characterized by the great diversity of interactions, is a determining factor for resilience due to its ability to absorb changes and reorganize itself.

Hollnagel (2014) uses the terms Safety I and Safety II to differentiate two views on safety in complex systems. The Safety I perspective is associated with a preoccupation with things that go wrong. Adverse events are analyzed retrospectively to understand what went wrong and to define measures to avoid similar outcomes in the future. As a complementary perspective, it is suggested to include knowledge about how and why things work out. This perspective has been labeled Safety II (Wahl, Kongsvik & Antonsen, 2020). Similarly, the term resilience engineering refers to this new Safety II paradigm.

Therefore, Hollnagel et al. (2006) define resilience as the intrinsic ability of a system to regulate its operation before, during and after disturbances, so that it can maintain the necessary operations, even after a serious accident or in the presence of a continuous voltage. More recently, Gao, Barzel and Barabási (2016) state that resilience provides organizations with an adaptive capacity, which enables their continuous development.

Hollnagel et al. (2006) defined four essential capabilities that characterize a resilient system: (1) knowing what to do, that is, how to respond to regular and irregular interruptions and disturbances, either through a set of prepared responses or by adjusting the normal functioning of the system. ; (2) know what to look for. That is, how to monitor what is or could become a threat in the short term; (3) knowing what to expect. Or rather, how to anticipate future events, threats and opportunities, such as possible changes, interruptions, pressures and latent threats; and finally (4) know what happened. Which is how to learn from experience, in particular, how to learn the right lessons from the right experience; learn from successes and failures.

2.2 Knowledge Waste, Loss and Gain

Since knowledge is a strategic resource for the organization (Grant, 1996), it is important to understand the risks associated with it. According to Sarkheyli, Alias and Ithni (2014), different sources can be used to identify knowledge risks and, when identifying threats, it is important to assess the probability of occurrence and its severity. Above all, the knowledge loss and waste are considered risks, as both can impact organizations.

According to Ferenhof (2011), it is considered waste of knowledge the non-use of the full capacity to use knowledge and when there are failures or negligence in the knowledge conversion processes. Knowledge waste affects organizational performance (Locher, 2008; Ferenhof, 2015). Still, Bauch (2004) states that there is a

waste of knowledge when organizations do not take advantage of the knowledge acquired or created through their experiences, projects and solutions.

Knowledge loss is "the diminished capacity for effective action or decision making in a specific organizational context" (p. 13), which occurs at the organizational or group level (Delong & Storey, 2004). It occurs when employees with important knowledge leave the organization, when codified knowledge (e.g. documents and databases) is lost or even when knowledge decays (Massingham, 2018). Also, it can occur through failures in the reorganization of the work environment and the difficulty in accessing knowledge files due to lack of maintenance, improper maintenance or obsolete database (Delong & Storey, 2004).

Although the knowledge loss and waste are referred to as risks to organizations, some studies point to some gains arising from these situations. Wensley and Navarro (2015) state that these risks are a source for the creation of new knowledge structures. However, this will only occur through the recognition of losses and the intentional knowledge management.

By identifying organizational knowledge losses, management can counteract the negative consequences of this risk, serving as a motivation for change processes and the incorporation of strategic knowledge (Wensley & Navarro, 2015). Still, from the departure of employees, there is the growth of the remaining employees and the arrival of new ones, causing knowledge gains to organizational structures (Massingham, 2018).

2.3 Capital intelectual

Capital Intelectual (CI) pode ser definido de diferentes formas, não possuindo uma conceitualização única. Entretanto, trata dos componentes intangíveis das organizações. Segundo Sveiby (2001), um dos principais autores da área, o CI é composto pela combinação de ativos intangíveis, nos quais geram crescimento, eficiência, renovação e estabilidade organizacional. Estes recursos crescem na medida em que os conhecimentos pertencentes a eles são compartilhados.

Alguns autores compreendem o CI como os recursos de conhecimento organizacional, que geram valor para as organizações (Edvinsson & Sullivan, 1996; Stewart & Ruckdeschel, 1998; Stewart, 2007; Urban & Joubert, 2017). Para Stewart (2007), este valor é criado a partir dos conhecimentos que transformam a matéria-prima - física ou intangível (como informação) - em algo mais valioso para as organizações. Por sua vez, Edvinsson e Sullivan (1996), afirmam que o valor é determinado a partir do conhecimento organizado, que é utilizado para algum propósito.

Além disso, o Capital Intelectual possibilita que as organizações mantenham-se atrativas e sustentáveis no mercado. Mas para isto é necessário identificar os fatores dinâmicos ocultos (Edvinsson & Malone, 1998). Para estes autores, o CI também se origina do conhecimento, no qual compõe os ativos imateriais, ocultos e invisíveis. Estes ativos de conhecimento pertencem, principalmente, a três dimensões específicas, com suas devidas características. Estas, compõem as principais estruturas do CI. São elas: Capital Humano, Capital Estrutural e Capital Relacional.

Capital Humano (CH), segundo Sveiby (2001), é o recurso intangível primário. Pois, segundo o autor, todas as relações intangíveis e todos os bens são resultados da ação das pessoas. Assim, o CH nada mais é que os recursos humanos da organização (Petty & Guthrie, 2000). Dos recursos humanos, estão os conhecimentos e experiências individuais, as habilidades, as capacidades humanas, as competências relacionadas ao trabalho e a qualificação vocacional (Sveiby, 2001; Edvinsson & Malone, 1998; Petty & Guthrie, 2000). Para Bontis (1998), o CH é difícil de ser codificado por se tratar, especialmente, pelo conhecimento tácito das pessoas.

O Capital Estrutural (CE) diz respeito à capacidade organizacional e sua infraestrutura, que apoia a produtividade dos funcionários. Trata-se de tudo aquilo que fica na organização quando os funcionários vão embora (Evinsson & Malone, 1998). Ou seja, diz respeito a marcas registradas, patentes, cultura, sistemas de informação e de rede, processos gerenciais, filosofia da gestão, processos direcionados à ampliação da eficiência, entre outros elementos (Edvinsson & Malone, 1998; Petty & Guthrie, 2000).

Por fim, o Capital Relacional (CR) refere-se às relações externas da organização. Ou seja, com os clientes, *stakeholders*, parceiros estratégicos. Nestas relações permeiam conhecimentos que geram valor para a

organização (Edvinsson & Malone, 1998). Para os autores, uma das medidas de medir o CR se dá através da longevidade das relações e das medidas de satisfação.

3. Method

3.1 Identifying the research question

The research question guiding this study was the following: What is the evidence between knowledge loss, waste and gain, and resilience, from the perspective of resilience engineering? These evidences were identified according to the perspective of Intellectual Capital and its main dimensions: Structural capital; Human capital; relational capital.

The central topics of each study were also the object of study of this article, but analyzed in a secondary way.

3.2 Selection of studies and exclusion criteria

In order to answer the main research question, a bibliographic search of articles was carried out using four electronic databases: IEEE Xplore, Scopus, Web of Science and Scielo. The choice of search terms are shown in Table 1. The search took place in the titles, abstracts and keywords of the articles. This search was carried out between April and May 2021 and had the following exclusion and eligibility criteria established: (i) studies from any segment or sector; (ii) publications in any language, in any location and also in any publication period; and (iii) the studies should contain evidence relating knowledge loss, gain and waste with resilience.

Table 1: Selection of studies.

String de busca	Data base			
	Scopus	*Web of Science*	*IEEE Xplore*	*Scielo*
("knowledge loss" OR "loss of knowledge") AND "organi*ational resilience"	1	1	0	0
("knowledge loss" OR "loss of knowledge") AND ("resilience engineering" OR "Safety II")	0	0	0	0
"knowledge waste" AND ("resilience engineering" OR "Safety II")	0	0	0	0
"knowledge waste" AND "organi*ational resilience"	0	0	0	0
("knowledge loss" OR "loss of knowledge" OR "knowledge waste") AND resilience	8	8	0	1

Source: authors (2022).

EndNote and Rayyan tools were used to manage publications. Thus, of the 19 selected studies, repeated articles were excluded, as well as studies that were not part of the eligibility criteria. Thus, the final bibliographic portfolio of this research had only 3 articles. Table 2 presents the studies.

Table 2: Portfolio.

Year of publication	Title	Authors
2018	Resilience beyond formal structures: A network perspective towards the challenges of an aging workforce in the oil and gas industry	Bento & Garotti.
2010	Strategic intent: Guiding port authorities to their new world?	Haugstetter & Cahoon.
2006	Leveraging Information Technology for Organizational Resilience in Design of Complex Products: A Case Study	Lal & Samrit.

Source: authors (2022).

4. Findings and Discussion

In order to answer the research question, we sought to identify the common elements of the articles, which touch the objective of this study. It was verified the reasons for the knowledge loss or waste, if these, in turn, directly impact resilience, and, finally, what are the possible gains from loss/waste, for the resilience of organizations. With this, we tried to classify the knowledge loss and/or waste and the gains, according to the IC

structures. It is important to note that only one study was practical, the others are theoretical and conceptual research.

The article by Lal and Samrit (2006) is a case study, which presents the development and application of a tool created for knowledge retention. The authors suggest that the departure of employees who have specialized knowledge generates a significant impact on the organization. In this study, resilience is not a central topic of analysis, but it considers the departure of employees a great risk, for which organizations must be prepared and be resilient. To this end, the study recognizes that organizational structure is critical to resilience. This structure should enable new employees to acquire the necessary knowledge quickly and effectively. That is, the resilience of the organization will be given from the creation of an organizational structure that recovers the skills and knowledge, in a short term.

Sudden departures and retirements generate adverse conditions and important changes, as there is a knowledge loss on the part of specialists about the development of the product. In order to mitigate the impact and to leverage the experiences and lessons learned, the company sought to develop a system that identifies and converts employee knowledge, skills and experience into organizational resources. This system integrated and formalized the knowledge involved, and was used as a technological tool for capturing, organizing and sharing organizational knowledge (Lal & Samrit, 2006). To this end, the tool's functionality consisted of a knowledge repository; a design process that specifies and designs the work process; a visual representation, through diagrams and flowchart, to better communicate the process and its components; standardization of process representation, documents and project rules; and a simple, accessible workflow.

To make this possible, a specialized information technology team was created, adept at new technologies. This resource was developed from an easy-to-learn and globally deployable framework. The implementation of this feature allowed a significant increase in productivity as it facilitated access to information for workers and managers, reduced rework, as the instructions were previously accessible and it facilitated the storage of results of previous works for verification and validation. It also had a positive impact on organizational resilience as this tool facilitated and made available individual knowledge to circulate in the organization. Thus, knowledge was retained in the organization even if the holders of it left (Lal & Samrit, 2006).

Likewise, the study by Bento and Garotti (2018) states that the oil and gas industry has been impacted by the knowledge loss due to retirements. Through theoretical analysis, it presents loss mitigation strategies. According to the authors, as presented by the literature, mapping knowledge across the organization, codifying knowledge in databases, properly orienting new employees, replacing departing employees with other professionals with similar knowledge/experiences, creating people retention strategies reduces the risk of loss. However, these may be limited means as they may not include the tacit knowledge of professionals and knowledge networks. Therefore, there is a need for innovative knowledge management practices (Bento & Garotti, 2018).

As an alternative, the authors suggest that social network analysis is a strategy to contribute, as network analysis helps to map knowledge in the organization, engages professionals in transdisciplinary cooperation, preserves communication flows, increases connectivity between individuals. , reallocates access to information and increases network redundancy. Thus, network analysis is a way of anticipating the risks of knowledge loss by identifying knowledge, and facilitates the sharing of complex information, thus contributing to the adaptation of the system.

For the authors, employee knowledge is highly tacit and experiential, which makes it impossible to store and code it. However, the knowledge loss is inevitable. Therefore, for resilience in the oil and gas industry, the organization cannot depend on individual knowledge, but rather develop network structures that create, share and disseminate new knowledge. For this reason, there is an organizational change in this sector, which consolidates new forms of collaborative work in integrated production processes, creating clusters of knowledge.

From another perspective, the study by Haugstetter and Cahoon (2010) analyze aspects that exist between commercial networks, and claim that seaports are key elements for these networks, as they act as a link between the various supply and logistics chains. According to the authors, the impact of the “financial tsunami” on these organizations required them to develop their resilient capabilities, needing to develop strategies to reduce organizational risks.

In this scenario, port authorities are key actors as they enable integration between organizations, and contribute to resilience through innovation, which is developed by learning in the network. In addition, they must play a central role in integrating the network's knowledge, managing learning opportunities. For this integration of knowledge to occur, it is necessary to identify the levels of common knowledge, which enable effective communication. It is also necessary for organizations to promote knowledge sharing based on structured organizational routines. And finally, efficient structures of the port authority maintain assertive communication in order to minimize the knowledge loss in the integration (Haugstetter & Cahoon, 2010).

Strategic collaborations in these organizational networks offer lessons that can be used strategically for growth, innovation and risk reduction from the financial tsunami, impacting organizational resilience. To successfully integrate knowledge, it is necessary to develop social networks with other organizations, reducing the risk of knowledge loss as communication increases. Also, establishing routines that promote knowledge sharing can help in the integration of knowledge (Haugstetter & Cahoon, 2010).

The analysis of the three articles shows that the knowledge loss is a factor that impacts organizational resilience, the main reason for the loss being the departure of employees. This is in agreement with other authors who, when analyzing organizational loss, identified that retirement and turnover generate organizational loss knowledge (Delong & Storey, 2004; Sulaiman, Nordin & Noor, 2016; Rashid, Clarke & O'Connor, 2017; Su, Yang & Li, 2017; Sumbal et al., 2018, Geeraerts, Tynjälä & Heikkinen, 2018). Thus, considering the structures of Intellectual Capital, Human Capital has a greater implication in terms of knowledge loss and resilience. However, although the waste of knowledge is also a risk that impacts resilience, none of the articles brought elements that referred to waste.

In order to mitigate this risk and strengthen resilience, organizations develop strategies that directly impact the organization's structure, such as creating knowledge repositories and establishing internal social networks, for sharing and creating knowledge. They also strengthen inter-organizational relationships for the same purpose. That is, although human capital is negatively impacted by the knowledge loss in the face of resilience, structural and relational capital are strengthened and improved. In terms of resilience, they provide the resources for the organization to respond to the unexpected. This happens because by strengthening relationships and creating internal structures that aim to mitigate loss or even deal with it, knowledge is retained. Thus, the results indicate that loss mitigation actions generate gains for structures, as these actions reinforce relationships, sharing, interpersonal contact and the reinforcement of internal structures.

Although not cited by the articles in this sample, organizational learning processes are also effective strategies in mitigating loss. These, in turn, generate gains for the organization because from organizational learning, they create new knowledge for the institution and retention of the same because, according to Crossan, Lane and White (1999), organizational learning is the institutionalization of knowledge from routine actions and incorporation of the learning that occurred in individuals and groups. There are changes in systems, structures, procedures and even strategy.

Although not cited by the articles in this sample, organizational learning processes are also effective strategies in mitigating loss. These, in turn, generate gains for the organization because from organizational learning, they create new knowledge for the institution and retention of the same because, according to Crossan, Lane and White (1999), organizational learning is the institutionalization of knowledge from routine actions and incorporation of the learning that occurred in individuals and groups. There are changes in systems, structures, procedures and even strategy. And these changes can strategically support resilience, by creating the conditions for resilient responses.

Also, organizational unlearning can be a strategy in the face of knowledge loss and its impact on resilience. Organizational unlearning, according to Tsang and Zhara (2008), is the discarding of old routines so that new routines are incorporated, if necessary. These new routines, if they allow for more action to respond to controversial events, will generate gains for the organization considering resilience.

In this sense, Wensley and Navarro (2015) already proposed that organizational unlearning is a way of dealing with knowledge loss, as this will lead to the development of new adaptive capabilities of the organization (Nystrom & Starbuck, 1984) in the face of its risks. Knowledge loss is a risk, and therefore Wensley and Navarro (2015) suggest that it is necessary to create an unlearning context for the corporation to recover from the loss,

identifying learning opportunities (which in turn will incorporate new knowledges). Unlearning, according to the authors, makes it possible to create and review their knowledges.

To summarize the research findings by samples, Table 3 provides an overview of the results.

Table 3: Presentation of findings

Article	Topic central	Loss and/or Gain	IC dimension
Lal & Samrit (2006)	Development of a technological tool for knowledge retention	**(LOSS)** Sudden departures of employees and retirement	Human capital
		(GAIN) Development of a technological tool for capturing, organizing and sharing knowledge	Structural Capital
Haugstetter & Cahoon (2010)	Inter-organizational strategic networks in the logistics sector	**(GAIN)** Development of social networks with other organizations; development of structured organizational routines that promote knowledge sharing and creation	Structural Capital e Relational Capital
Bento & Garotti (2018)	Resilience in the oil and gas industry	**(LOSS)** Retirement	Human capital
		(GAIN) Analysis of social networks and creation of knowledge clusters	Structural Capital e Relational Capital

Source: authors (2022).

5. Conclusion

This literature review provided an overview of the relationship between knowledge loss and resilience (from the perspective of resilience engineering), basically focusing on advancing the understanding of knowledge gains, since regular aspects to organizations such as turnover, waste of knowledge, low volume of specialists and absences from work generate risks to critical knowledge. These, in turn, affect the resilience and structures of the IC. The analysis of the articles selected for the portfolio share a perspective on the relationship between the knowledge loss and resilience engineering constructs.

The objective was achieved, as it was possible to identify and extract knowledge losses and gains and associate the classifications of intellectual capital. The study showed that, given the perspective of gaining knowledge, there is a direct impact on the structural and relational capital of the organization. This means that, even in the face of an imminent knowledge loss, gains in knowledge also occur.

Therefore, it is reinforced that the investment in interpersonal relationships and the creation of internal structures are fundamental for retention, recovery and loss mitigation. Thus, knowledge can be stored in organizational processes, databases, workgroups and even customers. To recover them, you can review the processes, search the bases and approach the people who have such knowledge. In addition, reviewing the processes and seeking to understand the weaknesses of the system, there are the needs for unlearning and organizational learning, in order to create specific conditions for the organization to respond quickly and effectively to unexpected and expected situations. In other words, managers are recommended to create environments and spaces for new knowledge to be incorporated, based on organizational learning and unlearning.

Although the literature already recognizes that knowledge is a key factor for resilient responses (Apgar, 2013; Salgado, 2013; Umoh, Amah & Mnim, 2014, Lundberg & Johansson, 2015), it is noted that few studies delve into the aspects of knowledge loss (nor waste) in the context of resilience, identifying the risks and impacts for this. In addition, only one article in the portfolio is the result of a practical study.

Therefore, this article recognizes its limitation and suggests that future studies analyze more deeply the relationship between risks associated with knowledge, such as loss and waste, in the context of organizational resilience. This is because, when there is a knowledge loss, it is important to identify whether there will be impacts on the structure (CR), on people (CH) or on external relations (CR), so that organizations can create preventive actions to knowledge, considering their need to monitor, respond, adapt and learn from imminent risks.

Acknowledgment

This study was carried out within the scope of the Human Factors Project (HF Project) of the Pontifical Catholic University of Rio Grande do Sul (PUCRS), funded by the Libra Consortium, with support from the ANP (Agência Nacional de Petróleo, Gás Natural e Biocombustíveis, Brazil) associated with the investment of resources arising from the R,D&I Clauses - Regulation No. 03/2015 (process 2019/00105-3).

References

Apgar, D. (2006). Risk intelligence: Learning to manage what we don't know. Harvard Business Press.

Bauch, C. (2004). Lean product development: making waste transparent (Doctoral dissertation). Munich, 2004.

Bento, F., & Garotti, L. (2019). Resilience beyond formal structures: A network perspective towards the challenges of an aging workforce in the oil and gas industry. Journal of Open Innovation: Technology, Market, and Complexity, 5(1), 15-25.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. Management Decision, 36(2), 63-76.

DeLong, D. W., & Storey, J. (2004). Lost knowledge: Confronting the threat of an aging workforce. Oxford University Press.

Edvinsson, L., & Malone, M. S. (1998). Capital intelectual: descobrindo o valor de sua empresa pela identificação de seus valores internos. São Paulo: Makron Brooks.

Edvinsson, L., & Sullivan, P. (1996). Developing a model for managing intellectual capital. European management journal, 14(4), 356-364.

Ferenhof, H. A. (2011). Uma sistemática de identificação de desperdícios de conhecimento visando à melhoria do processo de criação de novos serviços. Florianópolis, 2011. Mestrado em Engenharia e Gestão do Conhecimento, 107f. Universidade Federal de Santa Catarina.

Ferenhof, H. A. (2015). Um modelo para identificar desperdícios de conhecimento relacionados à performance dos portfólios de projetos. Florianópolis, 2015. Doutorado em Engenharia da Produção, 250f. Universidade Federal de Santa Catarina.

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. Global environmental change, 16(3), 253-267.

Gao, J., Barzel, B., & Barabási, A. L. (2016). Universal resilience patterns in complex networks. Nature, 530(7590), 307-312.

Geeraerts, K., Tynjälä, P., & Heikkinen, H. L. (2018). Inter-generational learning of teachers: what and how do teachers learn from older and younger colleagues?. European Journal of Teacher Education, 41(4), 479-495.

Grant, R. M. (1996). Toward a knowledge-based theory of the firm. Strategic management journal, 17(S2), 109-122.

Haugstetter, H., & Cahoon, S. (2010). Strategic intent: Guiding port authorities to their new world? Research in Transportation Economics, 27(1), 30-36.

Hollnagel, E., Woods, D. D., & Leveson, N. (Eds.). (2006). Resilience engineering: Concepts and precepts. Ashgate Publishing, Ltd.

Hollnagel, E. (2014). Safety-I and safety-II: the past and future of safety management. CRC press.

Hosseini, S., Barker, K., & Ramirez-Marquez, J. E. (2016). A review of definitions and measures of system resilience. Reliability Engineering & System Safety, 145, 47-61.

Hirose, T., & Sawaragi, T. (2020). Extended FRAM model based on cellular automaton to clarify complexity of socio-technical systems and improve their safety. Safety science, 123, 104556.

Lal, R., & Samrit, A. (2006). Leveraging Information Technology for Organizational Resilience in Design of Complex Products: A Case Study. In IFIP International Working Conference on the Transfer and Diffusion of Information Technology for Organizational Resilience (pp. 93-99). Springer, Boston, MA.

Locher, D. A. (2008). Value stream mapping for lean development: a how-to guide for streamlining time to market. CRC Press.

Massingham, P. R. (2018). Measuring the impact of knowledge loss: a longitudinal study. Journal of Knowledge Management, 22(4), 721-758.

Petty, R., & Guthrie, J. (2000). Intellectual capital literature review: measurement, reporting and management. Journal of intellectual capital, 1(2), 155-176.

Rashid, M., Clarke, P. M., & O'Connor, R. V. (2017). Exploring knowledge loss in open source software (OSS) projects. In International conference on software process improvement and capability determination (pp. 481-495). Springer, Cham.

Sarkheyli, A., Alias, R. A., & Ithni, N. B. (2014). A conceptual formative framework of knowledge risk governance to enhance knowledge sharing. In: PACIS, p. 270.

Stewart, T. A. & Ruckdeschel, C. (1998). Intellectual capital: The new wealth of organizations. Performance Improvement, 37(7), 56-59.

Stewart, T. A. (2007). The wealth of knowledge: Intellectual capital and the twenty-first century organization. Currency.

Su, J., Yang, Y., & Li, H. (2017). Stability of knowledge collaboration network facing member loss and knowledge loss. In 2017 6th International Conference on Industrial Technology and Management (ICITM) (pp. 192-197). IEEE.

Sulaiman, M. S. B., Nordin, A., & Noor, N. L. M. (2016). A review of knowledge retention frameworks for knowledge intensive organization. In 2016 International Conference on Information Management and Technology (ICIMTech) (pp. 106-111). IEEE.

Sumbal, M. S., Tsui, E., Cheong, R., & See-to, E. W. (2018). Critical areas of knowledge loss when employees leave in the oil and gas industry. Journal of Knowledge Management, 22(7), 1573-1590.

Sveiby, K. E. (2001). A knowledge-based theory of the firm to guide in strategy formulation. Journal of intellectual capital, 2(4), 344-358.

Urban, B., & Joubert, G. C. D. S. (2017). Multidimensional and comparative study on intellectual capital and organisational performance. Journal of Business Economics and Management, 18(1), 84-99.

Wahl, A., Kongsvik, T., & Antonsen, S. (2020). Balancing Safety I and Safety II: Learning to manage performance variability at sea using simulator-based training. Reliability Engineering & System Safety, 195, 106698.

Crowdsourcing as an Open Innovation Strategy in Knowledge-Based Smart City Management

Aleksandra Radziszewska
Czestochowa University of Technology, Czestochowa, Poland
aleksandra.radziszewska@pcz.pl

Abstract: A smart city is defined as an area that offers numerous opportunities for learning and innovation, relies on the creative potential of its inhabitants and institutions, and employs digital infrastructure for communicating and managing knowledge. An important related research direction to be considered is knowledge management for smart cities and urban innovation. The idea in this area is to collect and share knowledge in order to arrive at a collaborative approach towards the development of future urban environments. Open innovation is a new paradigm for building smart cities, where governments and software developers take advantage of the experience, skills, and knowledge of citizens to develop digital services that are relevant to users of the urban environment. Citizen involvement is a key to the successful development of cities, but empirical research into the nature and characteristics of this involvement remains scarce. The objective of this study is to explore the potential of open innovation strategies in knowledge-based smart city management and the role of the municipality herein. A limited set of crowdsourcing initiatives has been introduced to illustrate the open innovation strategies. This paper will tackle a part of this problem by adding to the understanding of generating, evaluating and selecting innovative ideas for smart city innovation by means of online crowdsourcing. The case studies research presented in this paper generates some empirical evidence with regards to the usage of crowdsourcing through an online platform in the context of trying to establish a smarter city. The study offers recommendations arising from the empirical research. An improved approach should consider citizens as active actors within the development process of smart cities. Citizens can collaborate in co-creating smart cities together with the private sector, governments, academia and knowledge institutes. One important element however still needs to be researched more in depth is user motivation. It remains an interesting research topic for future studies to investigate the optimal motivation for citizens in order to get them to share their knowledge.

Keywords: crowdsourcing, smart city, open innovation, knowledge sharing, knowledge-based urban development, knowledge-based smart city management

1. Introduction

Open innovation encourages organizations to search for solutions outside their organizational boundaries to address core management problems. The open innovation paradigm emerged when private firms started recognizing that useful knowledge is widely distributed and that they should use not only internal but also external ideas. As a consequence these roots, most extant open innovation research has studied this paradigm in the private sector (Mergel, 2018). Though significant scholarship has examined open strategies of firms and user communities in the private sector, less attention has been paid to open strategies for innovation in the public sector (Lee and Kwak, 2012; Nam, 2012). Open innovation in the private and in the public sector is different in many ways. While open innovation in the private sector usually has new product development as a main goal, open innovation in the public sector generally focuses on improving service performance and creating public value. Therefore it is a need of detailed analyses that explore the importance of public involvement in the development of smart cities, research on effective strategies for cities to become smarter and on approaches to mobilize the participation and intelligence of citizens, businesses and societal organizations.

The role and significance of social participation in local governance has been emphasized in the literature, but some researchers have also commented on the lack of detailed analyses that explore the importance of public involvement in the development of smart cities (Cortés-Cediel et al., 2021; Gollagher and Hartz-Karp, 2013).

Among the numerous concepts addressing urban development, the smart city concept offers the most comprehensive and multidimensional approach to knowledge-based city management, but none of the numerous definitions of a smart city has been universally recognized. Some definitions focus on technological aspects, some emphasize economic factors, and some highlight the importance of social participation.

Citizen involvement is key to the successful development of cities, but empirical research into the nature and characteristics of this involvement remains scarce.

The aim of this study is to explore the potential of open innovation strategies in knowledge-based smart city management and the role of the municipality herein. This paper will tackle a part of this problem by adding to the understanding of generating, evaluating and selecting innovative ideas for smart city innovation by means of online crowdsourcing. The case studies research presented in this paper therefore generates some empirical evidence with regards to the usage of crowdsourcing through an online platform in the context of trying to establish a smarter city.

2. Theoretical background

Crowdsourcing is the use of the crowd to obtain ideas, services, or content from a large group of people, usually from an online community, rather than from traditional channels. Crowdsourcing is a kind of participative online activity in which a large and possibly undefined group of people contribute to the tasks outsourced by requesters through a flexible open call (Estellés-Arolas and González-Ladrón-De-Guevara , 2012).

Inspired by the financial or non-financial benefits, there is a popular trend for firms or individuals to apply and for solvers to make use of crowdsourcing to handle different possible outsourced tasks, especially problem-solving tasks (Bassi et al., 2020). This idea refers to the intelligent decisions which are made when individuals, contrary to the wisdom of crowds, actually do combine their knowledge. Through social interaction, individual knowledge is shared, corrected, opened, processed, enriched and evaluated. This leads to results which are better than the results of a single individual (Schuurman et al., 2012). In the networked society in which we live today, the concept of collective intelligence seems to be more applicable than the wisdom of crowds. In the context of the open innovation-framework, these principles can be put into practice in order to give end-users or citizens, as external sources of innovation, a voice and an active role in the innovation process. The combination of the open innovation-concept of outsourcing with the concept wisdom of crowds leads to the process of crowdsourcing, a term first used by Jeff Howe (Howe, 2006). The rise of crowdsourcing connects the wisdom of crowds and the concept collective intelligence. Howe (2005) describes crowdsourcing as the phenomenon in which everyday people use their free time to help solving problems. The crowd is described as a big and unknown group of people. Using an online crowdsourcing platform, organizations are looking for creative ideas, answers or solutions, or they delegate certain tasks to a broad, diverse and decentralized network of individuals (Piller and Walcher , 2006).

A smart city is defined as an area that offers numerous opportunities for learning and innovation, relies on the creative potential of its inhabitants and institutions, and employs digital infrastructure for communicating and managing knowledge (Zheng and Schachter, 2017). Despite the fact that the smart city concept is already being implemented in many cities as part of projects and programs that rely on smart technologies, such as public Wi-Fi networks and intelligent traffic management systems, citizen-led development should be the next step in the evolution of smart cities. Technological advancement and the availability of modern ICT tools underscore the importance of e-participation as a source of external knowledge. Therefore an important related research direction to be considered is knowledge management for smart cities and urban innovation. The idea in this area is to collect and share knowledge regarding different projects, initiatives and concepts on organizational (Ferraris et al., 2019) and technical level, in order to arrive at a collaborative approach towards the development of future urban environments. Thus, cities are expected to become knowledge hubs for different participants in an urban innovation (Bresciani et al., 2018; Israilidis et al., 2021). The involved stakeholders who are considered for collaboration involve the public and the private sector. This includes city representatives and departments, citizens, companies, universities and research institutes as well as large scale industry such as software power houses or telecom and infrastructure providers (Tcholtchev and Schieferdecker, 2021).

Governments are increasingly looking for different governance mechanisms that open up this process by including interaction with citizens and other stakeholders. Hilgers and Ihl (2010) distinguish three levels of open innovation in the public sector. As a first tier, “citizen ideation and innovation” has been introduced, where citizens are involved through ideation and innovation challenges through online platforms to utilize the creativity and knowledge of the crowd. The second tier is referred to as “collaborative administration”, which means that common administrative tasks are improved through involving external actors in a systematic way. The third and final tier is entitled “collaborative democracy”, where larger groups of people are involved in policy making and implementation processes. Other example of open innovation in the public sector is collaborative innovation. Collaborative innovation refers to an opened-up innovation process, where citizens are integrated into the innovation cycle (idea generation, selection, implementation, and diffusion) from the earliest stage (Torfing ,

2019). In addition, Lee, Hwang and Choi (2012) describe a similar concept, citizen-centered governance, where a collaborative network of citizen experts is harnessed by the government to deal with problems more rapidly and precisely. They highlight that these networks can be both government-led and community-led. In this context of the open innovation-framework can be put into practice in order to give citizens as external sources of innovation. Using an online crowdsourcing platform, organizations are looking for creative ideas, answers or solutions, or they delegate certain tasks to a broad, diverse and decentralized network of individuals. Citizen engagement is now commonly central to smart city definitions and is said to be essential to address urban challenges. Information and communication technologies (ICTs) offer unprecedented opportunities for expanding public participation. Crowdsourcing enables the use of the crowd to obtain ideas, services, or content from a large group of people, usually from an online community, rather than from traditional channels (Cortés-Cediel et al., 2021).

Governments are increasingly looking for different governance mechanisms that open up city management process by including interaction with citizens and other stakeholders. Social participation with the involvement of new technologies is an inseparable element of the smart city concept. A modern smart city recognizes the importance of cooperation between the local authorities, inhabitants, and other users of urban space. The previous generations of smart cities have evolved into the smart city concept, where local residents are not only the recipients, but also the creators of the implemented changes in urban space. One of the theoretical goals of the smart city concept is to promote urban development through social participation and an improvement in the quality of life by engaging local community members in the process of planning urban development, setting directions for change, identifying problem areas in urban space, and proposing solutions (Israilidis et al., 2021; Torfing , 2019).

3. Research context and method

A lot of publications try to conceptualize and define the elements and application domains that constitute smart cities, mostly through case studies or comparative case study analysis. However, it is argued that there is a need for research on effective strategies for cities to become smarter and on approaches to mobilize the participation and intelligence of citizens, businesses and societal organizations (Gollagher and Hartz-Karp, 2013). Citizen engagement is now commonly central to smart city definitions and is said to be essential to address urban challenges. Information and communication technologies (ICTs) offer unprecedented opportunities for expanding public participation (Granier and Kudo, 2016) .

The objective of this study is to explore the potential of open innovation strategies in knowledge-based smart city management and the role of the municipality herein. For this purpose, a small sample of different crowdsourcing initiatives has been selected, to study various types of collaborations in order to inform the development of open innovation strategies in city management.

Data and information about crowdsourcing initiatives have been collected from secondary sources. The presented case studies have been explored through desk research using online resources (initiatives' web pages) and, when available, literature describing the initiatives has been included. The presented crowdsourcing examples refer to the concept of knowledge-based city management and provide insights into the dynamics of stakeholder relationships in open innovation process. The most important criterion of crowdsourcing examples selection was the nature of the collaboration of different actors for open innovation. The case studies have been selected on the premise of presenting both: variety regarding stakeholders' formulation of the collaboration and quality in the exchange of knowledge within the open innovation process.

The following case studies of crowdsourcing initiatives in knowledge- based smart city management have been presented and analyzed in this study.

Case 1. Philadelphia used online platform Change By Us to crowdsource ideas for how to improve the city's neighborhoods. Citizens submitted proposals online, which were posted for other users to see. The platform also aggregated similar ideas so that like-minded citizens could organize and initiate projects.

Case 2. New York used crowdsourcing in the Big Ideas challenge in which citizens submitted ideas online for applications that could be developed to improve New York civic services. In addition to citizen collaboration,

platforms like Change By Us and Big Ideas connected citizens with city officials that provided feedback and guidance on proposals.

Case 3. Betri Reykjavik (Better Reykjavik) is an open innovation website that enables citizens to submit, debate, and prioritize policy proposals and ideas. Betri Reykjavik runs on the free and open source platform Your Priorities. Currently Betri Reykjavik is officially recognized and used by the City of Reykjavik as an online consultation forum. Citizens can use the platform to present ideas, view the ideas of others, debate different proposals and show their support for an idea by rating it. The Reykjavik City Council pledged to discuss the top rated proposals from the platform. Every month the top five ideas overall are referred to the appropriate city council committee. Additionally, the top rated idea in each of the thematic areas (e.g. tourism, education, transportation, etc.) is also transferred to the appropriate committee. The city council aims to process each proposal within one month of receiving it. The platform was designed to be easily integrated into social media platforms already used by citizens (namely Facebook and Twitter). Next to the advantages on the technical side, the strong and visible commitment of the city council to discuss and implement citizens' ideas is certainly a motivating factor.

Case 4. Tirana is a city that has experienced a great transformation in the past decades. The city is hoping to improve living standards and the quality of life to rival nearby European cities. One of the city's strategies is to leverage the high number of smartphone users to open a real-time channel of communication with its citizens. To this end, the Tirana Ime (My Tirana) app was developed. Among its various features, Tirana Ime provides real time information to users about traffic, public transportation, pollution, tourism activities, as well as other emergency information and reports. Apart from receiving information from the city, users can also interact with the municipality by using the app to report issues to the municipality. The app allows users to report issues in their urban area, for example related to cleaning, infrastructure, or illegal constructions. For example, a citizen that notices a broken street light can take a picture of it, add details about the location, and send it to the city administration. The report will be followed up and the user will automatically be informed about the status.

Case 5. Decide Madrid is the official open governance website of the Madrid City Council. The platform is based on open source code and can be freely used by other cities. During the proposal phase, citizens suggest, discuss and rank ideas. Top ranked proposals are checked for viability and costs, and if they meet the viability criteria moved to the voting phase. If a proposal does not meet the viability criteria (e.g. legality, within the competence of the city etc.) a report is published with an explanation as to why it was excluded from voting. A cost report gives an estimate of the expected cost for implementation. In the subsequent voting phase, proposals chosen by the citizens are automatically included in the budget of the following year. Any person around the globe with internet access can propose ideas and discuss during the proposal phase. A simple, anonymous user account suffices. The voting, however, is limited to registered inhabitants of Madrid. Residents without internet access or with other barriers to online participation can take part in the proposal phase at offline meetings. For the proposal phase as well as the voting phase, they can receive assistance with using the online platform at citizen service offices located in every district.

Case 6. In Nexthamburg, citizens' ideas for projects are collected on an online platform. An editorial team clusters the submissions and users can comment and discuss the ideas, or express their support by becoming a fan. While taking advantage of online tools, the process also included important offline elements like workshops. The experience in Hamburg has shown that ICT can be very useful in organizing citizen participation, but that it also has its limits. Rates of online participation usually peaked immediately after an offline event, indicating that inspiration and motivation are easier to foster in-person.

Case 7. Other example of crowdsourcing is the city Ghent (Belgium) and its Ghent Living Lab. Through various city channels, citizens were asked to submit their ideas with regards to ICTs and how they could benefit the quality of life of the citizens of Ghent through an online platform. The citizens can submit ideas and also cast three votes on the preferred ideas and discuss each idea. A panel of experts rate both the citizen and the expert selection of ideas on three quality dimensions: innovativeness, user benefit and feasibility.

Case 8. An interesting example of open innovation strategy implementation in city management is Rotterdam. The platform of Qurrent is used to divide the profits of the generated energy. Citizens then collectively buy solar panels for this roof, from which they will receive part of the yield. The motivation to do this is that citizens wanted to create sources of clean energy for themselves. Moreover, they do not want to wait for the

government to act, but they initiate renewable energy sources themselves. The municipality of Rotterdam funded this initiative through CityLab010. The initiative operates on the neighborhood level and has face-to-face interactions with citizens, as well as digital interactions (through the Qurrent platform).

Case 9. Other example from Rotterdam is Happy Streets. It is organization that sets up temporary experiments in the streets of Rotterdam to create a more inclusive and sustainable mobility and to make better use of the public space. The experiments, organized together with the municipality, the residents, entrepreneurs, and researchers, are tactile interventions on the streets to test what type of solutions could work in the long term for the city of Rotterdam. A Happy Streets Index is also being developed by the group, which will be a research-based tool which can help to identify how spaces can be used best to increase quality of life. Happy Streets is a collaboration effort of the City of Rotterdam, the research institute DRIFT, and the urban agency Humankind and Street Events.

Case 10. As part of a larger campaign to promote cycling behavior, the municipality of Rotterdam has implemented several interventions to experiment with ways to make the city friendlier towards bicycle traffic. Input was collected from different sources to define the bicycle program, for example: district committees, stakeholders, and cyclists. A lot of comments are collected, mainly through the platform Fietsfan010 (Fan of Cycling Rotterdam). With this input, some changes were made to the original plan. For example, more attention was given to lighting on bicycle paths. Another example is a sort of traffic light that shows cyclists the shortest way to cross an intersection. This traffic light interventions system has been developed for the improvement of cycling traffic in the city.

Implementing open innovation methodologies in the public sector can have myriad positive benefits, including improved awareness of social problems, more effective practices based on broad citizen experience, and increased trust between government and citizens (Mergel and Desouza, 2013). The involvement of citizens into innovation processes through and with regards to ICTs is a key aspect in cities becoming smarter.

4. Results and discussion

For this research, different examples of initiatives with innovative proposals for city development have been selected and studied. This section collects outcome of analysis in the form of comparison of different crowdsourcing solutions, analysed in this study.

The examples of the open innovation have been mapped in two different tables. The first one explains their relation to urban development and urban challenges addressed by the crowdsourcing initiatives. Based on the literature review the following categories of urban challenges have been proposed: quality of life improvement, city innovation development, sustainable development, environment protection, urban development and city problems solving. In the second table, types of stakeholders involved in each initiative have been mapped, as well as their roles in the different initiatives, in order to primarily elaborate upon the different roles the municipality can take in each of the presented examples.

The below tables bring together outcomes of analysis of the initiatives in regards to the urban challenge they address (Table 1), as well as the collaboration that takes place in each instance (Table 2).

Table 1: The urban challenges addressed by the open innovation initiatives

	Quality of life	**City innovation**	**Sustainable development**	**Environment protection**	**Urban development**	**City problems solving**
Change By Us Philadelphia	X				X	X
Big Ideas New York	X				X	X
Betri Reykjavik	X				X	X
Ghent Living Lab	X	X			X	X
Decide Madrid	X				X	X
Nexthamburg	X	X	X	X	X	X
Tirana Ime (My Tirana)	X			X	X	X

	Quality of life	**City innovation**	**Sustainable development**	**Environment protection**	**Urban development**	**City problems solving**
Happy Streets (Rotterdam)	X		X	X	X	X
Qurrent platform (Rotterdam)	X	X	X	X		
Fietsfan010 (Rotterdam)	X	X	X	X		

Table 2: The involved stakeholders and their role in the open innovation initiatives

	Municipality	**Citizens**	**Business and Industry**	**Academia**	**Other organisations, institutions and agencies**
Change By Us Philadelphia	Project initiator Funding provider Project executor	Knowledge provider Project initiator			
Big Ideas New York	Project initiator Funding provider Project executor	Knowledge provider			
Betri Reykjavik	Project initiator Funding provider Project executor	Knowledge provider			
Ghent Living Lab	Project initiator Funding provider Project executor	Knowledge provider	Knowledge provider	Knowledge provider	Knowledge provider
Decide Madrid	Project initiator Funding provider Project executor	Knowledge provider			
Nexthamburg	Project initiator Funding provider Project executor	Knowledge provider			
Tirana Ime (My Tirana)	Project initiator Funding provider Project executor	Knowledge provider	Project executor		
Happy Streets (Rotterdam)	Project initiator Funding provider	Knowledge provider Project executor	Knowledge provider	Project initiator Knowledge provider	Project initiator Knowledge provider Project executor
Citylab010	Funding provider	Project initiator	Project executor		

	Municipality	**Citizens**	**Business and Industry**	**Academia**	**Other organisations, institutions and agencies**
Qurrent platform (Rotterdam)		Project executor Knowledge provider	Knowledge provider		
Fietsfan010 (Rotterdam)	Project initiator Funding provider Knowledge provider Project executor	Knowledge provider			Knowledge provider

To understand how these initiatives came to fruition, all stakeholders involved in each initiative have been mapped. Moreover, their roles within the collaboration are described in the table: initiator of the project, provider of the funding, provider of knowledge, and execution of the project. Providing knowledge can be either some form of expert knowledge, or knowledge of citizens on their own living environment. The aim is to understand the possible different roles the municipality takes in collaborations for open innovation for city development. The selected innovative initiatives showed a dynamic variety in collaboration among the different urban stakeholders. Moreover, they showed different roles of the municipality in participating in open innovation in the city. Data collection showed that multiple parties collaborated and contributed to the impact of the project, although, some initiatives were community-led while others were government-led, and in other cases the initiation of the project was the result of an initial collaboration, therefore there was not a defined single initiator. However, the municipality was playing a crucial role in all selected initiatives.

Through exploration, three strategies of open innovation have been identified, depending on the role of the municipality in the collaboration and the impact of this collaboration on the different actors involved.

The first strategy observed, which can be seen as a basic type of collaboration for open innovation. The municipality involves other agents, such as the city locals or an expert, in order to collect input that will be processed inside the local government. In these initiatives, the municipality applies an open innovation approach with the intention of learning from other agents. Among those explored in this study, this level of open innovation has been observed in example of Fietsfan010, where has been elaborated the traffic light interventions system for the improvement of cycling traffic in the Rotterdam. The initiatives that fit within this level are usually temporary experiments or small-scale urban interventions.

The second strategy identified, where the municipality is taking the role of the main funding agency and an infrastructure agent of an open innovation process, without partaking of the learning generated from these processes, or being involved in a co-creation process. Regarding the selected initiatives, the excellent example of this strategy is Qurrent platform. This initiative received funding from the municipality's platform CityLab010. Through an authority such as Citylab010, the municipality of Rotterdam creates fertile grounds for the generation of a participatory climate and for innovative initiatives.

A third strategy for open innovation can be observed in those initiatives where all stakeholders were closely involved along the collaboration process and started to act in a co-creative partnership with other stakeholders. This third strategy of open innovation is highly collective and co-creation plays an important role on multiple levels in the development process. Exemplary initiatives illustrating this third strategy are Happy Streets and Ghent Living Lab, where all stakeholders have an important and clear role towards the shared goal. They also openly share the generated knowledge, whereby interested parties can join or help in this transition. Another significant aspect in the explored initiatives in the third strategy is that the municipality actively supports a co-creative process with their citizens.

Open innovation is a new paradigm for building smart cities, where governments and software developers take advantage of the experience, skills, and knowledge of citizens to develop digital services that are relevant to users of the urban environment. Using open innovation strategies in a city context can also have disadvantages, when not carefully executed. In an open innovation process, it is more difficult to distinguish who is responsible

and accountable for the outcomes of the project and different decision making processes, therefore it can create difficulties in implementation of innovations.

5. Conclusion

Whereas the main objective of this study is to explore the potential of open innovation strategies in knowledge-based smart city management and the role of the municipality herein, a limited set of crowdsourcing initiatives has been introduced to illustrate the open innovation strategies.

Citizen engagement is now commonly central to smart city definitions and is said to be essential to address urban challenges. Information and communication technologies offer unprecedented opportunities for expanding public participation. Crowdsourcing enables the use of the crowd to obtain ideas or content from a large group of people, usually from an online community, rather than from traditional channels. Therefore governments are increasingly looking for different governance mechanisms that open up city management process by including interaction with citizens.

The dynamic development of innovative technologies provides opportunities to build smart cities. However, excessive focus on the technological aspect alone leads to many problems in the implementation of the smart city concept. In the current perception of the smart city concept, there is a return to the needs and preferences of the inhabitants. They are the focus, and technical solutions are to serve their interests. This study offered evidence based on how citizen engagement can be embedded to deliver smart city activities of municipalities. Based on the case study analysis the study argued that citizen engagement needs to be at the forefront for co-creating smart cities development.

Smart city is seen as a centre of knowledge and creativity, because the development of smart cities is becoming more and more knowledge based. As a result, knowledge has been perceived as the core component that makes cities smart. Smart cities managers need to adopt proper organisational and managerial practices to effectively create, collect, organise, use, exploit, share, and transfer the external knowledge. The effective strategy in knowledge-based smart city management is crowdsourcing. This strategy highlights the importance of external knowledge sources in public sector management. This study contributes to research streams in open innovation by exploring this strategy in the public sector, distinguished from private business.

The study offers recommendations arising from the empirical research. An improved approach should consider citizens as active actors within the development process of smart cities. Citizens can collaborate in co-creating smart cities together with the private sector, governments, academia and knowledge institutes.

One important element however still needs to be researched more in depth is user motivation. It remains an interesting research topic for future studies to investigate the optimal motivation for citizens in order to get them to submit their best ideas.

References

Bassi, H., Lee, C. J., Misener, L. and Johnson, A. M. (2020) "Exploring the characteristics of crowdsourcing: An online observational study", *Journal of Information Science*, Vol. 46, No. 3, pp. 291-312.

Bresciani, S., Ferraris, A. and 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, Vol.136, pp. 331-338.

Cortés-Cediel, M. E., Cantador, I. and Bolívar, M. P. R. (2021) "Analyzing citizen participation and engagement in European smart cities", *Social Science Computer Review*, Vol. 39, No. 4, pp. 592-626.

Estellés-Arolas, E. and González-Ladrón-de-Guevara, F. (2012) "Towards an integrated crowdsourcing definition", *Journal of Information Science*, Vol. 38, No. 2, pp. 189-200.

Ferraris, A., Erhardt, N., Bresciani, S. (2019) "Ambidextrous work in smart city project alliances: Unpacking the role of human resource management systems", *The International Journal of Human Resource Management*, Vol. 30, No. 4, pp. 680-701

Granier, B. and Kudo, H. (2016) "How are citizens involved in smart cities? Analysing citizen participation in Japanese 'Smart Communities' ", *Information Polity*, Vol. 21, No. 1, pp. 61-76.

Gollagher, M. and Hartz-Karp, J. (2013) "The Role of Deliberative Collaborative Governance in Achieving Sustainable Cities", *Sustainability*, Vol. 5, No. 6, pp. 2343-2366.

Hilgers, D. and Ihl, C. (2010) "Citizensourcing: Applying the concept of open innovation to the public sector", *International Journal of Public Participation*, Vol. 4, No.1, pp. 67-88.

Howe, J. (2006) "The rise of crowdsourcing", *Wired magazine*, Vol. 14, No. 6, pp. 1- 4.
Israilidis, J., Odusanya, K. and Mazhar, M. U. (2021) "Exploring knowledge management perspectives in smart city research: A review and future research agenda", *International Journal of Information Management*, Vol. 56, 101989.
Lee, S. M., Hwang, T. and Choi, D. (2012) "Open innovation in the public sector of leading countries", *Management Decision*, Vol. 50, No. 1, pp. 147-162.
Lee, G. and Kwak, Y. H. (2012) "An open government maturity model for social media-based public engagement", *Government Information Quarterly*, Vol. 29, No. 4, pp. 492-503.
Mergel, I. and Desouza, K. C. (2013) "Implementing open innovation in the public sector: The case of Challenge. gov.", *Public Administration Review*, Vol. 73, No. 6, pp. 882-890.
Mergel, I. (2018) "Open Innovation in the Public Sector: Drivers and Barriers for the Adoption of Challenge. Gov ", *Public Management Review*, Vol. 20, No. 5., pp. 726 - 745.
Nam, T. (2012) "Suggesting frameworks of citizen-sourcing via government 2.0.", *Government Information Quarterly*, Vol. 29, No. 1, pp. 12-20.
Piller, F. T. and Walcher, D. (2006) "Toolkits for idea competitions: a novel method to integrate users in new product development", *R&d Management*, Vol. 36, No. 3, pp. 307-318.
Schuurman, D., Baccarne, B., De Marez, L. and Mechant, P. (2012) "Smart ideas for smart cities: Investigating crowdsourcing for generating and selecting ideas for ICT innovation in a city context", *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. *7*, No. 3, pp. 49-62.
Tcholtchev, N. and Schieferdecker, I. (2021) "Sustainable and Reliable Information and Communication Technology for Resilient Smart Cities", *Smart Cities*, Vol. 4, pp. 156–176.
Torfing, J. (2019) "Collaborative innovation in the public sector: The argument", *Public Management Review*, Vol. 21, No. 1, pp. 1-11.
Zheng, Y. and Schachter. H. L. (2017) "Explaining Citizens' E-Participation Use: The Role of Perceived Advantages", *Public Organization Review*, Vol. 17, No. 3, pp. 409-428.

I miss my Office in my home Office: Challenges with work from home

Ole Jørgen Ranglund, Hanne Haave and Tone Vold
Inland Norway University of Applied Sciences, Inland School of Business and Social Sciences, Department of Organization, Leadership and Management, Rena, Norway
Ole.ranglund@inn.no
Hanne.haave@inn.no
Tone.vold@inn.no

Abstract: The COVID-19 pandemic has sent many employees to home offices. Some employees enjoy their home office, while for various reasons others experience challenges working from home. Qualitative investigations show that new employees who have been recruited and hired during the COVID-19 pandemic can find life in the home office quite challenging. Despite adequate technological solutions that make it possible to perform the work tasks from home, these employees want to be able to physically attend at their workplace. Our data indicate that it is important that the company not only sees technology and digitalization as "hard core" skills, but that the digital and technological are woven into other aspects of organizational life, for example, structures, culture and social interaction. New employees need to feel that they are valued, and that the business wants to establish personal and social bonds that support the development of loyalty to the company and quality of the production. These are conditions that are often tied to informal learning in the workplace. Relational development and maintenance are vital for having newcomers to not only function in the digital arena, but also within the physical sphere at the workplace.

Keywords: work from home, digital onboarding, KM challenges, home office, remote work, COVID-19 pandemic

1. Introduction

When the governmental restrictions following the COVID-19 pandemic resulted in most employees having to work from home (WFH), even any newcomers had to stay at home, having just started in a new job. Knowing that onboarding processes may be of vital importance regarding reducing turnover among newcomers (Bauer, 2010; Feldman, 1981; Filstad, 2016), the newcomers still needed to be onboarded. Today's digital tools allow meeting online and even seeing each other, but does it weigh up for the personal presence in the office?

WFH is not new and different crisis has sparked the need for it. In the 1970s it was the oil crisis, with Jack Nilles presenting the idea of "move the work to the people´ (Nilles, 1997). Since then, there has been different developments enhancing the possibilities of working from home.

However, there is an increasing focus on knowledge as an important asset within an organization (Mårtensson, 2000). The attention to how knowledge is shared, and the research on knowledge sharing, emphasize the personal interaction between the employees (Nonaka, 1994; Nonaka and Takeuchi, 1995; Filstad, 2016). The knowledge sharing not only contributes towards the development in the organization, but also towards how the employees experience their work-life. For instance, Senge (2006) describes how team learning and personal mastery contribute towards the individual's personal development. This is also tied to what Bauer and Erdogan (1996) call establishing connections within the organization when they are discussing what is needed in onboarding processes. But how does one facilitate for knowledge sharing, team learning, personal development and personal mastery in order to keep the newcomers, in addition to knowing that it is a huge cost for the organization to not have fully operative employees (Filstad, 2016). The organization will benefit from a short but effective onboarding that secures the newcomers staying on.

Our research is done in a large service-providing governmental organization. They have hired approximately 50 people during the time of the pandemic, as they had to expand due to widened work tasks. According to Navrbjerg and Minbaeva (2020), it is difficult to establish and keep personal ties when we are not physically in the same place. However, most of the literature on organizational development is based on a personal presence in the office. For example, both theory on Communities of Practice (Lave and Wenger, 1991) and theory on tacit and explicit knowledge and knowledge sharing (Nonaka, 1994; Nonaka and Takeuchi, 1995) describe cooperation, collaboration and communication in a proximity. Even theory on organizational socialization and onboarding (Bauer and Erdogan, 1996) describe how the personal interaction between leader and newcomer,

between newcomer and the organizational members can be facilitated. During the COVID-19 pandemic, it has not been an option, neither to onboard or socialize in a personal (face-to-face) way and hence our research questions are:

How have new employees experienced being hired during the COVID-19 pandemic?

How can these experiences contribute toward facilitating for the employees' connection with their organization?

We will first present the theory that will enlighten our study. We will then elaborate on our choice of method for data collection and analysis, before we conclude and suggest further research.

2. Theoretical foundation

The discussion about the importance of Knowledge Management (KM) has been ongoing for several years (Davenport and Prusak, 1998; Mårtensson, 2000), as has the importance of knowledge and knowledge sharing as a prerequisite for the "learning organization" (Nonaka and Takeuchi, 1995; Malik and Garg, 2020). Yet, the persons **in** the organizations are the ones who learn (Irgens, 2011; Filstad, 2016), so it is therefore important to have a workforce that is engaged and resilient (Lee, Vargo and Seville, 2013; Malik and Garg, 2020). According to Malik and Garg (2020), the role of the learning organization and employee resilience is a driver for work engagement. Marsick et al. (1996) presented seven points regarding learning organizations: *continuous learning* (creating learning opportunities), *inquiry and dialog* (culture for questioning and feedback), *team learning* (collaboration), *empowerment* (creating and sharing vision and motivate for fulfilling obligations), *embedded system* (acquire and share information and mutual learning), *system connection* (connection between internal and external environment) and *strategic leadership* (shaping, improving and supporting learning). Malik and Garg (2020, p. 1076) claim that "resilience can be taught, practiced and developed as a skill among employees", though this does not only apply to the people already within the organization. Employees who are not fully into their jobs represent a cost to the organizations (Filstad, 2016). It is thus important to get the newcomers up to speed with the culture and way of working. Hence, there is an important focus on onboarding the newcomers.

Feldman (1981) claims that it is important to establish expectations from both sides, both for the organization and the newcomers, as a mismatch between expectations and factual work may lead to higher turnover. If the job is more difficult than the level of education and competences are, or the opposite, if the work is too easy or does not match the level of difficulty expected due to background and skills, the chance that the newcomer leaves due to this mismatch is high.

Bauer (2010) has developed a framework of 6 C's regarding the onboarding of newcomers: Compliance, Clarify, Confidence, Culture, Connection and Checkback. *Compliance* is about how the organization facilitates for the newcomers to become acquainted with the necessary routines and rules of the organization. *Clarify* is about how the organization facilitates for the proper understanding and expectations regarding the work tasks, much like Feldman (1981) claimed was important. The *Confidence* is about how the organization contributes toward the sense of mastery. *Culture* is about how quickly the newcomers are introduced to the organizational culture. *Connection* is about how the organization facilitates for the necessary connections and develops an internal network. *Checkback* is about how the organization continuously monitors how onboarding is perceived with the different approaches. These C's may support enhancing engagement, resilience and motivation.

Motivation is about the "biological, psychological and social factors that activate, direct and maintain behaviour of a different degree of intensity to reach a goal" (Kaufmann and Kaufmann, 2015, p. 113). There are four main types of motivational theory: Behavioural theories (based on basic needs), Cognitive theories (based on expected goal achievement), Social theories (based on the perception of justice and the distribution of goods at the workplace) and Job characteristics (based on factors that are motivational or demotivational) (Kaufmann and Kaufmann, 2015). Another motivational theory is the self-determination theory (Deci, Olafsen and Ryan, 2017). The psychological needs that the self-determination theory is based on are autonomy, competence and social belonging, which feed intrinsic motivation. Autonomy in the workplace is about a lack of detailed managing, that you can influence how tasks should be executed, that there are possibilities for coming up with suggestions and options for influence on one's own work situation. When the action is self-determined and free from pressure, the intrinsic motivation will be present (Løvaas, 2017, p. 228). While autonomy is often connected to individualism and independence, self-determination theory points towards being dependent on others in a controlling or autonomous way, and that the need for autonomy is universal – that it is a cross-cultural

phenomenon (Løvaas, 2017, p. 228, 229). The need for competence includes the mastering of tasks. Experiencing mastery may make some of the tasks be perceived as fun or exciting, something that promotes intrinsic motivation. The underlying assumptions are that the human being is an active organism who explores, learns and experiences satisfaction by learning (Løvaas, 2017, p. 229), and that the experience and mastery of competence affects the motivation has empirical support in one's work-life (Lai, 2013). Senge (2006) presented five disciplines where learning through teams (social learning), personal mastery, shared visions and shared mental models are important regarding being a learning organization, as well as the systems thinking and putting the disciplines together to make up the learning organization. According to Spurkeland (2013), this also applies to newcomers, as it is important to make sure that they are brought into the organizational "system" (Løvaas, 2017).

Most of the theory above is based on times of being physically present within an organization (Cooper and Kurland, 2002). However, during the COVID-19 pandemic when most people were working from home, this may have led to both social and professional isolation as the employees (both newcomers and others) were missing the social interaction (Contreras, Baykal and Abid, 2020). Even if the infrastructure for WFH or even remote work existed before the COVID-19 pandemic and teleworking was growing globally (Contreras, Baykal and Abid, 2020), there are still some limitations regarding "e-leadership". Contreras et al. (2020, p. 3) claim that there are studies that show that WFH is more productive, and that WFH also leads to less turnover and stress. Also, the less formal working atmosphere, as well as the "absence of an immediate supervisor", reduces stress. Nevertheless, they also refer to the risk of social isolation leading to a "lower performance and gradual demotivation" (Contreras et al., 2020, p. 3).

Cooper and Kurland (2002) refer to interpersonal networking, informal learning and mentoring as important informal developmental activities. For instance, managers may "use the grapevine to disseminate information" (Cooper and Kurland, 2002, p. 513). This, in addition to what Navrbjerg and Minbaeva (2020) refer to as "the watercooler talk", are informal ways of obtaining information about the employees that are more difficult with the employees in home offices. Cooper and Kurland's investigations showed that if the employees were in the office often enough they would be able to compensate for the possibilities of missing out on important information, and also that communication needs to be open and that the necessary information needs to be communicated through formal channels (Cooper and Kurland, 2002, p. 528). They also claim that employees need to be trained for WFH. Again, during a complete lockdown and with newcomers, this may prove difficult to obtain.

Another issue that has gotten a lot of attention in the past decades is a work-life balance (Kelliher, Richardson and Boiarintseva, 2019). While some research has found that some employees have high levels of job satisfaction working remotely, other studies have found that some employees experience isolation, which is negative regarding job satisfaction (Kelliher, et al., 2019, p. 84). Additionally, mental well-being and stress have surfaced in the research (Kelliher, et al., 2019, p. 85). According to Kompier, et al. (2012, p. 238), long hours and stressful conditions may also lead to ill-health.

Knowledge workers often rely on interaction with their colleagues (Lautsch, Kossek and Eaton, 2009), something that has been difficult during the pandemic. According to Davenport (2005, p. 3) "knowledge workers" are "responsible for sparking innovation and growth in an organization" Employees have experienced missing what Grant et al. (2013) refer to as office interactions. Not being able to share their concerns with colleagues may leave them feeling isolated (Mann and Holdsworth, 2003). Bentley and Yoong (2000, p. 351) claim that knowledge workers need a high level of communication with supervisors and colleagues, and to interact and collaborate.

The work-related, well-being dimensions are: affective, social cognitive, professional and psychosomatic (Charalampous, et al., 2019, p. 51). Psychosomatic symptoms may be pains experienced in the neck, back and generally the upper body (Charalampous, et al., 2022, p. 341).

3. Method of inquiry

This initially started as a pilot study where we wanted to investigate how organizations handled the long-term COVID crisis. In this paper, we present the data from a follow-up study, where we looked into how newcomers experienced digital onboarding and the WFH situation. This is a case-study approach in combination with a

longitudinal design. According to Yin (2003, 2014), the case study definition is "an empirical enquiry that investigates a contemporary phenomenon in real-life and within its real-life context, especially when the boundaries between phenomenon and context may not be clearly evident". The use of a case design approach also gives us the possibility to acquire a deeper understanding of the phenomenon in question, whether it is organizations, events or people, see Geertz (1973).

We interviewed a total of six employees (see Table 1 below). The informants were selected by the top manager based on the criteria that they were newcomers recruited and onboarded during the pandemic. The data of the study was collected by doing semi-structured individual interviews, using a digital programme (ZOOM). The interviews lasted for about 1 hour, and were recorded with written approval from the informants. As most people by now are used to communicating digitally, the informants were open and responsive to our questions, and we found the conversations interesting and elaborated, although with digital communication we missed the body language. The datamaterial has been analysed by qualitative content analysis. Westarted by reading through the transcribed text and coding the interviews by highlighting sentences with relevance to issues and themes central to our research questions. Furthermore, we discussed our findings against the theoretical perspectives presented above.

Although the number of informants is limited, we believe that their stories have given us an insight regarding digital onboarding during the pandemic.

In Table 1, we show an overview of the respondents and the timeline of the data collection:

Table 1: Overview of respondents

Respondent/ gender	**Period of interview**
Employee1 (Female)	November 2021
Employee 2 (Female)	November 2021
Employee 3 (Female)	November 2021
Employee 4 (Female)	November 2021
Employee 5 (Female)	November 2021
Employee 6 (Male)	November 2021

The case we studied is a governmental organization that delivers services produced through digital systems to large governmental institutions. However, pre-COVID, the staff worked daily at the employer's office. When the lock-down was implemented, there was a rapid reorganizing/change to use digital systems for administration and meetings. Today, the use of Microsoft Teams is vital to all administrative communications and meetings in the organization. The organization has implemented an organizational change, which implied that each of the four departments had a sublevel of two-three sections. As every leader has the responsibility for 12-15 employees, this would make it easier to follow up their employees during the lockdown when almost all members of the staff were working from home.

Approximately 50 new employees were recruited during the pandemic, with most of the recruiting and onboarding processes being digitally implemented. The onboarding programme started on the first day at the employer's office, where the newcomer met the nearest leader and the head of department, in addition to an assigned mentor. In some cases, there were a few other newcomers present. The introduction lasted a few hours; the newcomer then returned to WFH bringing PC equipment. The first weeks of training consisted of e-learning courses, in addition to having contact with the mentor and nearest leader via Teams. They were gradually introduced to the job, sitting in at Teams meetings and working in the different systems. Because the employees started in the organization at various times, the WFH period differed from five months to some weeks.

4. Results and discussion

The programme for onboarding was digitalized, and the newcomers could easily learn about the organization and how it worked. To have contact with their nearest leader and a mentor was of importance in order to get to know the organization and be trained for work (Bauer, 2013), as for most of the informants, this seems to have functioned well. Unfortunately, not all the newcomers had the advantage of a close follow-up by the mentor. One informant contacted her nearest leader when she felt the mentor did not have time for her, and the leader arranged for her to have more regular training by other colleagues. When returning to the office, the situation was improved (4):

> *But it was not until I was back at the office ...then it was easier to ask someone and just: Can you show me how to do this? Because it was not that simple to explain everything over Teams. (4)*

This shows that with newcomers the threshold is high for asking questions when working in a digital system, and that there is an experienced distance to mentors and colleagues. This again can have an impact on their process of getting to master their work, and feeling that they belong (being connected) in the organization (Bauer et al., 2021).

Another informant experienced that the digital work training was not sufficient for doing her tasks when she was back at the office:

> *So, in some ways I have wished for a more thorough training, it would have made me feel more confident. ...at one time during summer, I felt like I had a breakdown ….I didn't know what to do, felt helpless.* ***It would have been different if the job-training had been face-to face at the office... and I could have learned from listening to my mentor when she was on the phone.*** *You learn a lot from listening to each other. Overall, I feel lucky, others have been worse off when starting in a new job during the pandemic. (2)*

The digital training did not provide the newcomer with the qualifications for doing the job; hence, it was not clarified what was to be done, as suggested by Bauer (2010). This made her feel unable to master the tasks and left her with a lack of self-confidence. Bauer's (2010) description of the importance of confidence to do the work, and Senge's (2006) reference to personal mastery is not what this respondent was conveying. In addition, missing the proximity regarding having the connectedness to the organizational members did not improve the situation. The lack of connection also seems to have reduce the chances of utilizing checkbacks, which is one of the core themes described by Bauer (2010). Moreover, there seems to be the lack of a checkback. The statement also points to a lack of work-life balance (Lautsch, Kossek and Eaton, 2009).

How did the newcomers experience WFH?

In our material, we find that working from home had consequences regarding the employees' health. There were no natural pauses when sitting in your home, with the computer on all day long:

> *At first, I didn't take breaks, so I got problems with my neck, shoulder and back. I was very tired; my eyes and head were tired. After a while I started to go for a short walk in the neighbourhood to have a pause. (6)*

This statement also seems to imply that there is a work-life imbalance, and as found by Charalampous et al. (2021, p. 342), this may lead to be psychosomatic symptoms of deteriorating health. However, they also found that some employees developed healthy habits during the pandemic. Kompier et al. (2012, p. 238) also found a connection with long hours and ill-health. On the other hand, Contreras et al. (2020) claimed that an environment away from the office would contribute towards less stress. This may also be a case of not having a lot of experience with WFH, something which Cooper and Kurland (2002) claim needs some getting used to, which was not the case when hired during the time of the pandemic.

When is WFH to be preferred?

On the positive side, there is the possibility of working continuously without being disturbed. This is in line with what Contreras et al. (2020) claim. This may also be seen as a sign of autonomy (Deci, Olafsen and Ryan, 2017; Løvaas, 2017), which supports the resilience and work motivation:

> *I had a lot to do in that period, so it was convenient [to WFH]. I worked a lot, and was not as disturbed as I would have been working in the office. (6)*
>
> *But then you miss many things. Because in the office you can do a quick direct clarification with someone, and you lose that in WHF. It's a higher threshold. (6)*

These statements show the ambiguity of working from home versus working in the office. This is also what Cooper and Kurland (2002) claim regarding having enough time at work so as not to miss out on developmental activities, such as informal learning. Knowledge workers also need to interact with their colleagues (Bentley and Yoong, 2000, p. 351), and not being able to discuss with colleagues make them feel isolated (Mann and Holdsworth, 2003; Lautsch, Kossek and Eaton, 2009).

At the time of the interview, the "normal" in the organization was to be back in the office. Our informants were in unison in their preference of being at the office over WFH:

> *I think its ok. You have a whole different communication when everyone is present. And the meetings..., ...the meetings are much better now, we are sitting together, so it works much better professionally. (6)*
>
> *So, I find it more advantageous to work at the office, then. I find that both being social, to have lunch with colleagues, and it's easy to ask questions, and it's fun in a way to be at the office in our line of work. So, there are only advantages with sitting in at the office. (4)*

This point towards a desire to keep up a social proximity towards their work colleagues. The social interaction supplies them with the knowledge sharing, the social interaction and the team learning, which allows for shared visions and mental models. In this way, they also support Senge's (2006) learning organization, where the employees are learning and helping to develop the organization. The statements also imply that being at the office is intrinsically motivating (Deci and Ryan, 2012), as well as being a part of the "system" (Spurkeland, 2013).

How can these experiences contribute towards facilitating for the employees' connection with their organization?

It seems that to WFH is to prefer when the tasks demand to work in a concentrated manner, and being undisturbed (Cooper and Kurland, 2002; Contreras, Baykal and Abid, 2020):

> *We are placed in an open space, so it is some disturbance, then there are settings where you are supposed to work concentrated, then it is better to WFH... (6)*

To others, the advantage would be to save time when not having to use much time in commuting (Nilles, 1988)

> *I can't see any advantage for WFH other than as I have a long distance to commute to the office, I save time when working from home, and I can sleep longer. (4)*

One of the informants reports on being taken care of from the start by her colleagues, who had the same educational background:

> *They called me, and they were very nice and including … and I was introduced, we agreed to set up a meeting every morning [digitally] – to have a chat, and they called me frequently. So, it was really … that was nice, but it was strange to sit at home to look at my home office, thinking – here am I to sit in solitude. (1)*

This is an example of digital tools not making up for what is missed in the face–to–face meeting with other colleagues. Still, it may also refer to a sense of team learning (Senge, 2006) and some connectedness, which supports the developmental activities even if they are not meeting physically. There may also be a "sense of belonging", as they feel part of a group, but at the same time the proximity is missing.

Being at a home office may also contribute towards more independence:

> *It wasn't always that easy to ask the neighbour, so I used some extra time to learn things on my own, looking into and checking an extra time before I call a colleague. That sort of thing. So, on my part it has had a positive effect on being more independent. (1)*

This points toward a sense of autonomy (Deci and Ryan, 2012; Løvaas, 2017); this can also be tied to personal mastery (Senge, 2006), which may promote the intrinsic motivation that enhances the wish to stay in the organization. If it is perceived as overwhelming or not promoting the sense of personal mastery, one may feel the urge to terminate their employment (Feldman, 1981).

According to our informants there are several advantages when it comes to the use of digital systems:
1) For administration and meetings inside the organization:

> *It works very well using Teams. You share a screen and can raise your hand to ask questions, and it's possible to have good discussions as well. So, I don't see why we shouldn't continue using it, when it works so well. (1)*

The Teams tool also works for sharing knowledge (Watkins and Marsick, 2014). So, even if the digital systems are not completely supporting the connectedness (Bauer, 2013), it does work for knowledge sharing and for communication and some interaction.

2) Also, when it comes to customers, there is the advantage of saving time, money and the environment - and at the same time being more efficient:

> *And to have Teams meetings with customers...it is so much more efficient to have a Teams meeting … but at the same time being able to have physical meetings, well, there is something there..." (1)*

This implies that there are some financial advantages regarding utilizing digital tools for communications, but that it does not fully cover for the physical meeting.
3) Flexibility

> *Yes, I hope we can continue to have the flexibility in working from home. That I hope. (1)*

Digital work tools (such as, for example, Teams from Microsoft) are used for sharing and distributing important information, and also for sharing workspaces. Cooper and Kurland (2002) claim that it is important that vital information is distributed and suggest regular meetings, which may also be conducted in Teams, but also could be distributed via Teams as written material. The importance of the information provided is twofold, as it provides information that the employees need, but also provides a sense of inclusion, which in return enhances the intrinsic motivation and self-determination (Deci and Ryan, 2012), as well as work motivation and resilience (Malik and Garg, 2020).

The seven points by Marsick et al. (1996) regarding learning organizations has created learning opportunities, and sought to develop a culture for questioning and feedback by organizing for mentors for easier/better checkbacks. They have also started using Teams as a tool for communication as a basis for both working and learning, and sought to develop a system connection. The organization has also changed their management structure, as middle managers now have fewer employees to manage, thereby facilitating for a more strategic leadership. By this, they hope to support the development of resilience that Malik and Garg (2020) refer to.

5. Conclusion

The newcomers are provided with online courses and a mentor. The firm has also reorganized in order to be able to clarify, connect and to do checkbacks with their newcomers (Bauer, 2013), so that they are able to comply and be confident, and be a part of the culture. However, although finding the digital courses sufficient, the newcomers still fail to feel the connection, and being a part of the culture. Some of them are also not feeling that they have a full clarification of the job they are supposed to do. The newcomers show various degrees of self-determination, from the ones who rather quickly master their work tasks, to the ones who struggle longer before they experience any mastery.

Some of the newcomers even find it best to WFH, particularly if there are tasks that require concentration. Also, not having to commute is put forward as an advantage, just as claimed by Nilles (1998).

Because they are not trained to be at a home office, some work-life imbalance is reported. Also, some report on psychosomatic issues, such as feeling mentally unwell, regarding being uncertain on how to execute their work.

However, the onboarded employees want to spend most of their office time in the office. They refer to the ease of knowledge sharing and socializing in order to connect, and the sense of belonging. Some of the newcomers envision a flexibility that has been enabled by the hybrid way of working. Being able to do meetings online, learn online and share online workspaces is perceived as providing flexibility. WFH is not necessarily regarded as a benefit, but the flexibility is viewed as a beneficiary factor contributing to a future work-life.

5.1 Future research

We have two suggestions for further research: 1) To follow up the interviewees in order to acquire an understanding of how they now perceive their situation would help to provide insights to how the firm could provide sufficient onboarding mixing the digital support with personal in office support.

2) The other is to further investigate the work-life balance of newcomers who have been onboarded during the COVID-19 pandemic, how this affected them and how their present work-life is affected by these experiences.

References

Bauer, T. N. (2010) 'Onboarding new employees: Maximizing success', *Society for Human Resource Management Foundation*.

Bauer, T. N. (2013) 'Onboarding: The power of connection', *Onboarding White Paper Series. SuccessFactors*.

Bauer, T. N. *et al.* (2021) 'Jump-starting the socialization experience: The longitudinal role of day 1 newcomer resources on adjustment', *Journal of Management*, 47(8), pp. 2226–2261.

Bauer, T. N. and Erdogan, B. (1996) 'Organizational socialization', *APA Handbook of I/O Psychology*, 3, pp. 51–64.

Bentley, K. and Yoong, P. (2000) 'Knowledge work and telework: an exploratory study', *Internet Research*.

Charalampous, M. *et al.* (2019) 'Systematically reviewing remote e-workers' well-being at work: a multidimensional approach', *European journal of work and organizational psychology*, 28(1), pp. 51–73. doi: 10.1080/1359432X.2018.1541886.

Charalampous, M., Grant, C. A. and Tramontano, C. (2021) '"It needs to be the right blend": a qualitative exploration of remote e-workers' experience and well-being at work', *Employee Relations: The International Journal*.

Charalampous, M., Grant, C. A. and Tramontano, C. (2022) '"It needs to be the right blend": a qualitative exploration of remote e-workers' experience and well-being at work', *Employee Relations: The International Journal*, 44(2), pp. 335–355. doi: 10.1108/ER-02-2021-0058.

Contreras, F., Baykal, E. and Abid, G. (2020) 'E-Leadership and Teleworking in Times of COVID-19 and Beyond: What We Know and Where Do We Go', *Front Psychol*, 11, p. 590271. doi: 10.3389/fpsyg.2020.590271.

Cooper, C. D. and Kurland, N. B. (2002) 'Telecommuting, professional isolation, and employee development in public and private organizations', *J. Organiz. Behav*, 23(4), pp. 511–532. doi: 10.1002/job.145.

Davenport, T. H. (2005) *Thinking for a living: how to get better performances and results from knowledge workers*. Harvard Business Press.

Davenport, T. H. and Prusak, L. (1998) *Working knowledge: How organizations manage what they know*. Harvard Business Press.

Deci, E. L., Olafsen, A. H. and Ryan, R. M. (2017) 'Self-Determination Theory in Work Organizations: The State of a Science', *Annual review of organizational psychology and organizational behavior*, 4(1), pp. 19–43. doi: 10.1146/annurev-orgpsych-032516-113108.

Deci, E. L. and Ryan, R. M. (2012) 'Self-determination theory.'

Feldman, D. C. (1981) 'The multiple socialization of organization members', *Academy of management review*, 6(2), pp. 309–318.

Filstad, C. (2016) *Organizational Learning: from Knowledge to Competency (translated from Norwegian: Organisasjonslæring: fra kunnskap til kompetanse*. 2nd edn. Bergen: Fagbokforlaget.

Grant, S. J., Huang, H. and Pasfield-Neofitou, S. E. (2013) 'Language learning in virtual worlds: The role of foreign language and technical anxiety', *Journal for virtual worlds research*, 6(1).

Irgens, E. J. (2011) *Dynamic and learning organizations: Leadership and development in a changing work-life (Translated from Norwegian: Dynamiske og lærende organisasjoner: ledelse og utvikling i et arbeidsliv i endring)*. Fagbokforlaget Bergen.

Kaufmann, G. and Kaufmann, A. (2015) *Psykologi i organisasjon og ledelse*. 5. utg. Edited by A. Kaufmann. Bergen: Fagbokforl.

Kelliher, C., Richardson, J. and Boiarintseva, G. (2019) 'All of work? All of life? Reconceptualising work-life balance for the 21st century', *Human resource management journal*, 29(2), pp. 97–112. doi: 10.1111/1748-8583.12215.

Kompier, M. A. J., Taris, T. W. and Van Veldhoven, M. (2012) 'Tossing and turning-insomnia in relation to occupational stress, rumination, fatigue, and well-being', *Scandinavian journal of work, environment & health*, pp. 238–246.

Lai, L. (2013) *Strategic Knowledge Management (translated from Norwegian: Strategisk kompetanseledelse)*. Fagbokforl.

Lautsch, B. A., Kossek, E. E. and Eaton, S. C. (2009) 'Supervisory approaches and paradoxes in managing telecommuting implementation', *Human Relations*, 62(6), pp. 795–827.

Lave, J. and Wenger, E. (1991) *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Lee, A. V, Vargo, J. and Seville, E. (2013) 'Developing a Tool to Measure and Compare Organizations' Resilience', *Natural hazards review*, 14(1), pp. 29–41. doi: 10.1061/(ASCE)NH.1527-6996.0000075.

Løvaas, B. J. (2017) 'What promotes motivation in the workplace?', in Aadland, E. and Akseland, H. (eds) *Verdibevisst ledelse*. Oslo: Cappelen Damm akademisk.

Malik, P. and Garg, P. (2020) 'Learning organization and work engagement: the mediating role of employee resilience', *International journal of human resource management*, 31(8), pp. 1071–1094. doi: 10.1080/09585192.2017.1396549.

Mann, S. and Holdsworth, L. (2003) 'The psychological impact of teleworking: stress, emotions and health', *New Technology, Work and Employment*, 18(3), pp. 196–211.

Marsick, V. J., Phillips, J. J. and Watkins, K. E. (1996) *Creating the learning organization*. ASTD/American Society for Training and Development.

Mårtensson, M. (2000) 'A critical review of knowledge management as a management tool', *Journal of knowledge management*, 4(3), pp. 204–216. doi: 10.1108/13673270010350002.

Navrbjerg, S. E. and Minbaeva, D. (2020) *Virtual management during corona-crisis: Report 1: Qualitative studies (translated from Danish:Virtuel ledelse under corona-krisen: Rapport I: De kvalitative studier)*. FAOS.

Nilles, J. M. (1988) 'Traffic reduction by telecommuting: A status review and selected bibliography', *Transportation Research Part A: General*, 22(4), pp. 301–317.

Nilles, J. M. (1997) 'Telework: enabling distributed organizations: implications for IT managers', *Information Systems Management*, 14(4), pp. 7–14.

Nilles, J. M. (1998) *Managing telework: Strategies for managing the virtual workforce*. Wiley New York, NY.

Nonaka, I. (1994) 'A dynamic theory of organizational knowledge creation', *Organization science*, 5(1), pp. 14–37.

Nonaka, I. and Takeuchi, H. (1995) *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.

Senge, P. M. (2006) *The fifth discipline : the art and practice of the learning organization*. [Rev. and. New York: Currency/Doubleday.

Spurkeland, J. (2013) *Relational Management*. 4th edn. Oslo: Universitetsforlaget.

Watkins, K. E. and Marsick, V. J. (2014) 'Adult education & human resource development: Overlapping and disparate fields', *New horizons in adult education & human resource development*, 26(1), pp. 42–54. doi: 10.1002/nha3.20052.

The Impact of Covid-19 on Online Final Exam Scores Among Computer Science Students

Malgorzata Rataj and Joanna Wojcik
University of Information Technology and Management, Rzeszow, Poland
mrataj@wsiz.edu.pl
jwojcik@wsiz.edu.pl

Abstract: The main goal of this research is to identify the impact of COVID-19 on online final exam scores among Computer Science students. The correlation matrix we used indicates the interrelationships among learning outcomes and student profile, type of classes and student online behaviour. Six courses were taken under consideration: Practical Algorithms, Discrete Mathematics, Software Engineering, Programming, Team Projects and Artificial Intelligence. A total of 4,988 final exam results were examined. After a deep analysis of the literature on the topic, we expected two scenarios. The first scenario constituted a decline in passing grades due to challenges such as: learning platform failures, poor internet connections or poorer quality of lessons due to teachers' lack of online competence. We hypothesized the second scenario as extraordinary student performance compared to their prior exams, but due to their dishonesty. The results of the study revealed that neither of the scenarios took place. It turned out that the challenges that seemed to be the most difficult ultimately did not matter. The present study finds that there is not a significant difference in the students' final exam performance between their online and traditional courses. Our strategy as described in this article has demonstrated a smooth transition from traditional to online teaching and assessment in terms of the final assessment.

Keywords: online exam, assessment, delivering education, e-learning

1. Introduction

Nowadays society has become highly dependent on computer networks, particularly after the Covid-19 crisis demanded it on a global scale.

The development of information technologies not only opens up great opportunities for new ways of delivering education but also provides us with all the tools we need for carrying out higher education fully online. It is clear that successful implementation of university courses is no coincidence, but rather requires great analysis and planning (Rataj & Wojcik, 2020). Every professional learning initiative requires deep analysis to identify the learning needs so as to best shape the proposed solution. This article describes the seventeen-month period of university closure from March 2020 to August 2021, comparing it to the same semester conducted in the traditional form a year earlier. It is worth noting that in both years the subjects were conducted by the same teachers.

Among the many challenges in the transition from face-to-face education to online education, the assessment – namely the switch from oral/written exams to online exams – can be considered as one of the biggest hurdles. The main goal of this research was to identify the impact of the COVID-19 on final exams scores of Computer Science students. Traditionally, these courses were delivered in the classroom: all classes took place face-to-face with the teacher and all exams were fully supervised in person.

Despite the circumstances in 2020 calling for major changes, we were not allowed by the Ministry of Science and Higher Education to change the curriculum or learning outcomes (final grades); we were only allowed to change the form of the exam from open question to multiple-choice question or from solving a task to answering true/false questions. These questions were randomly selected and assigned by the system to each student. The fact that each student received randomly selected questions minimalized the possibility of the exchange of answers among students. We made sure that the difficulty level of the exam was the same for every student, and all students took the exam simultaneously. Students did not have the option to return to previously attempted questions, which also served to minimize the possibility of "collusion" between students. Additionally, students had to have their pc cameras turned on during the exam so as to be supervised. In the case of large groups, they were divided into smaller groups, each of which was supervised by additional teachers. All exams went ahead as planned from home via the Blackboard system.

The authors aimed to use the study results to help to understand the impact of the COVID-19 pandemic on exam results, particularly because they are in charge of implementing new technologies in the teaching process, and have been so for the last 20 years.

The University of Information Technology and Management (UITM) has a practical profile focused on the use of computers, and our priority was to close this divergent academic year with a complete set of exams and credits. Online classes at UITM began three days after the announcement by the Polish Government of the need to suspend classic didactic classes in universities due to the risk of spreading the corona virus. From March 26, diploma exams were also held online in synchronous mode. All sessions were recorded and remain in the resource of the Blackboard platform.

The survey we administered was approved and fully supported by the authorities of the University and by ethics board. Quantitative analysis was used in the calculations of research results, and the conclusions were supported by interviews with teachers. The Statistical Package for the Social Sciences (IBM SPSS Statistics 25) was used to compute all data and analyse the main output. We analysed the data using descriptive statistics and correlational survey research.

2. Literature review

Universities are teaching online on a scale never seen before because of Covid-19, which has led to the emergence of a new term: Emergency Remote Teaching (ERT). In contrast to steps that are planned from scratch and designed for online purposes, emergency remote teaching is a temporary shift to an alternate delivery mode due to crisis circumstances. It involves the use of fully remote teaching solutions for instruction or education that would otherwise be carried out in person (e.g., Hodges, 2020).

In order to critically explore the impact of the Covid-19 pandemic on the assessment process and results, we begin by a brief review of the literature. The analysis of literature sources also familiarized us with solutions and strategies, with good practices in online examination, and with the current state of research into online exams worldwide.

Literature that documents online assessments has to date dealt with courses such as: mathematics (Jungic, 2020), medicine (Birch & Wolf, 2020; e.g., Choi, 2020), digital electronics (George, 2020), STEM education (Sintema, 2020), chemistry (Bopegedera, 2020), environment and chemical engineering (e.g., Dietrich, 2020) criminology (Stack, 2015), microeconomics (Gratton-Lavoie & Stanley, 2009) gerontology (Kearns, 2012).

Many countries postponed examinations that were to take place in April, May and June until later in the year (e.g., Liberman, 2020; Daniel, 2020). However, as universities move to new ways of assessing final-year students during the coronavirus shutdown, there are also universities that decided to transfer the exams to the Internet.

Imperial College London, for instance, put 280 sixth-year medicine undergraduates through unsupervised exams from. Open-book exams allow students access to any resource material they may need during the exam (e.g., Tapper, 2020). The success of this strategy indicates that lockdown does not need to lead to a total suspension of university education. On the other hand, one must account for differences in access to the tools needed for online education. According to a study done by Sintema (2020) there is a drop in the percentage of students passing national examinations in Zambia. The main reason for this is “a lack of e-learning facilities that students could have been using to interact with their teachers.”

According to George (2020), however, students’ test scores in the 2020 final examinations at the University of the West Indies were consistent with those of the previous academic years. Moreover, students ultimately indicated that the support they received via the Internet eliminated their fears of failing the exam. The main concern in the switch to online exams is how to maintain the same high academic standards of examination (Jungic, 2020). Lockdowns due to the COVID-19 made the monitoring of exams difficult; it is difficult to ensure that students are not cheating during online tests (Watson & Sottile, 2010). Bilen and Matros (2020) noticed in their research that the final scores show extraordinary performance among students compared to their prior exams. Gratton-Lavoie and Stanley (2009) had noticed a similar phenomenon in their research ten years earlier.

There is little research available that analyses the quality of online teaching in the context of assessment (Senel & Senel, 2021; Hollister & Berensons, 2009). Few studies also address the impact of Covid-19 on online final exam scores (e.g., Cygan, 2021; e.g., Chen, 2021). The analysis showed that there were no significant differences for the final course grade between the semesters before and during pandemic. This is also confirmed by our research results, which we describe in more detail in the Results section.

Online exams have many challenges. Two of them are the dishonesty of students and the [lack of] technological skills among teachers. Regarding the first, online students have more opportunities for cheating. Bilen and Matros (2020) proved that students in large public universities were generally dishonest during the online exam. During online exam students can use their notes, do internet searches, and ask for assistance in solving exam problems. Students can also collaborate during the exam, for example via teleconference, or even use a solution key for the exams found online. Regarding the second challenge mentioned, teachers' online competences or lack, can seriously affect students' final exam results. Our discussions with teachers revealed that online examination is a stressful experience for them. Other issues mentioned in the literature about on online assessment included the importance of the relation between teacher IT skills and students' final scores. Brown and Liedholm (2002) had observed that learning outcomes in online classes and traditional classes depend on "teacher effects rather than mode of delivery effects".

3. Method

3.1 Data collection

To answer the research questions, a database with a total of 8,671 records was downloaded from the Dean's Office System that included album number, semester number, faculty, type of study, field of study, gender, citizenship, nationality, date of birth, age, number of corrections in the course of studies, second term exams, grade average, grade, subject, form of classes. In addition, we were able to make use of the BlackBoard platform, which gave access to values calculated on the basis of information about individual sessions: total number of joins to platform per semester, total time spent on the online classes per semester, percentage of presence, number of online sessions.

During the online semester, the university integrated its Blackboard Collaborate platform with its Blackboard Learn platform. Classes were held in accordance with a previously agreed schedule of classes in a synchronous mode.

To prepare the database for analysis some records were deleted, such as 82 records of students who had been removed from the student list and 596 records of students who did not attend classes regularly because they had to pass program differences or got credit in advance. Finally, when prepared for analysis, the database consisted of 7,993 records from when classes were provided online during the pandemic (summer semester March to July 2020 as well as winter and summer semester 2021) and records from when classes were provided traditionally at the University in a lecture hall or laboratory (summer semester March to July 2019).

The following courses were taken under consideration: Practical algorithmic, Discrete Mathematics, Software Engineering, Programming, Team Project and Artificial Intelligence. These were carried out in various forms: 42.9%, laboratory 25%, recitation class 9.2%, project 22.9%. All of them occurred in the summer semesters of 2019 and 2020, but due to changes in study plans the practical algorithmics did not appear in the summer semester 2021. Figure 1 shows the number of students assigned to particular courses in the online compared to the traditional learning paths.

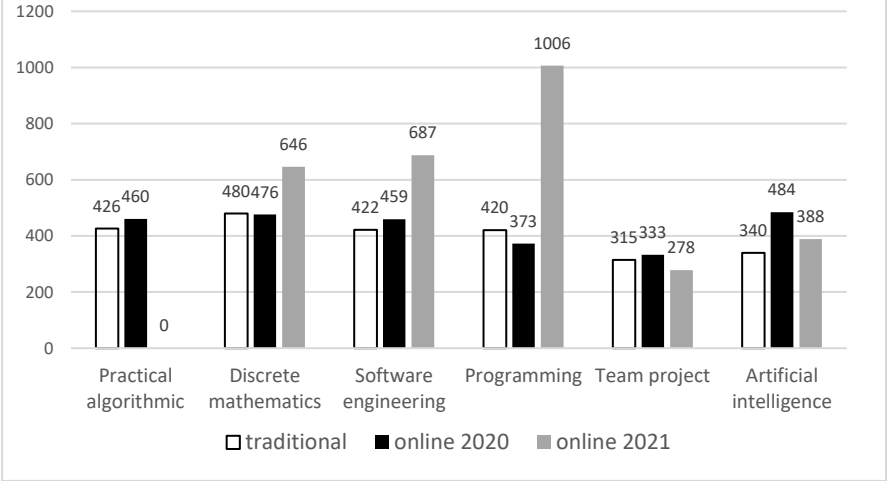


Figure 1: Courses: numbers of online vs. traditional students

The overall greater number of students in the online courses is due to the university's recruiting success.

3.2 Participants

The research population consisted of two groups of students that totaled 7,993 and ranged in age between 18 and 50.

The first group comprised 2,403 students (58.1 % full-time and 41.9% part-time) who had studied in the traditional manner at the university – in lecture halls or laboratories – during the summer semester of 2019. In total, 266 (11.1%) female and 2137 (88.9%) male students participated in the survey. Regarding nationality, 72.9% came from Poland, 22.6% from Ukraine, 1.5.% from Kazakhstan, and 3.0% from other countries: Bangladesh, China, India, Malaysia, Nigeria, Russia, USA, Thailand, Vietnam, Italy, Kyrgyzstan, Azerbaijan, Malaysia, Japan. A total of 90.5% are studying at bachelor's level and just 9.5% at master's level.

The second group consisted of 2,585 students (58.6% full-time and 41.4% part-time) who had attended courses online during the pandemic summer semester of 2020. In total, 230 (8.9%) female and 2,355 (91.1%) male students participated in the survey. Regarding nationality, 72.8% came from Poland, 15.4% from Ukraine, 5.4% from Kazakhstan, and 6.3% from other countries: Bangladesh, China, Egypt, India, Malaysia, Morocco, Nigeria, Russia, USA, Thailand, Tajikistan, Vietnam, Zimbabwe, Italy, Kyrgyzstan, Papua New Guinea, Azerbaijan, Gambia, Rwanda, Japan, Malaysia, and Zambia. A total of 92.8% are studying at the bachelor's level and just 7.2% at master's level.

The third group comprised 3005 students (58.1 % full-time and 41.9% part-time) who had attended courses online during the pandemic summer semester of 2021. In total, 248 (8.3%) female and 2757 (91.7%) male students participated in the survey. Regarding nationality, 71.9% came from Poland, 10.2% from Ukraine, 8.7.% from Kazakhstan, and 9.2% from other countries: Bangladesh, China, India, Malaysia, Nigeria, Russia, USA, Thailand, Vietnam, Italy, Kyrgyzstan, Azerbaijan, Malaysia, Germany.

A total of 97.7% are studying at bachelor's level and just 2.3% at master's level.

4. Research structure

In this research we try to outline how learning outcomes and student profile, type of classes and student online behaviour all interrelate. Details of the research structure are presented on Diagram 1.

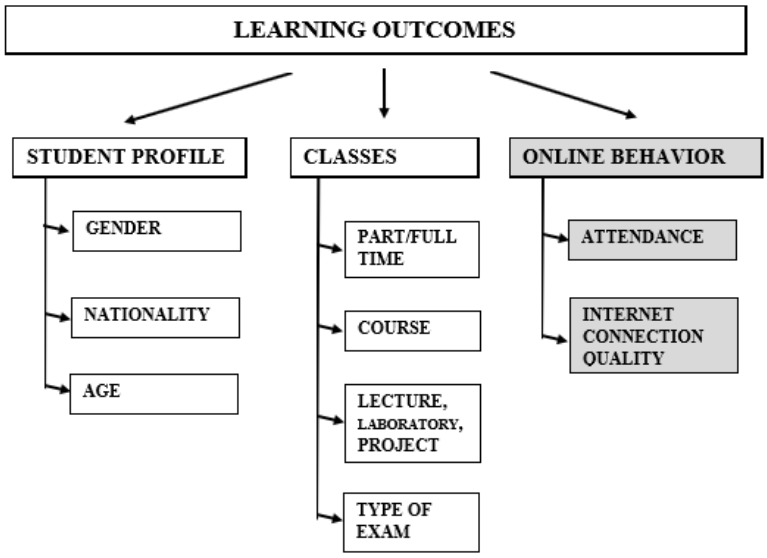


Diagram 1: Research structure

5. Data analysis

The average score on the spring 2020 online exam was 3.16, which is almost the same as the average score of 3.15 during the spring 2019 traditional exam.

After checking how many students did not take the exam, it turned out that in both study groups this percentage ranged from 5.3% to 8.7%. After analysing the database, it turned out that the students who did not take the exam were the Software Engineering students. After analysing the issue, we came to the conclusion that the problem was either the particular teacher or the poorly constructed syllabus.

The grading scale in university education ranges between 5.0 and 2.0, where 5.0 is very good and 2.0 is a failing grade. Figure 2 represents the scores of students from the surveyed courses: Practical Algorithmics, Discrete Mathematics, Software Engineering, Programming, Team Project and Artificial Intelligence.

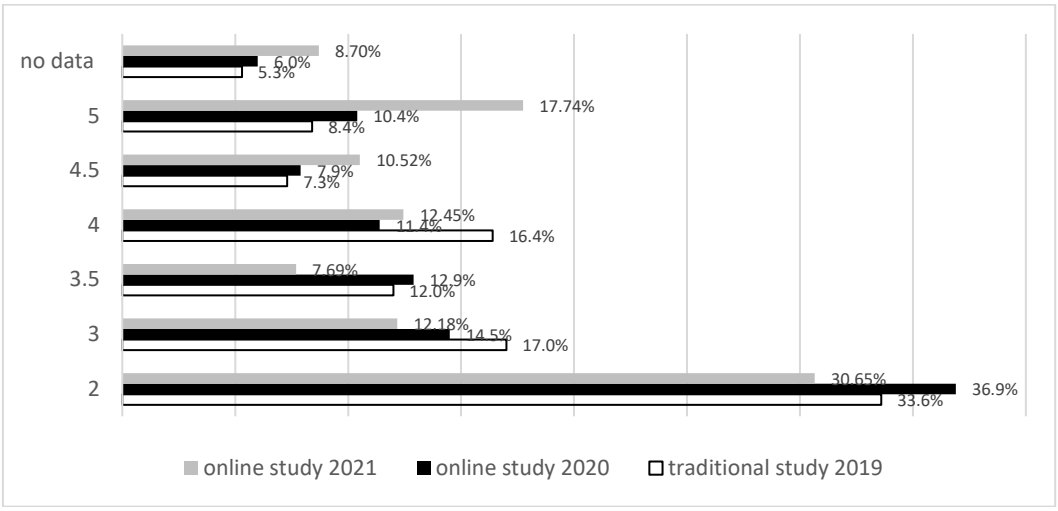


Figure 2: Exams results: online study vs. traditional study

In line with the literature on the subject (Bilen and Matros 2020) we expected fewer failing grades. Although the number of failed online exams is high, as presented in Figure 2, it is just insignificantly higher during a pandemic. The number of failed online exams proves the reliability of the examinations the well-tailored content of the courses and well selected forms of the examination. This conclusion could be supported by the fact that each of the exam questions needed complex problem-solving skills. What is more, the question had not trivial answers such as “100”, “350”, “yes”, “no”, which would make it easy randomly guess the correct answer.

5.1 Student profile

Gender. Our research has shown that women pass the exams better. While the number of women at Computer Science faculty in Poland is small (9% - 11%), they are more determined to prepare well for the profession during their studies, and thus achieve better grades on exams. Our results are in line with general statistics in education, which shows that women outperform men (Carvalho, 2016; Voyer &Voyer 2014).

Nationality. Among 25 nationalities, only the students of one nationality (we do not specify which for ethical reasons) have significant problems passing the exams, regardless of the form (online or traditional studies). The problem may lie in the quality of educational background in that country.

Age. The age of the students ranged from 17 to 51 years old. In Poland college-aged students are 18 years old. But UITM has students from Kazakhstan are 17 years old, because they have passed matura exam in their home country and in accordance with Polish law they are entitled to study at the University.

The highest number of failing exams occurred among the oldest students aged 37 to 51. This result is most likely related to technological problems, like the necessity of sending photos of exam papers, as the test does not allow backtracking. Interestingly, the smallest number of failing exams was not among the youngest students, but in the group aged 32 to 36. The explanation may be the great responsibility students must take up to organize and execute their own learning process. Students of this age study usually in part-time mode, which means they have to juggle their work schedules with studying.

5.2 Classes

Course. After checking the exam results from the e-learning platform, it was noticeable that students had more problems passing the online exams in the subjects Discrete Mathematics and Artificial Intelligence – in comparison with traditional exam form. Both subjects have open-ended questions during the exam, and in the traditional form of the exam it was possible to return to previous questions and rethink them. The traditional form of the exam also requires fewer steps. During the online exam, for example, students need to take a photo of the solution and send it by e-mail, which is associated with more stress. We did receive a few complaints about the assessment, but in general, students demonstrated a good grasp of technological skills. On the other hand, several of students sent messages commenting positively about their experience in the online course.

Part/full time. There were no differences in exam results between full-time and part-time students. It should be appreciated that part-time students who attend fewer class hours than full-time students achieved the same learning outcomes.

Lecture, laboratory, project. The difficulty with passing a lecture online had to do with the technical issue with the online platform. There is no difference in the laboratory or project results. Hence, the distribution of grades did not differ significantly from the grades obtained in traditional education (Figure 2). Regardless of the chosen form of exam, the lecturers tried to make individual tasks for almost each student. This hindered the students from sharing answers or asking third part for help. The biggest problems occurred with the exams with multiple answer portions. The difficulties here can be explained by the very short response time given or the inability to change the answers already given.

Type of exam. As only the Department of Applied Computer Science was analysed, all exams and credits were more or less computational. There was no need to change exam methodology after March 2020. Even when taking the exams, it was necessary to perform computational tasks, execute a mini-project, and the test questions contained references to the practice. We can claim that exams in 2019 and 2020 were equivalent and it makes sense to compare the results of these exams. The difficulty level of the exams in the summer semester of 2019 and 2020 was the same. The content of the tasks required students to have a deep understanding of the subject. Detailed information by type of exam and grades can be found in Table 1. When analysing the types of exams available to students, there are several basic types (used regardless of the form of classes):

- typically, computational exams (problems to be solved);
- mixed, consisting of a theoretical part, usually in the form of a single or multiple-choice test, and short tasks to be solved; problem tasks usually in the form of one major problem along with sub-problems to be solved;
- descriptive questions, which, however, try not to reflect directly the content of the lecture;

- quite rare single or multiple-choice tests, usually embedding fragments of practical tasks into the content of the questions;
- one large-scale project spread over the entire semester, requiring individual parts to be delivered on time; a project carried out throughout the semester and an additional theoretical knowledge test.

Table 1: Percentage representation of grades by type of exam

Grade	Calculated	Mixed	Problem solved	Descriptive	Long term project	Test	Project+test
2	50.90%	9.10%	35.50%	26.20%	21.90%	58.00%	43.60%
3	21.70%	40.50%	5.20%	11.80%	3.70%	10.30%	15.20%
3.5	9.80%	19.80%	14.80%	38.50%	8.00%	16.70%	14.00%
4	10.30%	14.90%	14.80%	13.60%	15.10%	8.00%	11.50%
4.5	2.90%	7.40%	13.50%	5.00%	19.80%	4.60%	10.30%
5	4.40%	8.30%	16.10%	5.00%	31.50%	2.30%	5.30%

5.3 Analysis of the online student behaviour

5.3.1 Attendance

The relatively low percentage of attendance of online classes (37.43% - 51.76%), shown in Figure 3, is surprising. Many students combine professional work with education, and in that type of situation, it is paradoxically easier to take part in online classes than to come to the university in person. Some classes were also recorded (by the teacher or by students on their own). The high percentage of students who did not attend online classes and nevertheless obtained a very good grade is also surprising. In this case, the explanation may be the individual organization of studies (the situation when the student is released from classes and prepares for the exam in consultation with the teacher). The problem of low attendance requires further analysis.

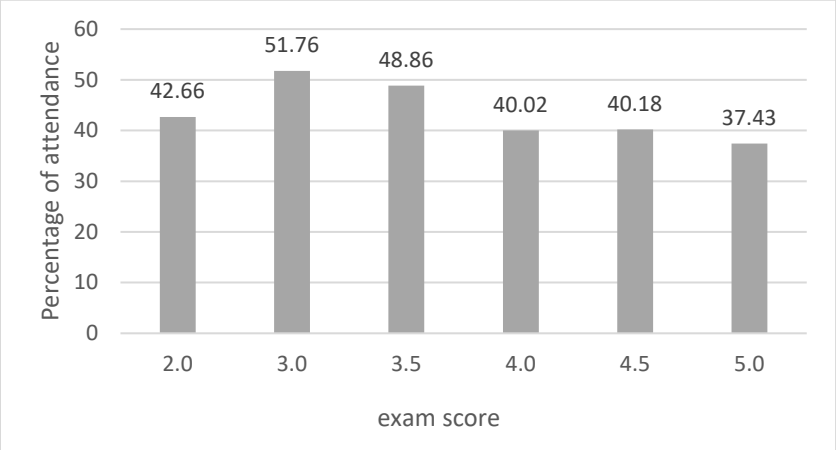


Figure 3: Percentage of attendance vs. exam score

The socioeconomic factor may have an impact on the presence of students during classes. UITM is a private university where students pay tuition every month. After the outbreak of the pandemic, the University prepared a fund of social scholarships for students. However, students paid tuition on time and did not apply for a social scholarship. According to interviews with students, they did not get into financial trouble during the pandemic. Each student had access to a suitable study place. Therefore, in our analysis was not taken into account socioeconomic factor.

5.3.2 Internet connection quality

The quality of the Internet connection was calculated on the basis of the number of connections per session in relation to the number of sessions (Table 2). Absent students were analysed separately because the quality of the connection could not be determined. Due to the synchronous teaching system owned by the university, we did not have detailed data on the quality of the connection. Absent students were thus included separately in the results. Although access to broadband Internet is becoming the norm, a few of the students had a poor internet connection, but we were unable to ascertain any differences in the nationalities of those students with a weak Internet connection.

Table 2: Percentage distribution of grades by Internet connection quality

Grade	Excellent	Very good	Good	Poor	Absent
2	31,8%	8,7%	14,2%	12,9%	32,5%
3	38,9%	12,8%	12,3%	12,5%	23,5%
3.5	22,2%	11,4%	14,1%	18,3%	34,1%
4	26,5%	11,6%	15,3%	12,2%	34,4%
4.5	27,5%	9,3%	13,2%	10,8%	39,2%
5	31,0%	10,4%	14,2%	8,2%	36,2%

As the last part of the research, a correlation matrix was created to find key factors that have a direct impact on final online exam results (Table 3). Given that a correlation matrix is a square, symmetric matrix with all autocorrelations along the main diagonal equal 1 and all the pairwise Pearsonian product moment correlations listed above the main diagonal equal their corresponding row and column placements below the main diagonal. In this table, pairwise correlations that are significant at the .05 alpha level (two-tail) are indicated with an asterisk ($*$) and those significant at the .01 level are represented by a double asterisk ($**$). The Kendall tau coefficient (τ-Kendall) was used in the correlation matrix for the types of variables. This coefficient takes values in the range <-1, 1>. From Table 3 we observe that grade is significantly correlated with several outcome measures like gender, age, course, form of classes (Lecture/Laboratory/Project) and type of exam. Grade is not significantly related to online behaviour measures like attendance and Internet connection quality.

Table 3: Correlation matrix for outcome measure in online classes

	Grade	Gender	Nationality	Age	Course	Part time/Full time	Lecture/Laboratory /Project	Type of exam	Attendance	Internet connection quality
Grade	1,000	-.107**	-0,023	.068**	.037*	-0,031	.113**	.175**	-0,014	0,031
Gender		1,000	-.112**	-.044**	-.036*	0,036	-0,014	-0,026	.047**	-0,030
Nationality			1,000	-.321**	-0,003	-.467**	-0,008	-0,014	-.115**	.056**
Age				1,000	.175**	.423**	.120**	.175**	-.052**	.104**
Course					1,000	0,014	.099**	.568**	-0,020	.120**
Part time/ Full time						1,000	0,005	0,026	.062**	-0,005
Lecture/ Laboratory/ Project							1,000	.044**	-.377**	.245**
Type of exam								1,000	-.091**	.206**
Attendance									1,000	-.483**
Internet connection quality										1,000

6. Results

The results of the present study reveal no significant difference in final exam scores between the students in online classes (summer semester 2020) and those in traditional classes (summer semester 2019).

Undoubtedly, the transition to online learning and online assessment is beset by several challenges such as: learning platform failures, poor Internet connections, poorer quality of lessons due to teachers' lack of online competence, or the dishonesty/cheating among the students. The case study of UITM proved that the challenges that seemed to be the most difficult ultimately did not matter. Of course, this is no accident – we have been using the BlackBoard platform and Blackboard Collaborate system for several years. The research was conducted among students of Computer Science, students who have no problem with the use of modern technologies. Our

fears that teachers might fail during online classes also turned out to be unfounded. We consider that a success that reflects many years of effort in studying, creating a strategy and implementing online and mobile learning classes.

As mentioned in the literature review, we expected increased levels of cheating, but ultimately, no evidence of cheating behaviour was found. During the exams, students were divided into small groups in virtual rooms. All rooms were supervised by teachers' assistants who observed the students and checked their identity.

Interestingly, the results of interviews with teachers show that the pandemic situation made communication with students more intense. Students who did homework and projects at home felt the need to communicate more with teachers outside of classes. From their side, understanding that the situation was difficult for both sides, teachers felt more responsible for the well-being of students. Interestingly, neither the activities of scientific circles nor individual tutoring sessions were suspended during the pandemic.

7. Discussion and Conclusions

The results of our research confirm that the mode of education itself (traditional vs online) does not significantly affect the assessment process. Modern technology used in education enables educators to implement the educational process regardless of the form of communication.

Lecturers who are able to engage students, provide effective feedback, or engage in interactions with students, do it at a comparable level, regardless of the mode of education. With the support of the institution and good infrastructure, the teaching staff can implement the educational procedure both traditionally and online. But there is no doubt that is necessary to constantly develop and support academic staff who feel less confident in online teaching.

Our online students were able to be well assessed by teachers; that is, their exam results did not differ from those before the pandemic period. But were our teachers rated equally well by the students? In a future study we will try to answer that question.

Taking into account the most likely extending period of the pandemic, it is necessary to consider introducing projects or mid-term exams instead of final exams.

Another path for future research would be to investigate why the attendance of the practical courses – where students gain skills required on the labor market - was so low, and how to improve this negative phenomenon. Maybe rewarding student activity in laboratories can increase student involvement and attendance.

The other field of study in which we are interested is to generate a coherent model of strategy implementation for online learning at the university - a model based on our experiences and the experiences of other universities that have been successful in this field.

This study has some limitations. The results of this study cannot be generalised as it was conducted only in one business university. The University of Information Technology in Rzeszow is still a single institution in the context of one country and a particular virtual learning environment. The similar research in another higher education institution could bring completely different results influenced by a different academic staff structure or other infrastructure for distance learning. The research was conducted among students of Computer Science but how would students of another field – perhaps more humanistic – will react? The above points need to be taken into account in future research.

References

Birch, E. and Wolf, M. (2020) “A novel approach to medical school examinations during the Covid-19 pandemic”, *Medical education,* [online] https://doi.org/10.1080.10872981.2020.1785680

Bilena, E. and Matrosa, A. (2020) “Online Cheating Amid COVID-19”, [online] https://ernbilen.github.io/pdfs/Cheating.pdf

Bopegedera, A. M. R. P. (2020) “Using Familiar and New Assessment Tools in Physical Chemistry Courses During COVID-19”, *American Chemical Society and Division of Chemical Education, Inc.* [online] https://doi.org/10.1021/acs.jchemed.0c00789

Brown, B. and Liedholm C. (2002) “Can Web Courses Replace the Classroom in Principles of Microeconomics?” *American Economic Review*, No.92(2), pp. 444-448

Carvalho, R. (2016) "Gender differences in academic achievement: The mediating role of personality", *Personality and Individual Differences,* No. 94, pp. 54–58, [online] https://doi.org/10.1016/j.paid.2016.01.011

Chen, Z., Jiao, J., Hu, K. (2021) "Formative Assessment as an Online Instruction Intervention: Student Engagement, Outcomes, and Perceptions", *International Journal of Distance Education Technologies,* [online] doi: 10.4018/IJDET.20210101.oa1

Choi, B., Jegatheeswaran, L., Minocha, A., Alhilani, M., Nakhoul, M. , Mutengesa, E. (2020) "The impact of the COVID-19 pandemic on final year medical students in the United Kingdom: a national survey", *BMC Medical Education*, [online] https://doi.org/10.1186/s12909-020-02117-1

Cygan, H., Bejster, M., Tribbia, C., Vondracek H. (2021) "Impact of COVID-19 on public health nursing student learning outcomes", *Public Health Nurs,* [online] https://doi.org/10.1111/phn.12978

Daniel, J. (2020) "Education and the COVID-19 pandemic", *PROSPECTS Comparative Journal of Curriculum, Learning, and Assessment*, No. 49, pp. 91–96

Dietrich, N., Kentheswaran, K., Ahmadi, A., Teychené, J., Yolaine, B., Sandrine, A., Laborie, S., Bastoul, D., Loubière, K., Guigui, Ch., Sperandio, M., Barna, L., Etienne, P., Cabassud, C., Liné, A., Hébrard, G. (2020) "Attempts, Successes, and Failures of Distance Learning in the Time of COVID-19", *Journal of Chemical Education* 2020, No. 97 (9), pp. 2448-2457

George, M. (2020) "Effective Teaching and examination Strategies for undergraduate Learning during COVID-19 School Restrictions", *Journal of educational technology*, [online] https://doi.org/10.1177/0047239520934017

Gratton-Lavoie, Ch. and Stanley, D. (2009) "Teaching and Learning Principles of Microeconomics Online: An Empirical Assessment", Journal of Economic Education, Vol. 40 Nr.1, pp. 3-25

Hodges, Ch., Moore, S., Lockee, B., Trust, T., Bond, A. (2020) "The Difference Between Emergency Remote Teaching and Online Learning", *EDUCAUSE Review*, March 27, 2020

Hollister, K. and Berenson, M. (2009) "Protocoled versus unprotocoled online exams: studing the impact of exam environment on student performance", *Decision Sciences Journal of Innovative* Education, Vol.7, Nr 1.

Jungic, V. (2020) "Making calculus relevant: final exam in the time of COVID-19", *International Journal of Mathematical Education in Science and Technology*, [online] https://doi.org/10.1080/0020739X.2020.1775903

Kearns L.R., (2012) "Student assessment in online learning: challenges and effective practices", *MERLOT Journal of Online Learning and Teaching*, Vol.8, No 3. [online] https://jolt.merlot.org/vol8no3/kearns_0912.pdf

Levin, V., Luna-Bazaldua, D., Harnisch, M., LIBERMAN J. (2020), "High-stakes school exams during COVID-19 (Coronavirus): What is the best approach?", *Education for Global Development*, April 01, 2020

Rataj, M. and Wojcik, J. (2020) "The Mobile Learning Adoption Model Tailored to the Needs of a Private University", *The Electronic Journal of e-Learning (EJEL)*, [online] doi: 10.34190/EJEL.20.18.4.004Senel S. and Senel H. (2021) "Remote Assessment in Higher Education during COVID-19 Pandemic", *International Journal of Assessment Tools in Education,* [online] https://doi.org/10.21449/ijate.820140

Sintema, J. (2020) "Effect of Covid-19 on the performance of grade 12 students: Implication for STEM education", *EURASIA Journal of Mathematics, Science and Technology Education*, [online] http://doi.org/10.29333/ejmste/7893

Stack, S. (2015) "Learning outcomes in an online vs traditional course", *International journal for the Scholarship of teaching and learning*, Vol. 9, No. 1, [online] https://doi.org/10.20429/ijsotl.2015.090105

Tapper, J., Batty, D., Savage, M. (2020) "Medical students take final exams online for the first time despite student concern", [online] https://www.theguardian.com/education/2020/mar/22/coronavirus-forces-medicalstudents-sit-final-exams-online (accessed on 10.04.2020)

Watson G. and Sottile J. (2010) "Cheating in the digital age: do students cheat more in online courses?", *Online Journal of Distance Learning Administration,* [online] https://www.westga.edu/~distance/ojdla/spring131/watson131.html

Voyer, D. and Voyer, S. D. (2014) "Gender differences in scholastic achievement: A meta-analysis", *Psychological Bulletin*, Nr. 140(4), pp. 1174–1204, [online] https://doi.org/10.1037/a0036620

The Analytic Hierarchy Process for new Product Screening Decisions: A Knowledge Management Perspective

Marcin Relich
Faculty of Economics and Management, University of Zielona Gora, Zielona Gora, Poland
m.relich@wez.uz.zgora.pl

Abstract: The selection of the most promising new product development projects is one of the most important decisions in a company. This decision affects the cost of failed projects, company's profitability, and its survival. The selection of new product development projects with the greatest potential requires the evaluation criteria that reflect the adjustment of a new product to customer requirements, company's strategy, manufacturing, and knowledge management issues. There are specified sub-criteria to identify the impact of a new product on a single area of the company's activity, for example, on the knowledge management area. The criteria and sub-criteria are evaluated by managers, engineers (including knowledge engineers), and IT specialists, who work in departments such as research and development, sales and marketing, manufacturing, IT, and top management. Company professionals have the most updated information of the ongoing processes related to new product development. This paper is concerned with using the analytic hierarchy process (AHP) methodology to a new product screening problem, paying attention to the knowledge management perspective. So far, this perspective is neglected in the context of the decision problem of new product screening. This research develops the field of knowledge acquisition from experts towards selecting and evaluating criteria related to the potential of a new product. Knowledge acquisition refers to issues related to a new product, customer requirements, and uncertainties of project performance. Using criteria related to various areas of the company's activity, the decision maker can identify factors significantly impacting performance of new product projects, and compare these projects with each other. Moreover, the AHP approach prioritizes criteria and sub-criteria, and as a result, it can identify areas of the company's activity that could be improved.

Keywords: knowledge acquisition, evaluation criteria, multi-criteria decision-making, new product development, project selection problem

1. Introduction

Nowadays, companies are continually searching for ways to be closer to customer needs, improve their business processes, develop products more effective, and accelerate their launch. New product development (NPD) is one of the most important processes in maintaining business success. The NPD process includes several phases from market analysis, idea generation, and concept selection, through product design and prototype tests, to production and commercialization. The goal of the concept selection phase is evaluation of different NPD projects and selection of the most promising project(s) to reduce the risk of developing non-profitable ones. Consequently, project portfolio selection belongs to key decisions in project-oriented companies, decisions that affect business survival.

Project portfolio selection can be based on financial measures related to costs, sales, and cash flows in the expected product life cycle, or on non-financial measures related to, for example, customer requirements. The total costs of a new product refer to its development, promotion, production, and the removal from the market, and it can be estimated using analogical, analytical, or parametric techniques (Relich, 2016). The sales volume and the product life cycle depend on the market and are harder to predict than costs that can be controlled, to some extent, by the company. However, decision makers should tend to prepare predictions about new product performance and profitability, considering the highly expenses related to unsuccessful new product projects.

The NPD literature emphasizes the impact of introducing new products on employment, economic growth, technological progress, high standards of living, and on continuing business success (Nielsen et al., 2010; Fish, 2012; Relich and Bzdyra, 2015). There are many approaches to describe and solve a multi-criteria decision problem within, for example, finance (Dobrovolskienė and Tamošiūnienė, 2016), production and distribution (Sitek and Wikarek, 2018; Rudnik et al., 2021), or maintenance sustainability (Jasiulewicz-Kaczmarek et al., 2021). One of these approaches is the AHP methodology that is a suitable tool to present a hierarchical structure of criteria involved in the evaluation process (Velasquez and Hester, 2013).

This study is addressed to project-oriented companies that are interested in evaluating the potential of a new product and selecting the most promising projects at the early phase of new product development. This evaluation is based on expert judgments and the AHP methodology. The approach proposed in this study

develops previous approaches towards incorporating the knowledge management perspective into a model of new product screening.

The paper is organised in the following parts: Section 2 presents a literature review, including description of evaluation criteria for new product development projects, the analytic hierarchy process in new product screening, and acquiring knowledge related to new product development. Section 3 describes the proposed method for evaluating the potential of a new product. The applicability of the proposed approach is illustrated in Section 4. Finally, conclusion and further research are presented in Section 5.

2. Literature review

2.1 Evaluation criteria for new product development projects

Evaluation criteria are often dedicated to a specific stage of an NPD project such as idea generation, concept development, business analysis, product development, market testing and launch. For example, the phase of concept screening can be evaluated according to technical feasibility, customer acceptance, and product performance, whereas the stage of business analysis can include criteria such as sales in units, margin, and market potential (Hart et al., 2003). Evaluation criteria can also be considered from the perspective of financial and nonfinancial dimensions or quantitative and qualitative measures. The financial dimension is particularly important at the phase of business analysis and after-market launch, and evaluation criteria can include profit or sales objectives, and return of investment (ROI) (Hart et al., 2003). The nonfinancial dimension is usually dedicated to the NPD phases such as idea screening, product testing, and testing customer acceptance/satisfaction, in which opinions from the research and development (R&D) employees and customers are analysed. An example of nonfinancial criteria can be the quality of a new product, intuition, market potential or product uniqueness.

Evaluation criteria can also be grouped into factors that significantly impact the success of an NPD project. These factors can be related to technical feasibility, strategic fit, customer acceptance, financial performance, and market opportunity (Carbonell-Foulquié et al., 2004). The technical feasibility dimension includes the following criteria: estimation of the project total cost, availability of resources, and leverage of company's R&D, engineering, and manufacturing skills. Strategic fit refers to alignment of an NPD project with company's strategy and window of opportunity. Evaluation criteria for customer acceptance are related to customer satisfaction, product quality, including its reliability and performance. The dimension of financial performance contains criteria such as expected margin rate, internal rate of return (IRR), and sales volume. Criteria related to market opportunity refer to market share and market growth (Carbonell-Foulquié et al., 2004). Another classification of evaluation criteria refers to dimensions related to market (e.g., customer acceptance/satisfaction, sales growth, market share, market potential), finance (e.g., break-even time, profit, margin, IRR/ROI), product (e.g., quality, technical feasibility, product performance, product uniqueness), process (e.g., time-to-market, stay within budget), and intuition (Tzokas et al., 2004). In turn, Martinsuo and Poskela (2011) proposed a few models to verify the impact of strategic, market, and technical criteria on competitive and future business potential. Moreover, they compared the proposed models in the context of using quantitative measures (sales revenue, R&D investments, number of employees, number of front-end projects), and product complexity (including concept novelty).

Another perspective of classifying evaluation criteria is related to the level of novelty regarding a new product. Evaluating innovations can use other criteria compared to modifications of existing products. The comparison of evaluation criteria in the context of the NPD stage and highly, moderately, and low innovation strategy is presented in (Wang and Lee, 2011). Financial criteria of evaluating NPD projects can be based on metrics related to the expected values of sales, costs, profits, and cash flows in the expected product life cycle. The discounted cash flows are used in the net present value (NPV) method to evaluate and compare NPD projects over the whole period of the investment. The expected performance of the NPD project can be provided by experts (if product-related data is not available, e.g. during development of innovations) or acquired from a product management system (e.g., during development of modifications of existing products (Relich, 2017)). The evaluation of NPD projects aims to compare them and select the most promising ones. This problem belongs to the class of decision problems and can be solved using a multi-criteria decision-making method, for example, the analytic hierarchy process.

2.2 The analytic hierarchy process in new product screening

The analytic hierarchy process is a multi-criteria decision-making approach, in which a pairwise comparison procedure is used to range a set of alternatives at a scale of preferences. The word "analytic" means that the object of the decision is described in the form of criteria to compare the possible options (alternatives). Criteria can be specified in a quantitative and qualitative manner and ranked according to the weights. The word "hierarchy" in the name of this approach refers to the manner, in which the criteria and alternatives are presented. In turn, the word "process" is related to the use of a sequence of steps to solve a decision problem. The AHP procedure is based on three following principles: (1) decomposition of a complex unstructured problem, (2) comparative judgments related to components of a problem, and (3) synthesis of priorities derived from the judgments (Pun et al., 2010). The decomposition of an unstructured problem into a systematic decision hierarchy is determined using a qualitative method. The AHP methodology aims to specify both objective and subjective judgements of the evaluators in order to make trade-off and determine priorities among the hierarchy. It requires a pairwise comparison to execute the consistency test, and finally, to validate the consistency of responses (Saaty, 2001; Pun et al., 2010).

An AHP approach enables enterprises to involve their own experts in the process of selecting the criteria and evaluating them. Moreover, the AHP bases on judgments related to the most updated information of the current state of a decision problem rather than on historical statistical data. This approach is also a tool of choice and prioritization, as well as it enables companies to develop a set of criteria according to their needs, a set that can be modified when the situation is changed. In addition to this, the AHP is a group approach to decision making and obtains an overall score to reflect group judgments, what makes this approach suitable for product project screening (Chin et al., 2008).

As the evaluation process of an NPD project involves several criteria related to different areas of the company's activities and employees to evaluate these criteria, new product screening is an example of a multi-criteria decision-making problem. Calantone et al. (1999) presented that the AHP is an important management tool for NPD project screening that provides the potential towards improving decisions within the considered problem. The weaknesses of the AHP approach can be seen from the perspective of the ranking reversal problem and the limited capability in dealing with the issue of uncertainty (referring to incomplete data and imprecise judgments), what is a common problem at the early stages of new product development (Chin et al., 2008).

2.3 Acquiring knowledge related to new product development

The processes of creating and accumulating knowledge can be seen as common ground between projects, companies, and networks, in which projects are operated (Scarbrough et al., 2004). The role of knowledge creation and learning in managing complex projects has been analysed and presented from a problem-solving perspective by Ahern, Leavy and Byrne (2014). Evaluation of project suitability from a knowledge perspective is related to experts and identification of dimensions regarding the knowledge contribution. This term refers to the impact and outcomes of a project-based learning. A model of the knowledge management process presented by Botha et al. (2014) classifies learning activities into three groups: knowledge creation and sensing, knowledge organizing and capture, and knowledge sharing and dissemination.

The specification of the knowledge contribution results from the knowledge taxonomy used in a company, and it can be considered from the following perspectives: (i) individual learning, (ii) organizational level learning, and (iii) organizational culture change (Botha et al., 2014; Geng et al., 2018). The first perspective is related to knowledge and skills of team members who are involved in meeting project objectives. Complex projects may affect continuous learning by team members over the project life cycle (Ahern et al., 2014). According to the second perspective, decision makers may decide whether a company has the capability (including knowledge competency of knowledge workers) of accomplishing the project. Challenging requirements occurring in a project can provide motivation for project-based learning by team members. According to the third perspective, projects significantly impact organizational culture change, as they require communication among employees within and across structural units of an organization (Geng et al., 2018).

There are many models related to incorporating knowledge issues into the NPD project perspective. Akgün et al. (2005) proposed a model dedicated to identify the impact of factors related to project team (interpersonal trust, team stability, team member proximity, team member familiarity, and team communication) on project outcomes (team learning, speed-to-market, and new product success). Peng et al. (2014) investigated the associations between an aspect of NPD collaboration (including cross-functional, customer, and supplier

perspectives) and IT tools related to communication, product design, project management, and product data and knowledge management. Relich (2016) proposed a knowledge-based system for the new product portfolio selection problem, in which financial and nonfinancial criteria are considered. Hellebrandt et al. (2018) presented a model of selecting a suitable knowledge management solution for complaint knowledge transfer, in which a set of admissible solutions includes, for example, lessons learned and best practices, knowledge communities, education and training, expert search and investigation.

A knowledge management perspective is also considered in the context of supporting the innovation processes in companies. For example, Grimaldi and Rippa (2011) investigated the impact of improvement in the areas related to knowledge, performance, and network on sustaining the innovation process. Mannan and Haleem (2017) proposed a hierarchical model of dimensions and determinants for the successful diffusion and adoption of product innovation. Their model consists of dimensions such as innovativeness, social system, communication, and time. In turn, Frederiksen and Knudsen (2017) presented innovation performance from the perspective of the following criteria: product novelty, product usefulness, and commercialization (market potential). These three criteria can be considered in the context of knowledge related to a new product, customer requirements, and uncertainties regarding NPD project performance. These knowledge-related factors are further considered in the proposed model of NPD screening.

3. The proposed method for evaluating the potential of a new product

The proposed method bases on an AHP approach, and it mainly consists of the following steps:

1. Specification of the project selection problem into a hierarchical structure.
2. Information collection and pairwise comparisons.
3. Calculation of standardised weights.
4. Selection of the most promising NPD project.

3.1 Specification of the project selection problem into a hierarchical structure

A hierarchical structure of the considered problem usually consists of four levels. The first level refers to the goal associated to a decision problem, the second and third levels of this structure represent the criteria and sub-criteria related to the considered problem, whereas the lowest level includes the decision alternatives (Grimaldi and Rippa, 2011). The hierarchical structure is developed through specifying a list of criteria and sub-criteria that are selected using a literature review and expert experiences. In this study, the hierarchical structure is as follows:

***Goal*:** solving the NPD project selection problem, considering fit of an NPD project to issues related to market (customers, competitors, suppliers) and company (its strategy, technology, knowledge management).

***Criteria*:** customer, manufacturing, company's strategy, and knowledge acquisition.

***Sub-criteria*:**

Customer perspective:

- The ability to design a product according to the customer requirements (CUST_REQ)
- The ability to set product price that is acceptable for target customers (PROD_PRI)
- The ability to distribute the product to customers (PROD_DIS)

Manufacturing perspective:

- The adjustment of a new product to current technology (CUR_TECH)
- The adjustment of a new product to current supply chains (CUR_SUPP)
- The adjustment of a new product to manufacturing capacity (MANU_CAP)

Strategy perspective:

- The adjustment of a new product to current product lines (CUR_LINE)
- The adjustment of a new product to current business processes (CUR_PROC)
- The adjustment of a new product to the preferred product life cycle (PREF_CYC)

Knowledge perspective:

- The ability to acquire knowledge related to a new product (KNOW_PRO)

- The ability to acquire knowledge related to customer requirements (KNOW_CUS)
- The ability to acquire knowledge related to uncertainties of NPD project performance (KNOW_UNC)

***Alternatives*:** new product development projects.

Figure 1 presents the hierarchical structure proposed for solving the NPD project selection problem.

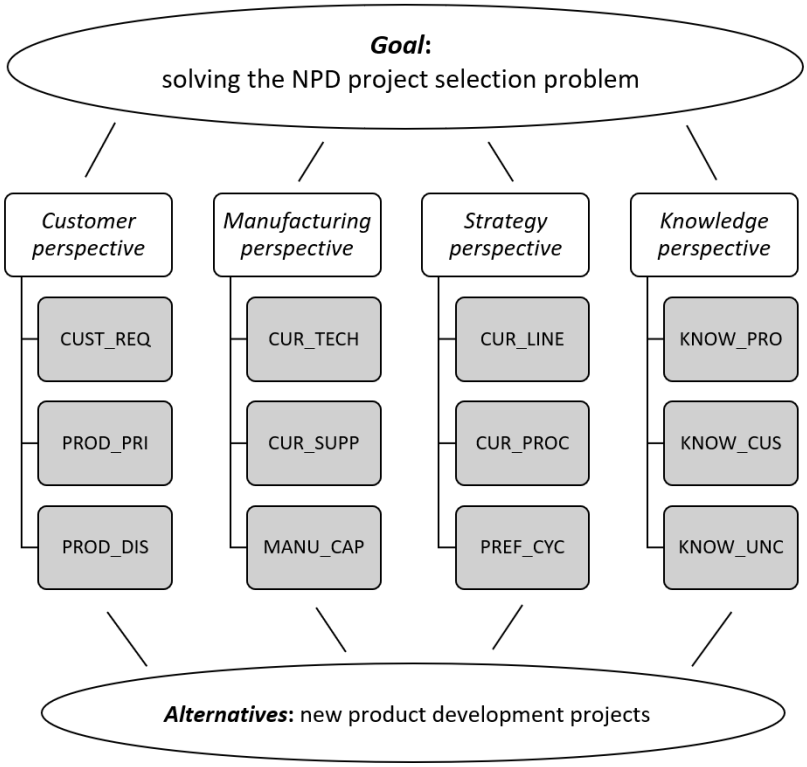


Figure 1: An NPD project selection model

3.2 Information collection and pairwise comparisons

Information is collected from specialists who work in departments such as R&D, sales and marketing, manufacturing, IT, and top management. Pairwise comparisons are given by experts using 1–9 scale proposed by Saaty (2001), where 1 denotes equal importance of (sub)criteria, 3 – moderate importance, 5 – strong importance, 7 – very strong importance, 9 – absolute importance, and 2,4,6,8 – intermediate values. Figure 2 presents a pairwise comparison matrix, which components derive from the structure of criteria (the 4 x 4 matrix) and sub-criteria (the 3 x 3 matrix). If the *i*-th (sub)criterion has one of the above non-zero numbers assigned to it when compared to the *j*-th (sub)criterion, then the *j*-th (sub)criterion has the reciprocal value when compared to the *i*-th (sub)criterion.

	i	j	...	...
i	1/1	a_{ij}		
j	a_{ji}	1/1		
...			1/1	
...				1/1

Figure 2: A pairwise comparison matrix

The fulfilment of the pairwise comparison matrix can result in inconsistencies that commonly appear in making multiple comparisons. These inconsistencies are acceptable within certain limits, what requires the determination of a consistency index.

3.3 Calculation of standardised weights

After the fulfilment of the pairwise comparison matrix, the weights of (sub)criteria are calculated by solving the eigenvector of the pairwise comparison matrix. The relative weights of (sub)criteria are determined by calculating the eigenvalues for their judgments matrices with these relative weights aggregated. If the weights of components of the decision hierarchies are calculated, they are synthesised to obtain the ranking scores of NPD projects. Weights are synthesised from the highest level down by multiplying weights by the weight of their corresponding parent component in the level above and adding them for each component in a level according to the component if affects (Grimaldi and Rippa, 2011).

In order to synthesise the local priorities throughout the hierarchy and compute the global priorities of the alternatives, the principle of hierarchic composition is applied. The local priorities are multiplied by the corresponding criterion weight, and the results are summed up to obtain the global priority of the alternative with respect to the goal stated at the top level. The global priority weight in each level should be equal to a sum of one. A value of the above-mentioned consistency index should be less than 0.1 (at larger values, the decision maker should reduce the inconsistency by revising expert judgements). More details related to theoretical foundations of the AHP approach is presented in (Pun et al., 2010).

3.4 Selection of the most promising NPD project

In the last step, the principle of hierarchic composition is applied for computing the global priority weights in each hierarchy level (Saaty, 2001). The global weights are used to prioritise various criteria and sub-criteria considered in the project selection problem. The local priorities are multiplied by the corresponding criterion weight, and the results are summed up to obtain the global priority of the criterion with respect to the stated goal. The AHP methodology determines the consistent nature of the pairwise comparisons (using the consistency index) for all matrices. If there is inconsistency, the procedure should be repeated (Pun et al., 2010).

The results of the AHP analysis may be clearly presented at the radar chart, in which the impact of the considered sub-criteria on different NPD projects is illustrated. The next section presents an example of using the proposed method for selecting the post promising NPD project.

4. An illustrative example

The AHP method has been applied to the evaluation of three NPD projects, considering their impact on factors related to the customer, manufacturing, company's strategy, and knowledge perspective. The expert panel consists of five experts who work as managers, engineers, and IT specialists in the following departments: R&D, sales and marketing, manufacturing, IT, and top management.

Figure 3 presents the relative importance of criteria related to the considered perspectives of selecting an NPD project. According to expert evaluation, the most important perspective is the customer perspective, and further the company's strategy, knowledge, and manufacturing perspective.

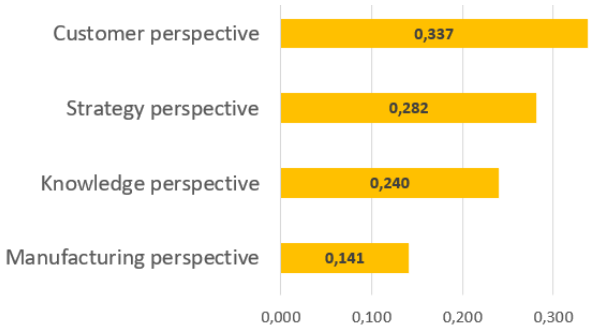


Figure 3: The relative importance of criteria

Figure 4 illustrates the relative importance of sub-criteria within a single perspective. The sum of local weights for a single perspective equals 1.

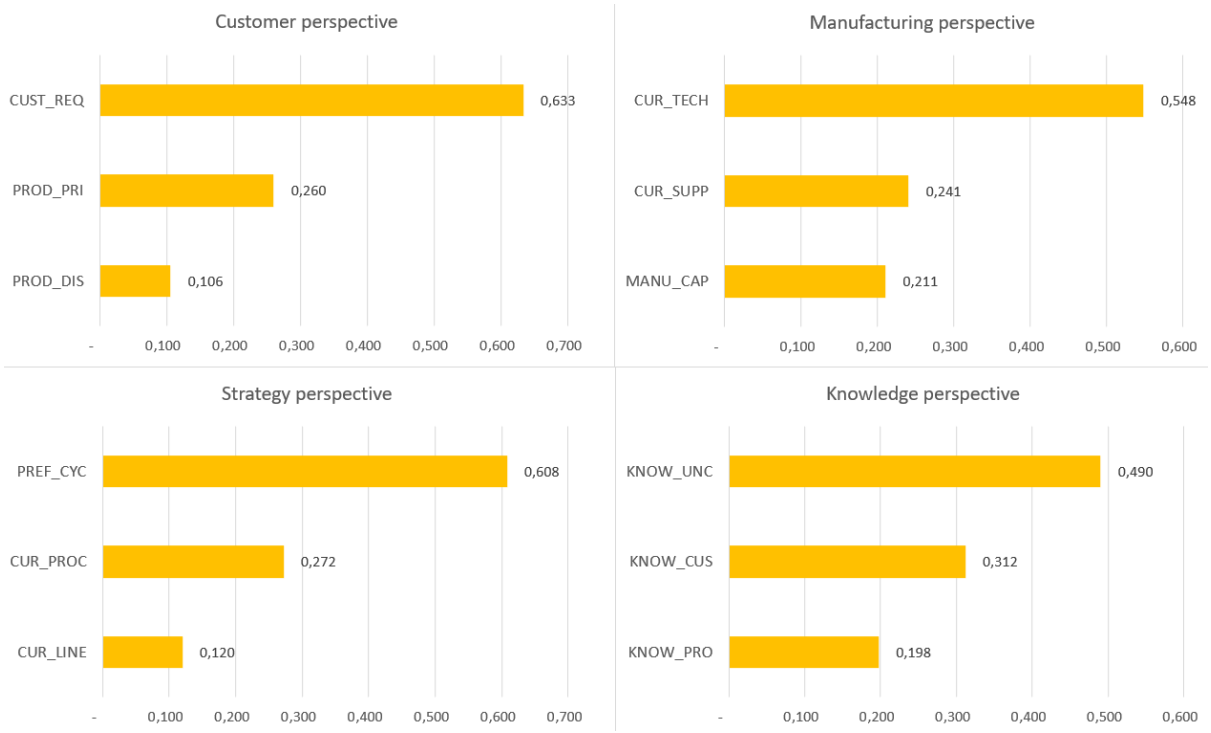


Figure 4: The relative importance of sub-criteria within a single perspective

Figure 5 presents the global weights for sub-criteria within four considered perspectives. The sum of weights for all sub-criteria equals 1. The most important sub-criteria refer to issues regarding the ability to design a product according to the customer requirements, the adjustment of a new product to the preferred product life cycle, and the ability to acquire and codify knowledge related to uncertainties of an NPD project performance.

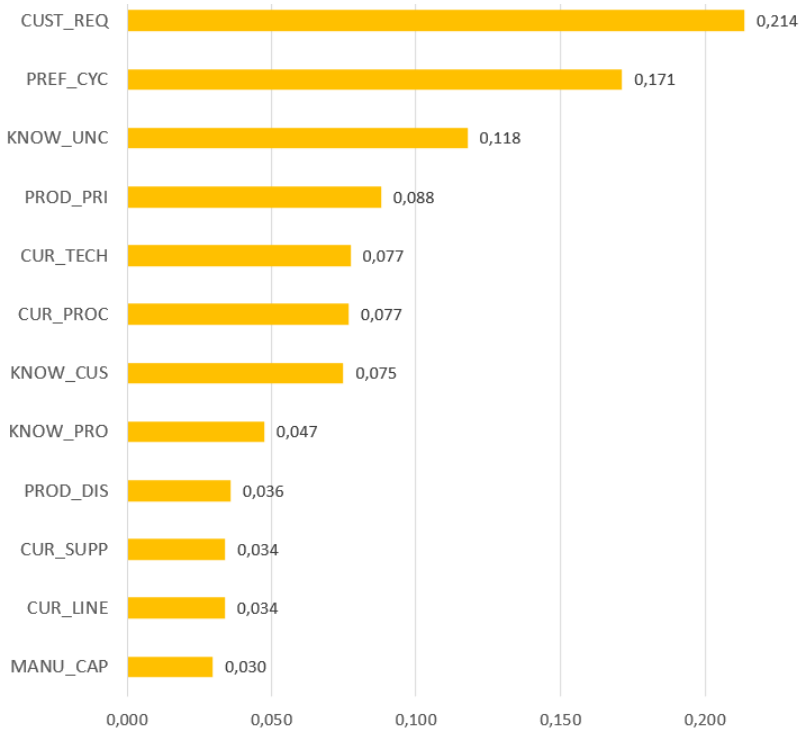


Figure 5: The importance of sub-criteria for all perspectives

Figure 6 illustrates the radar chart related to weights of sub-criteria for three NPD projects.

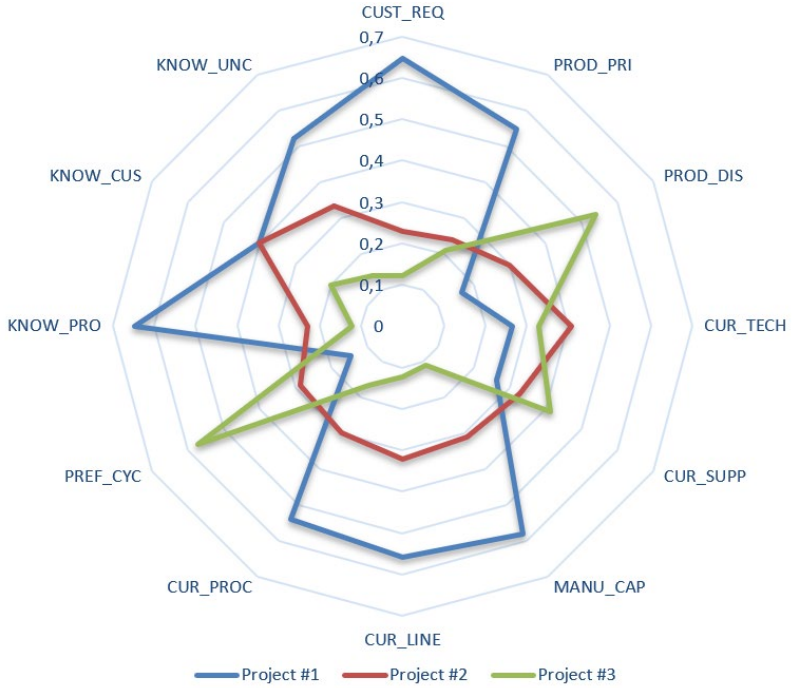


Figure 6: The weights of sub-criteria for NPD projects

Figure 7 presents the global evaluation of the considered NPD projects according to expert judgments. The results of the AHP analysis indicates that the most promising project is Project #1, considering all criteria and sub-criteria.

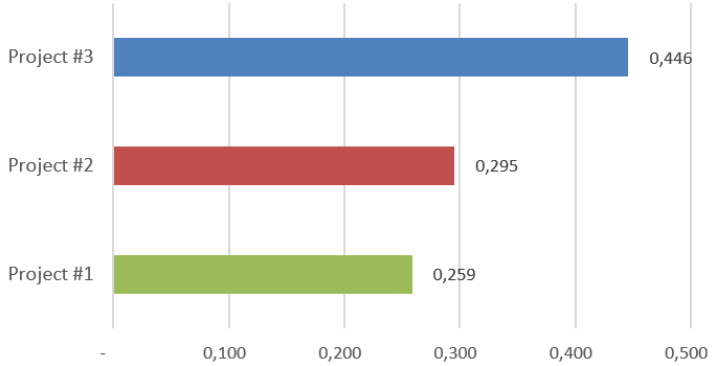


Figure 7: The evaluation of NPD projects

5. Conclusion

The presented research has been based on the AHP methodology dedicated to the selection of the most promising NPD project, incorporating the knowledge-related issues into this problem. NPD projects should be evaluated using various criteria regarding different areas of the company's activity. This research investigates the impact of customer, company's strategy, manufacturing, and knowledge-related factors on evaluating the potential of a new product. Each area includes three components selected through the literature review. A customer perspective refers to issues regarding customer requirements, product price, and distribution. A manufacturing perspective includes the adjustment of a new product to current technology, current supply chains, and manufacturing capacity. A company's strategy perspective contains issues regarding the adjustment of a new product to current product lines, current business processes, and the preferred product life cycle. In turn, a knowledge perspective refers to issues such as the ability to acquire knowledge related to a new product, customer requirements, and uncertainties of NPD project performance. The knowledge perspective is rarely considered in the context of a new product screening problem, and the above-mentioned knowledge-related issues have been specified to acquire knowledge regarding product novelty, product usefulness, and commercialization (market potential). Compared to previous research, the proposed structure of project evaluation allows the decision maker to get information to what extent knowledge acquisition (within a new

product, customer requirements, and uncertainties of project performance) impacts the attractiveness of a new product project.

The AHP approach is a suitable tool for solving a multi-criteria decision problem, including new product screening. The use of criteria related to various areas of the company's activity enables the decision maker to check what factors significantly impact the NPD project performance, and compare NPD projects with each other. A set of criteria and sub-criteria is set by a knowledge engineer, and it can be adjusted to current situation and company needs. Another advantage of using the AHP refers to expert judgments, who work in the company and have the most updated information of the ongoing processes related to new product development. Moreover, the AHP approach enables prioritization of criteria and identification of areas that could be improved.

A drawback of using the AHP is pairwise comparisons within criteria and sub-criteria, also in the context of alternative NPD projects. Further research includes the use of the best-worst method to reduce the above-mentioned drawback of using the AHP. Moreover, further research will investigate the extent of using knowledge management towards diffusing an adapting product innovation.

References

Ahern, T., Leavy, B. and Byrne, P. J. (2014) "Knowledge formation and learning in the management of projects: A problem solving perspective", *International Journal of Project Management*, Vol 32, No. 8, pp 1423–1431.

Akgün, A. E., Byrne, J., Keskin, H., Lynn, G. S. and Imamoglu, S. Z. (2005) "Knowledge networks in new product development projects: A transactive memory perspective", *Information & Management*, Vol 42, No. 8, pp 1105–1120.

Botha, A., Kourie, D. and Snyman, R. (2014) *Coping with continuous change in the business environment: Knowledge management and knowledge management technology*, Elsevier, Amsterdam.

Calantone, R. J., Di Benedetto, C. A. and Schmidt, J. B. (1999) "Using the analytic hierarchy process in new product screening", *Journal of Product Innovation Management*, Vol 16, No. 1, pp 65–76.

Carbonell-Foulquié, P., Munuera-Alemán, J. L. and Rodrıguez-Escudero, A. I. (2004) "Criteria employed for go/no-go decisions when developing successful highly innovative products", *Industrial Marketing Management*, Vol 33, No. 4, pp 307–316.

Chin, K. S., Xu, D. L., Yang, J. B. and Lam, J. P. (2008) "Group-based ER–AHP system for product project screening", *Expert Systems with Applications*, Vol 35, No. 4, pp 1909–1929.

Dobrovolskienė, N. and Tamošiūnienė, R. (2016) "Sustainability-oriented financial resource allocation in a project portfolio through multi-criteria decision-making", *Sustainability*, Vol 8, No. 5, pp 485.

Fish, A. N. (2012) *Knowledge automation: how to implement decision management in business processes*, John Wiley & Sons, Hoboken, New Jersey.

Frederiksen, M. H. and Knudsen, M. P. (2017) "From creative ideas to innovation performance: The role of assessment criteria", *Creativity and Innovation Management*, Vol 26, No. 1, pp 60–74.

Geng, S., Chuah, K. B., Law, K. M., Cheung, C. K., Chau, Y. C. and Rui, C. (2018) "Knowledge contribution as a factor in project selection", *Project Management Journal*, Vol 49, No. 1, pp 25–41.

Grimaldi, M. and Rippa, P. (2011) "An AHP-based framework for selecting knowledge management tools to sustain innovation process", *Knowledge and Process Management*, Vol 18, No. 1, pp 45–55.

Hart, S., Hultink, E. J., Tzokas, N. and Commandeur, H. R. (2003) "Industrial companies' evaluation criteria in new product development gates", *Journal of Product Innovation Management*, Vol 20, No. 1, pp 22–36.

Hellebrandt, T., Heine, I. and Schmitt, R. H. (2018) „Knowledge management framework for complaint knowledge transfer to product development", *Procedia Manufacturing*, Vol 21, pp 173–180.

Jasiulewicz-Kaczmarek M., Żywica P. and Gola A. (2021) "Fuzzy set theory driven maintenance sustainability performance model: A multiple criteria approach", *Journal of Intelligent Manufacturing*, Vol 32, No. 5, pp 1497–1515.

Mannan, B. and Haleem, A. (2017) "Understanding major dimensions and determinants that help in diffusion & adoption of product innovation: Using AHP approach", *Journal of Global Entrepreneurship Research*, Vol 7, No. 1, pp 1–24.

Martinsuo, M. and Poskela, J. (2011) "Use of evaluation criteria and innovation performance in the front end of innovation", *Journal of Product Innovation Management*, Vol 28, No. 6, pp 896–914.

Nielsen, P., Nielsen, I. and Steger-Jensen, K. (2010) "Analyzing and evaluating product demand interdependencies", *Computers in Industry*, Vol 61, No. 9, pp 869–876.

Peng, D. X., Heim, G. R. and Mallick, D. N. (2014) "Collaborative product development: The effect of project complexity on the use of information technology tools and new product development practices", *Production and Operations Management*, Vol 23, No. 8, pp 1421–1438.

Pun, K. F., Chin, K. S. and Yiu, M. Y. (2010) "An AHP approach to assess new product development performance: An exploratory study", *International Journal of Management Science and Engineering Management*, Vol 5, No. 3, pp 210–218.

Relich, M. and Bzdyra, K. (2015) "Knowledge discovery in enterprise databases for forecasting new product success", In Proceedings of International Conference on Intelligent Data Engineering and Automated Learning, Wroclaw, Poland, pp 121–129.

Relich, M. (2016) “A knowledge-based system for new product portfolio selection”, *Intelligent Systems Reference Library*, Vol 98, pp 169–187.

Relich, M. (2016) “Portfolio selection of new product projects: A product reliability perspective”, *Eksploatacja i Niezawodnosc – Maintenance and Reliability*, Vol 18, No. 4, pp 613–620.

Relich, M. (2017) “Identifying project alternatives with the use of constraint programming”, In Proceedings of 37th International Conference on Information Systems Architecture and Technology, Karpacz, Poland, pp 3–13.

Rudnik, K., Bocewicz, G., Kucińska-Landwójtowicz, A. and Czabak-Górska, I. D. (2021) “Ordered fuzzy WASPAS method for selection of improvement projects”, *Expert Systems with Applications*, Vol 169, No. 114471.

Saaty, T. L. (2001) *Decision making for leaders: The analytic hierarchy process for decisions in a complex world*, RWS publications, Pittsburgh.

Scarbrough, H., Swan, J., Laurent, S., Bresnen, M., Edelman, L. and Newell, S. (2004) “Project-based learning and the role of learning boundaries”, *Organization Studies*, Vol 25, No. 9, pp 1579–1600.

Sitek, P. and Wikarek, J. (2018) “A multi-level approach to ubiquitous modeling and solving constraints in combinatorial optimization problems in production and distribution”, *Applied Intelligence*, Vol 48, No. 5, pp 1344–1367.

Tzokas, N., Hultink, E. J. and Hart, S. (2004) “Navigating the new product development process”, *Industrial Marketing Management*, Vol 33, No. 7, pp 619–626.

Velasquez, M. and Hester, P. T. (2013) “An analysis of multi-criteria decision making methods”, *International Journal of Operations Research*, Vol 10, No. 2, pp 56–66.

Wang, K. J. and Lee, Y. H. (2011) “Criteria deployment at evaluation gates under different new product development strategies”, *European Journal of Social Sciences*, Vol 22, No. 2, pp 165–176.

Knowledge Exchange as a Factor Shaping Employee Relations in Remote Work

Elżbieta Robak
Częstochowa University of Technology, Częstochowa, Poland
elzbieta.robak@pcz.pl

Abstract: It is difficult to overestimate the benefits of positive employee relations, as they relate to individual, team and organisational aspects. Good relations between employees are reflected in effective communication, higher work efficiency, employee commitment, but also in a higher job satisfaction. Such relationships in the organisation also show respect, trust, and the willingness to cooperate among employees, which foster knowledge sharing. Employers whose employees work remotely are often faced with the problem of how to shape an organisational culture of openness, built on positive employee relations, encouraging the sharing of knowledge with colleagues. The empirical part of the study was prepared on the basis of the results of a survey conducted at the turn of 2021/2022 among young people, representatives of generation Z, living in the Silesian voivodeship in Poland. The results of the conducted research show that young people from generation Z negatively evaluate the impact of remote work on relations with both colleagues and superiors. Moreover, according to the respondents, the remote work interferes with building emotional ties and also limits mutual support in difficult situations and may lead to a feeling of social isolation. Although the respondents believed that remote work allows a quick exchange of information and promotes the exchange of knowledge between employees, they were reluctant to work remotely in the future (they preferred hybrid or stationary work).

Keywords: employee relations, knowledge exchange, remote work, Generation Z

1. Introduction

Relationships at work serve the achievement of specific goals, and the participants of these relationships interact with each other, realizing individual needs and expectations as well as common tasks and plans. During personal relationships, as opposed to business relationships, employees establish closer contacts, deepen the mutual bond, are more committed and willing to help each other. This type of relationship allows them to experience support from others, and also builds a friendly working atmosphere (Blyton and Turnbull 2004). A positive working atmosphere and especially good relations with colleagues are one of the most important values for today's employees. This applies especially to people from the Z generation, who often resign from employment with a given employer due to unsatisfactory employment relationships. In this context, the importance of the analysed issue is visible, as it concerns a key problem for many contemporary organizations. How to shape employee relationships in remote work, that will be conducive to sharing knowledge, among the youngest employees?

The aim of the article is to present the opinion of the representatives of Generation Z on employee relations in remote work in the context of knowledge exchange. The empirical part of the study presents the results of a survey conducted among young people representing the Z generation. As part of the study, the following research problem was raised: How do young people perceive the exchange of knowledge as a factor shaping employee relationships in remote work? The study also posed a number of detailed problem questions relating to employee relations and the exchange of knowledge and information in remote work. To assess the significance of differences in the analysed variables, the non-parametric ANOVA Kruskal-Wallis test was used, and the Spearman's rank correlation coefficient was used to assess the strength of the correlation between the variables. For the purposes of analysing the results of the study, a number of statistical hypotheses were adopted. The study presents the relationships verified with statistical tests, which authorise the conclusion about the regularities in the studied group.

2. Employee relations in remote work and the exchange of knowledge - an introduction to the problem

The occurrence of social relations refers to a situation where people are aware of their existence and take into account each other, and between them there are specific interactions as well as mutual connections and expectations, conducted by an agreed method of communication (Adler, Rosenfeld and Proctor 2011). Building relationships is one of the basic social skills thanks to which a person is able to function well in society. Having this skill allows achieving the intended goals, meeting the needs of, inter alia, belonging to a group and self-fulfillment in the private and professional area.

The benefits of shaping positive relationships at work can be seen in an individual, as well as team and organisational context. When analysing the individual benefits of maintaining good interpersonal relations at work, it is necessary to emphasize their importance not only in increasing job satisfaction, but also in shaping the self-esteem in employees (Robertson, O'Reilly and Hannah 2020, pp 596-619; Carmeli and Gittell 2009, pp 709-729). With regard to the organisational profits resulting from positive employee relations, their influence on the innovation, higher work efficiency - related to the effective communication, and stimulating employee involvement are emphasized (Glińska-Neweś et al., 2017, pp 25-37; Brhane and Zewdie 2018). On the other hand, negative relationships create a work environment in which conflicts occur more often, and the cooperation is limited only to fulfilling formal duties. Negative relationships are also associated with a reluctance to help each other and, what is very important, to share information and knowledge.

The employee relations and the associated working atmosphere are a very important factor, especially for the representatives of the youngest generations in the labor market. It turns out that they want not only attractive earnings and benefits, development opportunities and a stable employment, but also a good atmosphere. Especially the representatives of the youngest generation Z want to be aware that their work makes sense, to know what is happening in the organisation in which they work and to have an influence on it. However, most of all, they want to work in a place where there are good relations both among the employees of the same level and between the superiors and subordinates (Singh and Dangmei 2016). The representatives of generation Z believe that the professional environment is extremely important in their development, and therefore they expect their superiors to act as mentors and support, but also to be autonomous. In addition, they are characterised by the need for sustainable development, work-life balance and a strong need for security, reflecting their desire to have a decent job and a decent wage (Robak 2017). What is worth emphasizing, the social environment for this generation is an important factor shaping the organisational culture associated with a good working atmosphere and the positive employee relations.

Shaping positive employee relations, which are so important for young people entering the labor market, is a particularly difficult challenge for the management in the situation of remote work. This form of work, often forced by the COVID-19 pandemic, means work using means of direct remote communication, performed wholly or partially in a place indicated by the employee and agreed with the employer. The main organisational advantages of the remote work include, above all, an increase in organisational flexibility, a reduction in operating costs and a decrease in employee absenteeism. Remote work is also conducive to the employment of the disabled workers living in places far from industrial centers, as well as workers caring for children or other dependent persons. Another benefit for the employee is the flexible working time agreed with the employer (Sanchez et al., 2021; Pyöriä 2011). Apart from these unquestionable advantages, this form of work also has some drawbacks. People working remotely may feel that they are missing out on various meetings and discussions and therefore have less influence on making important decisions. In addition, remote workers, having limited contact with colleagues and superiors, have less chances of integration, support, sharing experiences and current observations, but also the exchange of knowledge. Remote work, impressing its specificity on employee relations, is not conducive to shaping the working atmosphere based on close ties and trust in colleagues, which makes it difficult to share knowledge (Hamilton 2002).

The exchange of knowledge between employees causes that it multiplies and each time gives rise to the possibility of new knowledge being created (Davenport and Prusak 2000; Mårtenson 2000, pp 204-216; Nielsen 2006, pp 59-71). When analysing the individual stages of the knowledge conversion process, particular attention is paid to the importance of the social competences of people involved in the process of sharing knowledge and creating informal organisational bonds (Lang 2001, pp 43-57; Heffernan 2019, pp 10-15). The exchange of knowledge is fostered by informal communication channels, free flow of thoughts and experiences between employees, organisational units, employees and superiors. It should be emphasized that knowledge cannot be treated as an individual resource of the employee, but as an organisational resource (Kukowska and Skolik 2021; Cichobłaziński 2021). It will become such a resource when it is available to all the employees, and therefore all the employees are ready to ask for it and share it at the same time. This poses great challenges for the management staff, which should solve such problems in a systemic manner, creating a work environment conducive to such attitudes and associated with the positive employee relations (Albrychiewicz-Słocińska 2020, p. 29).

3. Methodology

The study results presented in the study are part of a survey conducted at the turn of 2021/2022 among young people living in the Silesia voivodeship in Poland. The research problem of the project concerned the impact of the young people's experiences in the field of distance learning on their preferences in the field of remote work. The survey was conducted using quantitative research methods using the survey technique. In the surveys, the questionnaire was made available to respondents in a paper version (PAPI). A deliberate selection of the research sample was made - related to the availability of interviewees. The basic criteria for selecting the respondents were their age and education at university. The study covered young people studying various fields, because in relation to these people, due to their predispositions resulting from the generation's characteristics and professional competences, it is highly probable that they will use remote or hybrid work in the future.

The research tool used was a standardised questionnaire consisting of closed questions and statements. A Likert scale was used for the responses, which enables the relative intensity of the various responses to be determined. The research tool (the questionnaire) is original and was formulated by the members of the research team - the employees of the Department of Applied Sociology and Human Resource Management, the Faculty of Management, the Częstochowa University of Technology. The issues related to remote work were divided into several areas relating to: employee relations, knowledge, development and learning, motivation, communication, teamwork, creativity, work organisation and work-life balance.

This study presents an excerpt from the research results concerning employee relations. The aim of the survey is to analyse the opinions of young people about employee relations in remote work in the context of the knowledge exchange. As part of the research, the following main research problem was raised: How do young people perceive knowledge exchange as a factor shaping employee relations in remote work? The study also posed a number of detailed problem questions relating to employee relations and the exchange of knowledge and information in remote work.

STATISTICA software was used in the process of compiling the research results. The non-parametric ANOVA Kruskal-Wallis test was used to evaluate the significance of the differences in the analysed variables. Spearman's rank correlation coefficient was used to assess the strength of correlations occurring between variables.

For the purposes of analysing the results of the study, a number of statistical hypotheses were adopted regarding the occurrence of significant differences in the responses of the respondents due to their socio-demographic characteristics and experience in the field of work, as well as remote learning and remote work. It was assumed that H0 is a hypothesis that there are no differences due to the grouping variable, while H1 is an alternative hypothesis that there are such differences. These hypotheses were verified with the use of a statistical test, which allowed for the rejection of the null hypothesis about the lack of significant differences and the adoption of an alternative hypothesis about the existence of significant differences. The study presents the relationships verified with statistical tests, which authorise the conclusion about the regularities in the studied group.

4. Results of the research

226 people studying at 13 different faculties took part in the study. Among them, 50.44% were women, 48.23% were men, and 1.33% did not enter their gender in the questionnaire. Generation Z was dominant in the studied group (people born in 1995 and later constituted 83.19% of all respondents). Due to the fact that the statistical tests did not reveal statistically significant differences in the opinions of the Z representatives and other respondents regarding the analysed issues, the description and analysis of the research results will present the overall results without distinguishing between generation Z and older generation Y respondents.

The majority of respondents (86.73%) had experience in remote education (only 12.83% did not learn remotely, and 0.44% did not provide information on this issue). People with professional experience also dominated among the respondents (86.28%). Only 13.28% of the respondents did not have any professional experience, and 0.44% did not provide any information on this subject. On the other hand, work experience in remote work was declared by 48.67% of respondents (50.89% of respondents did not work remotely and 0.44% did not provide information on this subject). Moreover, the respondents declared that in the future they would like to work: stationary (35.4% of indications), hybrid (50% of indications), remotely (12.39% of indications), and 2.21% of respondents did not indicate any of the above employment options.

The information obtained from the respondents representing the Z generation allowed for the emergence of many interesting insights relating to the analysed issues. The question of employee relations in remote work directly related to the main research problem. As it results from the data obtained, the majority of respondents stated (53.54% of responses) that remote work hinders relations with colleagues. In this, 29.2% of the respondents rather agreed with such a statement, and almost every fourth respondent (24.34%) - fully agreed with it. Only 21.24% of the respondents had a different opinion, and the same number did not give an unambiguous answer on this matter. Opinions of the respondents from the generation Z regarding the relationship with the superior were similar. Half of the survey participants believed that remote work hampers relations with the superiors, 24.34% had the opposite opinion, and 22.12% did not express an unambiguous opinion on this statement. Importantly, the respondents, when asked whether remote work hinders relationships with the clients, also had a critical opinion on the impact of remote work in this area of employee functioning. However, their responses were not so clear, because although 37.16% of respondents said that remote work worsens the relations with clients, 30.98% of the respondents had a different opinion, and 24.34% marked the answer "neither agree nor disagree".

The statistical analysis conducted revealed that the opinions of the respondents regarding the impact of remote work on relations with colleagues were differentiated due to the preferred form of work (Kruskal-Wallis test results ($p = 0.0002$), with the adopted significance level ($\alpha = 0.05$) indicates the rejection of the verified null hypothesis). Survey participants who would like to work stationary in the future relatively more often (68.75%) than respondents preferring hybrid work (44.25%) and respondents opting for remote employment (17.85%) - critically assessed the impact of remote work on relationships with co-workers. On the other hand, respondents who believed that remote work was the best form of work - were much more often (53.57%) against the statement that the remote employment hinders relationships with colleagues than people opting for stationary work (7.5%) and people preferring hybrid work (29.2%). The respondents' assessments of the impact of remote work on the relationship with the supervisor were also differentiated due to the form of preferred work, and their distribution was very similar (AKW test $p = 0.0000$, $\alpha = 0.05$).

Additional light on this critical assessment of the impact of the remote work on employee relations is shed by the respondents' responses regarding other aspects of the impact of remote work on employee interaction. According to the results of the survey, almost half of the young people participating in the survey (49.56%) indicated that remote work hinders contacts between the employees (26.99% of respondents had a different opinion, and 20.8% did not give a clear answer on this matter). Even more, as many as 58.85% of the respondents stated that remote work also hinders non-professional contacts between the employees (16.82% of the respondents had a different opinion on this matter, and 19.91% did not give a clear answer). What's more, as many as 60.62% of the respondents emphasised that remote work makes it difficult to build emotional ties with colleagues. Moreover, according to half (49.56%) of the respondents, remote work limits the mutual support in difficult situations. Particularly noteworthy is the fact that the people participating in the study were the most unanimous in the statement that remote work leads to a feeling of social isolation (62.39% of responses).

The results of the statistical analysis show that the opinions of the respondents regarding the impact of remote work on building emotional ties with colleagues were differentiated due to their experience in remote work (AKW test $p = 0.0043$, $\alpha = 0.05$). The shaping of these ties was assessed much more critically by the young respondents who had no experience of working remotely (70.43%) compared to those with such professional experience (50.91%). The study of the significance of differences also shows that the respondents who wanted to work stationary in the future relatively more often (67.5%) than people who want to work hybrid (61.95%) and people preferring to work remotely (25.71%) indicated difficulties in building relationships between employees (AKW $p = 0.0243$, $\alpha = 0.05$). The representatives of generation Z who wanted to work stationary also more often (68.75%) than the respondents who preferred hybrid work (64.6%) and people opting for remote work (42.86%) emphasised the fear of being in danger of being isolated when working remotely (AKW test $p = 0.034$, $\alpha = 0.05$).

In the survey, the respondents were also asked whether remote work is conducive to shaping a good working atmosphere and building trust in relationships with the employees. These two aspects of the employees' functioning in the work environment have a significant impact on the creation of the positive employee relationships. The analysis of the data obtained in the survey shows that only a small percentage of respondents (16.36%), the same in both questions, confirmed the positive impact of remote work on the working atmosphere and trust between employees. Young people participating in the survey also indicated that remote work does

not help in building trust in relationships with employees (42.03% of responses). As shown by the results of the statistical analysis, the opinions of the respondents regarding the impact of remote work on building trust in relationships with employees were varied due to their experience in remote work (AKW test $p = 0.006$, $\alpha = 0.05$), but also due to their experience of remote learning (AKW test $p = 0.0385$, $\alpha = 0.05$). People declaring a lack of practice in remote work more often (46.09%) than young people with such experience (38.18%) stated that remote work does not help in building trust in relations with employees. Opinions of the respondents on this subject developed in a similar way, depending on the experience of remote learning they had. People who have never learned remotely much more often (68.96%) than people with experience of education in this form (38.27%) were critical about building trust in remote work. Therefore, it should be emphasised that both people without practice in remote work and people without the remote learning experience were more often of the opinion that when undertaking work in this form, it is difficult to build trust between employees. The statistical analysis also revealed that the declarations of young people participating in the survey - regarding their preferred job in the future - differentiated their statements regarding the impact of remote work on building trust in the employee relations (AKW test $p = 00106$, $\alpha = 0.05$) and statements related to shaping the work atmosphere (AKW test $p = 0.0002$, $\alpha = 0.05$). People who want to work stationary relatively more often (55%) than the respondents opting for hybrid work (36.28%) and remote work (28.57%) declared a critical assessment of creating trust between the employees working remotely. Very similarly, the small possibilities of shaping a positive atmosphere in remote work were seen most often by people who preferred stationary work (61.25%) in relation to the respondents choosing hybrid (43.36%) and remote work (28.57%).

In connection with the adopted aim of the research and the research problems related to it, in the survey, the respondents were also asked to comment on the statements concerning the impact of remote work on the exchange of information and knowledge exchange between the employees. The majority of young people participating in the study (57.07% of responses) indicated that remote work allows a quick information exchange (only 19.46% of respondents had a different opinion on this matter, and 19.91% did not give an unambiguous answer). The respondents had a similar opinion on the impact of remote work on the exchange of knowledge, although their opinions were not so unanimous on this issue. 41.14% of respondents believed that remote work was conducive to the exchange of knowledge between employees, however, 27.43% were of the opposite opinion, and 27.87% did not give a clear answer. The results obtained are puzzling in the context of the critical opinions expressed by the respondents regarding the influence of remote work on employee relations. This unequivocally negative assessment of the lack of direct contacts between the employees, typical for remote work, is in contradiction with the positive perception by the respondents of the impact of remote work with the knowledge exchange.

Studying this issue, as part of the statistical analysis, an attempt was made to determine the relationship between the variables using the Spearman's rank correlation index. The analysis of the level of dependence between the indicators regarding the impact of remote work on the exchange of knowledge and information between employees was made:

1. exchange of knowledge between the employees
2. exchange of information between the employees

and selected indicators describing the impact of remote work on the employee relations, which include:

1. contacts between the employees,
2. non-professional contacts between the employees,
3. shaping a good working atmosphere,
4. building trust in relations with the employees,
5. building emotional bonds with colleagues,
6. a sense of social isolation,
7. relations with colleagues.

Table 1 presents the values of the Spearman's rank correlation index, for the adopted significance level, which allow to find statistically significant correlations between the variables.

Table 1: Spearman's rank order correlation for selected variables at p <0.001

R Spearmana	(A)	(B)	(C)	(D)	(E)	(F)	(G)
(1)	-0,308212*	-0,189899**	0,339807*	0.275235 *	-0,177496**	-0,197944**	-0,211262**
(2)	-0,244638*	_	0,282761*	0,186709**	_	_	_

**p=0,001, *p=0,01
Source: own elaboration based on the research result

The analysis of the collected research material leads to the formulation of a number of interesting observations and conclusions. The first observation indicates that among the respondents who indicated that remote work creates a good working atmosphere, the majority also indicated that remote work is conducive to knowledge exchange and information exchange.

Spearman's rank correlation indices also prove that among the respondents who indicated that remote work builds trust in relations with employees, the majority also indicated that remote work is conducive to knowledge exchange and information exchange. From these two correlations, it can be concluded that people who have a good opinion about the impact of remote work on the employee relations are also convinced that remote work promotes the exchange of knowledge and information. Interesting is also the observed relationship that the respondents who believed that remote work favors the exchange of knowledge most often did not agree with the statement that remote work hinders contacts between the employees. This observation means that they have a positive opinion on remote work in terms of networking between the employees. This regularity also applies to other aspects related to generally understood employee relations, in particular: establishing non-professional contacts by employees, building emotional ties, feeling of social isolation and relations with colleagues.

5. Discussion

The research results of other authors, described in the literature on the subject, correspond with the presented survey results (Gill 2008; Bajaj, Sinha and Tiwari 2013). A very interesting study by Boyer O'Leary, Wilson and Matiu (2014) on remote work and the changes in the perception of the meaning of the concept of cooperation, closeness and interpersonal distance deserves special emphasis. The cited authors indicate that people can build strong ties and relationships despite being physically distant and working remotely. The quality of the relations with people at work does not depend on the physical distance between them, but on the subjective perception of this closeness. This symbolic closeness between remote colleagues develops as they share their personal experiences and exchange informal, personal information.

According to M. BoyerO'Leary, J. M. Wilson and A. Matiu, the perceived feeling of closeness has a huge impact on building relationships and the cooperation with other people, and the objective physical distance between people does not affect the quality of relationships built between them. At the same time, it should be emphasized that frequent communication between people working remotely not only brings a new dimension to their joint relationship, for example, sharing their own experiences, but also allows to predict the level of satisfaction of these people with the relationship they have built and their willingness to continue the contact. Thus, the research shows that remote work does not negatively affect cooperation or building relationships and the feeling of closeness in a team, if certain conditions are met.

6. Conclusions

The presented research results reveal interesting dependencies on employee relations and knowledge exchange between employees working remotely. According to the analysis of the data obtained from the survey, the majority of young people from generation Z believed that remote work hindered relations with both colleagues and superiors. They were especially critical of the impact of remote work on relations with colleagues and superiors - respondents who would like to work stationary or hybrid in the future. Therefore, it can be presumed that the reluctance of the respondents to work remotely in the future may result from the fear of the hindered employee relations. This conclusion is also confirmed by the statements of the respondents regarding other aspects of the employee relations. The young people participating in the survey also indicated that remote work hinders not only professional contacts, but also non-professional relations between the employees. Moreover, according to the respondents, remote work hinders the building of emotional ties with colleagues, limits the mutual support in difficult situations and leads to a sense of social isolation.

Negative assessments of the employee relations in remote work were also reflected in the opinions of the representatives of generation Z, regarding factors that are very important for them, which create the working environment, such as: the work atmosphere and trust between the employees. According to the respondents, remote work is not conducive to creating a good working atmosphere and does not help build trust in relationships with the employees. Importantly, both people without practice in remote work and people without experience of remote learning, more often than the respondents with such experience - indicated difficulties in building trust in remote work. Moreover, people who want to work stationary in the future - relatively more often than the respondents opting for hybrid and remote work - declared a critical assessment of creating trust between the employees and the possibility of shaping a positive atmosphere in remote work. These results lead to another conclusion that the lack of experience in education and remote work intensifies the concerns of the respondents about the difficulties in creating a positive atmosphere at work and trust among the employees working remotely.

In the light of such negatively assessed by the respondents - employment relationships in remote work - it is surprising that when asked about the exchange of information and knowledge in remote work, the majority of young people participating in the survey stated that this form of work not only enables a quick information exchange, but also it is conducive to the exchange of knowledge between the employees. When analyzing the presented results, a general conclusion arises that the management of the knowledge exchange processes, focusing on the identification of knowledge and people possessing it, is a factor which initiates establishing good employee relations, which are so important for the generation Z. This means that organisations that attach great importance to the management of the knowledge processes, as a result, not only stimulate the growth of knowledge and its dissemination, but also create an attractive work environment for the employees representing the generation Z.

References

Adler, R.B., Rosenfeld, L.B. and Proctor, R.F. (2011) Relacje interpersonalne. Proces porozumiewania się (Interpersonal relations. Communication process), Dom Wydawniczy REBIS, Poznań.

Albrychiewicz-Słocińska, A. (2020) Organizational Knowledge as an Element of the Innovation Climate in the TOP 500 Polish Enterprises, Proceedings of the 21st European Conference on Knowledge Management, eds. Garcia-Perez, A. and Simkin, L., Academic Conferences and Publishing International Limited, Reading, UK, pp 28-36.

Bajaj, R., Sinha, S. and Tiwari, V. (2013) "Crucial Factors of Human Resource Management for Good Employee Relations: A Case Study", International Journal of Mining, Metallurgy & Mechanical Engineering, No. 1(2), pp 90-92.

Blyton, P., Turnbull, P. (2004) The Dynamics of Employee Relations, Macmillan International Higher Education, New York.

Boyer O'Leary, M., Wilson, J.M. and Matiu, A. (2014) "Beyond being there: the symbolic role of communication and identification in perceptions of proximity to geographically dispersed colleagues", MIS Quarterly, Vol 38 Issue 4, pp 1219-1244, doi.org/10.25300/MISQ/2014/38.4.13

Brhane, H. and Zewdie, S. (2018) "A Literature Review on the Effects of Employee Relation on Improving Employee Performance" International Journal in Management and Social Science, Vol 6, No. 04, pp 66-76.

Carmeli, A. and Gittell, J.H. (2009) "High-quality relationships, psychological safety, and learning from failures in work organizations", Journal of Organizational Behavior, No. 30 (6), pp 709-729.

Cichobłaziński, L. (2021) Conflict Resolution as an Element of Knowledge Management in an Organization Based on Collective Disputes in Poland, Proceedings of the 22nd European Conference on Knowledge Management, eds. Garcia-Perez, A. and Simkin, L., Academic Conferences and Publishing International Limited, Reading, UK, pp 199-207.

Davenport, T.H. and Prusak L. (2000) Working Knowledge. How Organizations manage what they know, Harvard Business School Press.

Hamilton, E. (2002) Bringing Work Home: Advantages and Challenges of Telecommuting, Center for Work & Family.

Heffernan, M. (2015) Beyond Measure: The Big Impact of Small Changes, TED Books, Simon&Schuster, Inc.

Gill, Amarjit S. (2008) "The role of trust in employee-manager relationship", International Journal of Contemporary Hospitality Management, No. 20 (1) pp 98-103.

Glińska-Neweś, A., Sudolska, A., Wińska, J. and Furmańska-Maruszak, A. (2017) "How Positive Relationships at Work Stimulate the Innovation Orientation of Social Enterprises and For-Profit Organizations", Annales Universitas Mariae Curie-Skłodowska. Oeconomia, Lublin, No. 51(3), pp 25-37.

Kukowska, K. and Skolik, S. (2021) Wikipedia as a Space for Collective and Individualistic Knowledge Sharing, Proceedings of the 22nd European Conference on Knowledge Management, eds. Garcia-Perez, A. and Simkin, L., Academic Conferences and Publishing International Limited, Reading, UK, pp 459-466.

Lang, J.Ch. (2001) "Managerial concerns In knowledge management", Journal of Knowledge Management, Vol 5, No. 1, pp 43-57.

Mårtenson, M. (2000) "A critical review of knowledge management as a management tool", Journal of Knowledge Management, Vol 4, No. 3, pp 204-216.

Nielsen, A.P. (2006) “Understanding dynamic capabilities through knowledge management”, Journal of Knowledge Management, Vol 10, No. 4, pp 59-71.
Pyöriä, P. (2011) “Managing telework: risks, fears and rules”, Management Research Review, Vol 34, No. 4, pp 386-399.
Robak, E. (2017) “Expectations of generation Y connected with shaping the work-life balance. The case of Poland”, Oeconomia Copernicana, No. 8 (4), pp 569-584.
Robertson, K.M., O’Reilly, J. and Hannah, D.R. (2020) “Finding meaning in relationships: The impact of network ties and structure on the meaningfulness of work”, The Academy of Management Review, No. 45, pp 596-619.
Sanchez, D.G., Parra, N.G., Ozden, C., Rijkers, B., Viollaz, M. and Winkler, H. (2021), “Who on Earth Can Work from Home?”, The World Bank Research Observer, Vol 36, Issue 1, pp 67–100, doi.org/10.1093/wbro/lkab002.
Singh, A.P. and Dangmei, J. (2016). “Understanding the Generation Z: The Future Workforce”, South-Asian Journal of Multidisciplinary Studies, No. 3, pp 1-5.

The Wise Leader: Where did the Roads pave by Nonaka and Takeuchi lead to?

Raysa Rocha[1], Florian Kragulj[2] and Paulo Pinheiro[1]
[1]NECE Research Center in Business Sciences, University of Beira Interior, Covilhã, Portugal
[2]WU Vienna University of Economics and Business, Vienna, Austria
geaquinto.rocha@ubi.pt
florian.kragulj@wu.ac.at
pgp@ubi.pt

Abstract: Ikujiro Nonaka's contribution to the knowledge management (KM) field over the last decades is remarkable. His research has heralded major paradigm shifts (e.g., emphasis on tacit knowledge). In this regard, we can consider his widely received article – The Wise Leader in Harvard Business Review (May 2011) – as an attempt to develop KM towards a new direction. In it, Nonaka and Takeuchi introduce *phronesis*, i.e., practical wisdom, as a complementary source of knowledge and emphasize its importance for responsible leadership. A decade after its presentation, we aim to understand how their work has influenced subsequent research. Using VOSviewer software, we develop a bibliometric analysis of the research that follows the paths laid out by Nonaka and Takeuchi. Therefore, we searched the studies citing The Wise Leader on the *Scopus* database. The outcomes comprise 119 documents. We scrutinized the metadata – papers, journals, institutions, countries, authors, and keywords – applying a comparative approach – authorship, bibliographic coupling, citation, co-citation, and co-occurrence analyses. The results reveal that the concepts of *phronesis* and practical wisdom link knowledge management and leadership, supporting Nonaka and Takeuchi's stance on knowledge management as a primarily social endeavor whose success depends on personal capabilities and the enactment of (tacit) knowledge, both of which are mirrored in *phronesis*. We also find that the concept has hardly spread beyond the boundaries of knowledge management, leadership, and business ethics, although it has become interwoven with other concepts. Of these connections, those to non-rational forms of knowledge and values (e.g., spirituality, emotions, virtue ethics) may be of particular relevance to the further development of the knowledge management field. This is also reflected in the recently started discussion on *responsible knowledge management.* Moreover, we set an agenda for future research and offer contributions to theory and practice.

Keywords: Leadership, Practical Wisdom, *Phronesis,* Wise Leader, Responsible Knowledge Management

1. Introduction

The beginning of the 21st century is being marked by a number of global crises (Jones and Millar, 2010). Among them was the subprime crisis that was triggered by the sharp increase in high-risk mortgages that went into default beginning in 2007. In response to this crisis, Nonaka and Takeuchi (2011) turned to both practitioners and academics in their Harvard Business Review article, arguing that many companies were failing to be truly a "knowledge creating company". Analyzing the problem, they found that "many leaders use knowledge improperly, and most do not cultivate the right kinds" (Nonaka and Takeuchi, 2011, p. 59). Faced with this problem these authors argue that two important concepts have been sidelined by many knowledge management practices: *phronesis*, i.e., practical wisdom, and wise leaders, i.e., those who can judge goodness, can grasp the essence, create shared contexts, communicate the essence, exercise political power, and foster practical wisdom in others.

These wise leaders, also called phronetic leaders, always have in mind the people (in the organization or in the surrounding environment), trying to make them and those who work with them make decisions that benefit the whole, including people, the organization, its stakeholders, and society (Nonaka and Takeuchi, 2011). Thus, wise leaders must possess six abilities: (1) make decisions only after they figure out what is good for the organization and society; (2) quickly grasp the essence of any situation or problem and intuitively fathom the nature and meaning of people, things, and events; (3) constantly create informal as well as formal shared contexts for senior executives and employees to construct new meaning through their interactions; (4) know how to use metaphors and stories to convert the essence of their actual experiences into tacit knowledge for individuals and groups; (5) exercise political power to bring together people with conflicting goals and spur them to action; and (6) encourage the development of practical wisdom in others, especially employees on the front lines, through apprenticeship and mentoring (Nonaka and Takeuchi, 2011, p. 60).

This vision adds complexity to the already complex activity of managing knowledge, demanding from leaders much more than treating knowledge as one more resource, but integrating it into a set of actions that have to

be understood from a holistic and ethics-based perspective (Nonaka and Takeuchi, 2011, 2019). For researchers, too, the challenges have grown, and the approach to knowledge management as a set of tasks (mainly knowledge creation, memorization, sharing, and use, e.g., Jordan and Jones, 1997) has become insufficient. This brings a new dimension to the study of organizational wisdom, combining two perspectives: action capability and ethics. This study starts to have *phronesis* as a central element, where it is not enough to do the right thing, but to make it happen through the right values (do the right thing and do things right), *phronesis* becoming the consequence of the SECI model (Nonaka and Takeuchi, 2019).

However, the financial crisis did not remain the last global challenge. The COVID-19 virus triggered a pandemic (WHO, 2020) that is still troubling most parts of the world, and more recently we are witnessing a new tragedy with the war in Ukraine that could escalate into an energy crisis, a food crisis, or both. Considering the concept of wise leadership against the background of these more recent crises, it becomes evident that it remains a timely concept that highlights the role of leaders - for better or for worse. Wise leaders are those who profoundly understand and weigh anticipated outcomes before implementing appropriate actions. In other words, they not only have the desired future for the common good in mind but are guided by that vision when implementing actions. This power of practical wisdom is vividly reflected in the concerted response to the COVID-19 pandemic and the development of vaccines and drugs that have allowed an increasing normalization of life and economies in record time.

Given the importance of the concept of the wise leader and Nonaka and Takeuchi's (2011) foundational work on it, we aim to understand how their article in Harvard Business Review has influenced subsequent research in the first decade following its presentation. Therefore, we conduct a bibliometric analysis of the research that follows the paths laid out by Nonaka and Takeuchi.

2. Method and Analysis of the results

We conducted a systematic review searching for documents that cite *The Wise Leader* in the *Scopus* Elsevier database on March 4th, 2022. The outcomes comprise 119 sources, including book chapters, papers published in journals, and conference proceedings. The results cover all periods, all fields, and all languages. We did not exclude any documents. We acknowledge that other databases, e.g., *Scholar Google*, also present citations[1]. However, it is not possible to use the results in a bibliometric analysis using VOSviewer (van Eck and Waltman, 2010).

Using VOSviewer version 1.6.18 (van Eck and Waltman, 2010), we conducted a bibliometric analysis (Broadus, 1987; Zupic and Čater, 2015) of the research that follows the paths laid out by Nonaka and Takeuchi (2011). We scrutinized the metadata – documents, journals, organizations, countries, authors, and keywords – applying a comparative approach (e.g., Rocha and Ferreira, 2021) – authorship, bibliographic coupling (Total Link Strength – TLS), citation (Cit), co-citation, and co-occurrence analyses (see Table 1).

Concerning these analyses, we use citation analysis to uncover the most significant publications. Additionally, to evaluate the cited documents we use the co-citation analysis. Likewise, to perceive what are the most impacting documents we use the bibliographic coupling. Moreover, co-authorship provides the networks of institutions and countries. Furthermore, the co-occurrence analysis offers the thematic visualization of the results. Therefore, comparing these outcomes provides a comprehensive analysis of the documents citing *The Wise Leader*, enhancing the validity and overcoming bias limitations of choosing only one of them (van Eck and Waltman, 2010, 2014; Waltman, van Eck, and Noyons, 2010).

Figure 1 displays the citation evolution on *Scopus* from 2011 until 2021. After its publication, there was a growth in number of citations until 2014. Then, from 2016 to 2021, we see a steady number of citations per year. In the following sections, we comparatively examine each unit of analysis.

[1] The Wise Leader has 460 citations on Google Scholar. For more information, see: Google Scholar - The Wise Leader

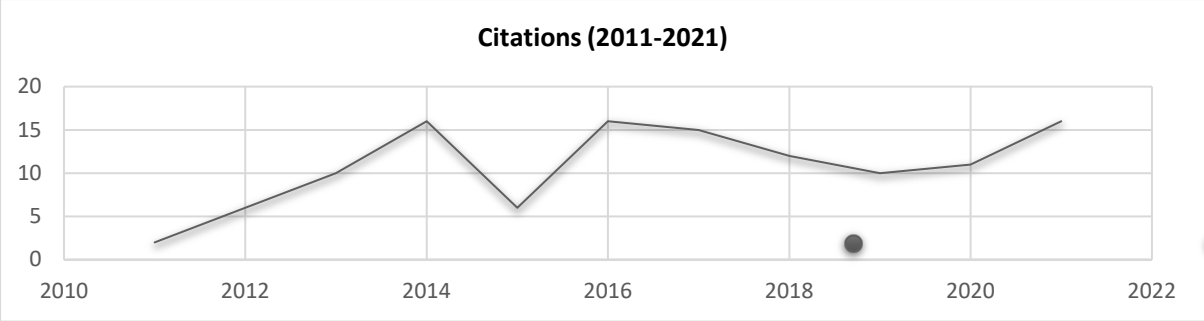


Figure 1: Citations by year

2.1 Sources

Using the default settings, we analyzed the sources in terms of co-citation, citation, and bibliographic coupling. Table 1 shows these results. The top sources are distinguished outlets and international conferences, e.g., *Academy of Management Journal*, *Journal of Business Ethics*, and the *European Conference on Knowledge Management*.

Table 1: Sources' citation, co-citation, and bibliographic coupling

Co-citation			Citation				Bibliographic coupling	
Source	**Cit**	**TLS**	**Source**	**Doc**	**Cit**	**TLS**	**Source**	**TLS**
Journal of Business Ethics	235	162.1	Academy of Management Journal	2	184	0	Journal of Business Ethics	46.81
Harvard Business Review	234	185.9	Management Learning	3	129	3	Wisdom Learning: Perspectives on Wising-up Business and Management Education	38.93
Academy of Management Review	123	110.4	European Management Journal	2	122	1	Proceedings of the European Conference on Knowledge Management	29.83
Organization Science	112	99.77	Journal of Business Ethics	6	76	2	Management Learning	26.59
The Leadership Quarterly	102	82.05	Advances in Intelligent Systems and Computing	4	28	0	Proceedings of the Annual Hawaii International Conference on System Sciences	25.92
Journal of Knowledge Management	94	67.03	Proceedings of the Annual Hawaii International Conference on System Sciences	2	24	0	Advances in Intelligent Systems and Computing	20.50
Strategic Management Journal	91	74.64	Faculty Development in the Health Professions: A Focus on Research and Practice	2	18	0	Wise Management in Organisational Complexity	13.67
Academy of Management Journal	79	73.11	Proceedings of The European Conference on Knowledge Management	5	5	1	European Management Journal	12.92
Business Ethics Quarterly	67	54.82	Knowledge Creation in Public Administrations	3	5	1	Knowledge Creation in Public Administrations	8.52
Organization Studies	67	61.50	Wisdom Learning: Perspectives on Wising-Up Business and Management Education	3	3	2	Faculty Development in The Health Professions	7.92

The sources in the citation analysis are those that cited *The Wise Leader*, e.g., *Academy of Management Journal* and *Management Learning*. While the sources in the co-citation analysis are the sources most cited in the references of our results, e.g., *Journal of Business Ethics* and *Harvard Business Review*. Conversely, the sources in the bibliographic coupling analysis share the most references, e.g., *Journal of Business Ethics* and the book *Wisdom Learning: Perspectives on Wising-up Business and Management Education*.

2.2 Documents

The results include articles (65), book chapters (23), conference papers (20), and others. They belong to a range of areas, namely, Business, Management and Accounting (68), Social Sciences (37), Economics, Econometrics and Finance (35), Computer Science (20), Decision Sciences (14), Arts and Humanities (13), Engineering (13), Medicine (5), Psychology (5), Mathematics (4), and others. Applying the default settings, we analyzed documents' citation, co-citation, and bibliographic coupling (Table 2).

Table 2: Documents' citation, co-citation, and bibliographic coupling

Co-citation		Citation		Bibliographic Coupling		
Cited Reference	**Cit**	**Document**	**Cit**	**Document**	**Cit**	**TLS**
Nonaka and Takeuchi (2011)	63	Donate (2015)	334	Shotter and Tsoukas (2014)	98	45
Ardelt (2003)	4	Dattee (2018)	138	Shotter *et al.* (2014)	79	39
Baltes and Staudinger (2000)	4	Nonaka *et al*. (2014)	117	Nayak *et al*. (2020)	25	26
Brynjolfsson and McAfee (2012)	4	Shotter and Tsoukas (2014)	98	Zacher *et al*. (2014)	39	21
Bynum (2006)	4	Shotter *et al.* (2014)	79	Nonaka *et al.* (2016)	32	19
Hoffer *et al*. (2002)	4	Spiekermann (2015)	48	Giudici *et al.* (2018)	46	18
Nonaka and Takeuchi (1995)	4	Giudici *et al*. (2018)	46	Küpers (2015)	27	16
Shotter and Tsoukas (2014)	4	Nonaka *et al*. (2014)	45	Nonaka *et al*. (2014)	45	13
Sommerville (2011)	4	Zacher *et al*. (2014)	39	Nonaka *et al*. (2014)	117	12
Storr (1988)	4	Dickson and Tholl (2014)	38	Donate (2015)	334	11

* Total Link Strength – TLS; citation – Cit

2.3 Authors

Using the default settings, we analyzed the authors in terms of co-citation, citation, bibliographic coupling, and co-authorship (Table 3). *The Wise Leader*'s authors continued to work on this topic (citations and co-citations). Likewise, Nonaka is the author who appears most in the corpus we analyzed (co-authorship). Moreover, the top authors have cited *The Wise Leader* at least in three different documents.

Table 3: Authors' citation, co-citation, bibliographic coupling, and co-authorship

Bibliographic			Citation		
Author	**Documents**	**Total Link Strength**	**Author**	**Documents**	**Citations**
Bassano, C.	3	182.32	Nonaka, I.	5	212
Piciocchi, P.	3	182.32	Spohrer, J.	4	45
Spohrer, J.	4	150.01	Kohda, Y.	3	28
Pinheiro, P.	3	128.58	Intezari, A.	3	27
Rocha, R.	3	128.58	Bassano, C.	3	25
Kohda, Y.	3	79.56	Piciocchi, P.	3	25
Kragulj, F.	3	47.34	Mckimm, J.	3	23
Nonaka, I.	5	29.9	Ozuem, W.	3	16
Intezari, A.	3	28.7	Fachrunnisa, O.	3	11
Scalzo, G.	3	16.98	Béranger, J.	3	6
Fachrunnisa, O.	3	10.84	Scalzo, G.	3	5
Béranger, J.	3	4.33	Kragulj, F.	3	4
Mckimm, J.	3	2.84	Pinheiro, P.	3	0
Ozuem, W.	3	1.33	Rocha, R.	3	0
Co-Authorship			**Co-Citation**		
Author	**Documents**	**Total Link Strength**	**Author**	**Citations**	**Total Link Strength**
Nonaka, I.	5	0	Nonaka, I.	326	227.47
Spohrer, J.	4	4	Takeuchi, H.	162	147.00
Bassano, C.	3	3	Toyama, R.	65	61.40
Béranger, J.	3	0	Rooney, D.	61	52.87
Fachrunnisa, O.	3	0	Mckenna, B.	54	49.45
Intezari, A.	3	0	Spohrer, J.	48	34.04

Kohda, Y.	3	2	Avolio, B.J.	45	38.31
Kragulj, F.	3	1	Tsoukas, H.	43	36.04
Mckimm, J.	3	0	Sternberg, R.J.	40	37.03
Ozuem, W.	3	0	Baltes, P.B.	37	32.75
Piciocchi, P.	3	3	Bass, B.M.	37	32.27
Pinheiro, P.	3	3	Staudinger, U.M.	36	32.36
Rocha, R.	3	3	Crossan, M.	30	23.48
Scalzo, G.	3	0	Von Krogh, G.	30	25.10

2.4 Organizations

Applying the default settings, we analyzed the organizations in terms of co-citation, citation, and bibliographic coupling (Table 4). The *University of Cyprus* is the most relevant organization concerning citations (177). Conversely, the *Japan Advanced Institute of Science and Technology* has the most publications (3).

Table 4: Organizations' citation, bibliographic coupling, and co-authorship

Co-Authorship			**Bibliographic**		**Citation**		
Organization	**Docs**	**Cit**	**Organization**	**TLS**	**Organization**	**Docs**	**Cit**
University of Cyprus, Cyprus	2	177	University of Cyprus, Cyprus	194.91	University of Cyprus, Cyprus	2	177
University of New Hampshire, US	2	177	University of New Hampshire, US	194.91	University of New Hampshire, US	2	177
University of Warwick, UK	2	177	University of Warwick, UK	194.91	University of Warwick, UK	2	177
Hitotsubashi University, Japan	2	162	Japan Advanced Institute of Science and Technology, Japan	67.43	Hitotsubashi University, Japan	2	162
University of Glasgow, UK	2	70	University of Glasgow, UK	60.38	University of Glasgow, UK	2	70
Japan Advanced Institute of Science and Technology, Japan	3	69	Hitotsubashi University, Japan	58.55	Japan Advanced Institute of Science and Technology, Japan	3	69
Hitotsubashi University, Japan	2	45	Hitotsubashi University, Japan	34.03	Hitotsubashi University, Japan	2	45
Royal Roads University, Canada	2	38	Department of Global Business, College of Business, Rikkyo University, Japan	21.98	Royal Roads University, Canada	2	38
Department of Global Business, College of Business, Rikkyo University, Japan	2	18	IBM Almaden Research Center, US	16.82	Department of Global Business, College of Business, Rikkyo University, Japan	2	18
IBM Almaden Research Center, US	2	17	Royal Roads University, Canada	5	IBM Almaden Research Center, US	2	17
Department of Management, Sapienza University of Rome, Italy	2	12			Department of Management, Sapienza University of Rome, Italy	2	12
Vienna University of Economics and Business, Austria	2	4			Vienna University of Economics and Business, Austria	2	4
Southampton University, UK	2	1			Southampton University, UK	2	1
NECE, University of Beira Interior, Portugal	2	0			NECE, University of Beira Interior, Portugal	2	0

Co-Authorship			Bibliographic		Citation		
Organization	**Docs**	**Cit**	**Organization**	**TLS**	**Organization**	**Docs**	**Cit**
Universidad Panamericana, Mexico	2	0			Universidad Panamericana, Mexico	2	0
University of Wales, UK	2	0			University of Wales, UK	2	0

* Total Link Strength – TLS; citation – Cit

2.5 Countries

Using the default settings, we analyzed the sources in terms of co-authorship, citation, and bibliographic coupling. The most relevant countries are the United Kingdom (25) and the United States (22). Their publications combined were cited by more than nine hundred documents. Conversely, countries from Africa, Central and South American are absent in the results, as well as from the Middle East.

Table 5: Countries' citation, bibliographic coupling, and co-authorship

Co-authorship			Bibliographic			Citation	
Country	**Docs**	**Cit**	**Country**	**Docs**	**Total Link Strength**	**Country**	**Cit**
United Kingdom	25	522	United States	22	846.98	United Kingdom	522
United States	22	385	United Kingdom	25	776.65	United States	385
Australia	12	87	Australia	12	309.82	Spain	346
Japan	11	272	China	6	239.52	Japan	272
Canada	7	87	Japan	11	225.41	France	154
China	6	25	France	6	215.84	Australia	87
France	6	154	Italy	6	210.28	Canada	87
Italy	6	31	Spain	5	167.77	Italy	31
Indonesia	5	11	Canada	7	167.5	China	25
Portugal	5	3	Portugal	5	113.56	Indonesia	11
Spain	5	346	Indonesia	5	53.73	Portugal	3

* Total Link Strength – TLS; citation – Cit

2.6 Keywords

Using the co-occurrence analysis of the authors' keywords, with a fractional counting method, we selected all 280 keywords, of these, only 211 have significant links and appears on the following figures. The normalization method selected was *fractionalization* with a cluster minimum size of five keywords. Figure 2 displays the network visualization. The distance between and size of the keywords indicate their relatedness and weight. For example, in the results, research on spirituality is not linked to research on corporate governance. Therefore, the network visualization displays the sparsity of the research that followed *The Wise Leader*.

Figure 3 displays the thematic evolution over the last years. The circles identify the previous clusters (Figure 2). Moreover, there is a diverse average year of publication in the clusters. Following, Figure 4 displays the density visualization, where *red/orange* indicates the high importance and the number of keywords nearby. Conversely, *light yellow/greenish* indicates the opposite, small number, and importance of the keyword nearby. Accordingly, research approaching knowledge management and leadership are the densest in the results.

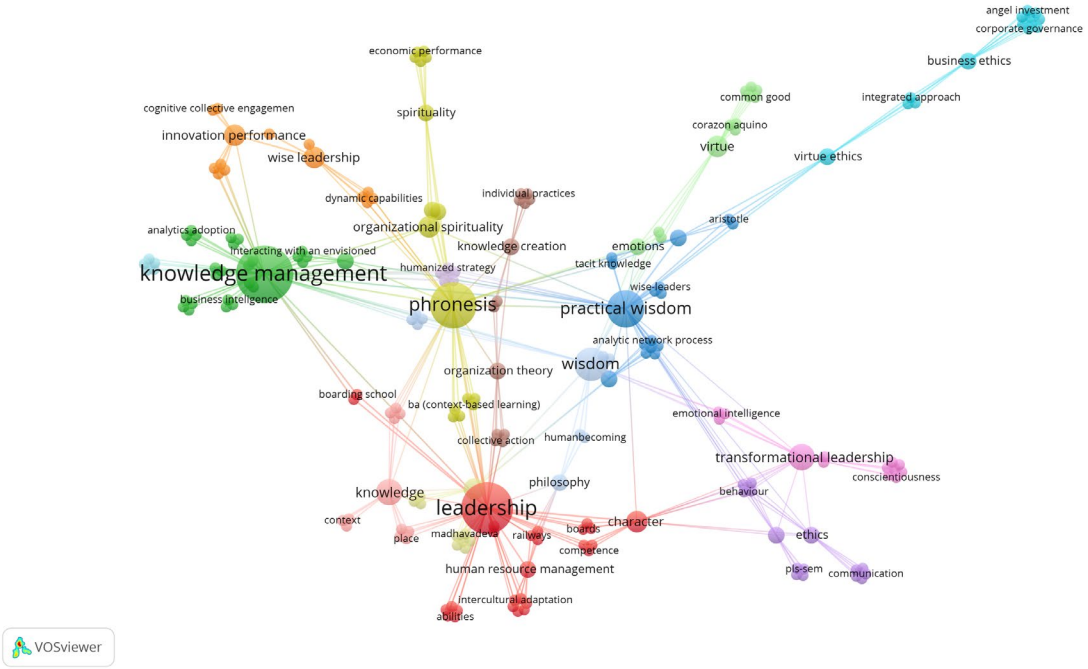


Figure 2: Network visualization by VOSviewer

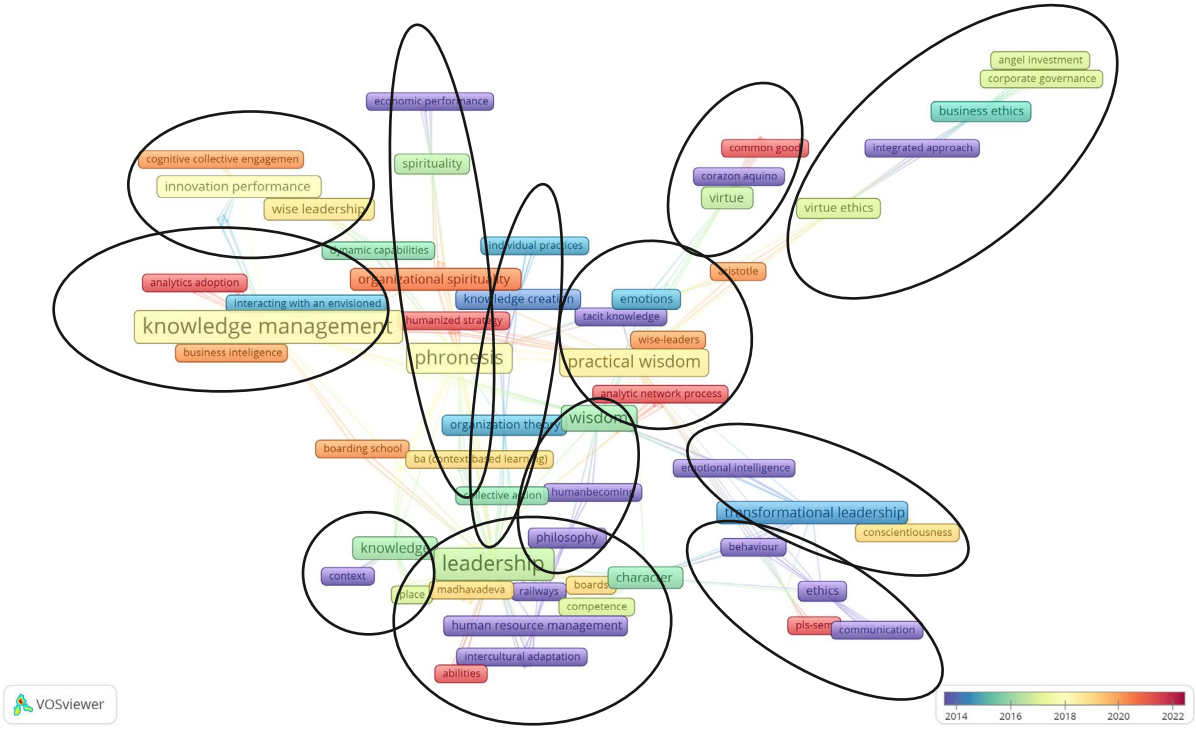


Figure 3: Overlay visualization by VOSviewer

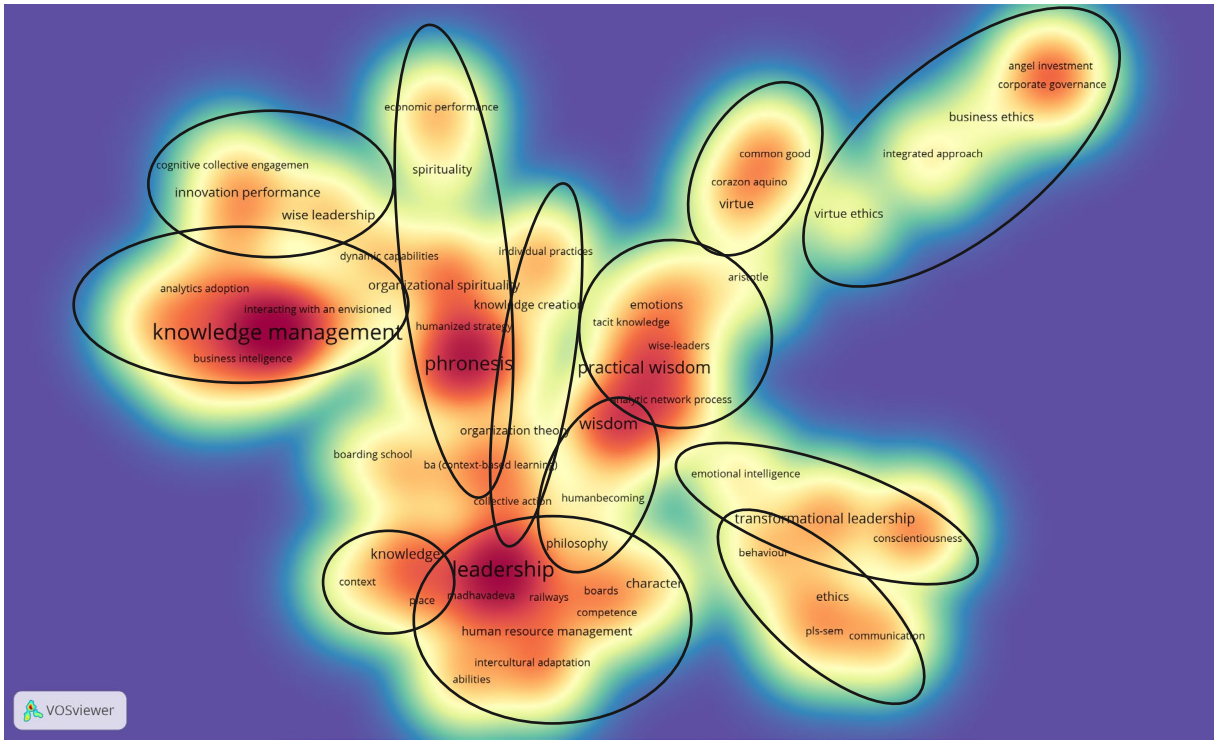


Figure 4: Density visualization by VOSviewer

3. Discussion

In the aftermath of the financial crisis, about ten years ago, Nonaka and Takeuchi (2011) outline their view of what makes a wise leader. Although the paper was published in *Harvard Business Review*, a prestigious journal that invites both practitioners and scholars to discuss contemporary issues in business and management, our analysis shows that the width of the paper's scholarly impact is limited. It has not significantly moved beyond the areas of knowledge management and leadership (Figure 4), which we initially expected to be different. *The Wise Leader* addresses a topic, i.e., *phronesis*, that has remained mostly discussed at the individual level; most sources refer to it as a personal capacity (e.g., Shotter and Tsoukas, 2014) or personality trait (e.g., Halverson, 2004). However, our analysis suggests that knowledge management is the gateway to shifting the concept to the organizational level (e.g., Rocha *et al.*, 2021; Schiuma *et al*., 2021).

In terms of the co-occurrence analysis (Figure 2), practical wisdom and *phronesis* are close but distinct concepts. This is surprising as the terms are often used interchangeably. Similarly, the concept of wise leadership is distant from both *phronesis* and practical wisdom, and even further from leadership. This finding indicates that wise leadership is considered a distinct concept in the literature. We find that fields that orbit around the central concepts of *The Wise Leader*, i.e., leadership and practical wisdom, are inspired by Nonaka and Takeuchi's work, but none builds on *The Wise Leader* or tests and evaluates its theoretical propositions. It appears that researchers implicitly take their theory as (empirically) granted.

Regarding the composition of the scholarly discussion that followed *The Wise Leader*, the analysis (Figure 2 and Figure 4) reveals that the discourse on *phronesis* and practical wisdom has emancipated itself from (business) ethics (Figure 2, blue-green cluster) and has become a field in its own right (central parts of the network), even if it is still interconnected. *Phronesis* links to (organizational) spirituality (Figure 2, yellow cluster), and a discussion has developed on related topics such as innovation performance, dynamic capabilities, or cognitive collective engagement (reflected by the yellow cluster in Figure 2).

From a temporal perspective, the discussion following *The Wise Leader* has gone through several phases that can be roughly divided into two-year periods (Figure 3). First, the discussion revolved around philosophy, ethics, and tacit knowledge, reflecting the (ancient) roots of *phronesis* (e.g., Beekun, 2012). Then, the discussion focused on knowledge creation, transformational leadership, and organizational theory. Around 2016 (Figure 3), authors mainly discussed *The Wise Leader* against the background of business ethics (e.g., Spiekermann, 2015),

leadership (e.g., Sturm, Vera and Crossan, 2017), and spirituality before turning to knowledge management, the wise leader, practical wisdom, and *ba* (shared context). The latest links are to spirituality (e.g., Rocha and Pinheiro, 2021), the common good (Meynhardt, 2019; e.g., Barile *et al.*, 2021), and humanized strategy (e.g., Nonaka and Takeuchi, 2021; Rocha, Kragulj and Pinheiro, 2022).

4. Conclusion

This research presented a bibliometric analysis of the publications citing *The Wise Leader* (Nonaka and Takeuchi, 2011). Nonaka and Takeuchi, as wildly renewed academics in the knowledge management field, introduced an insightful perspective on Leadership. Therefore, assessing its reverberation is a relevant matter to this evolving field. The major contribution of this research is the identification, the mapping, and the examination of research that has followed in the footsteps of Nonaka and Takeuchi in *The Wise Leader*.

The results reveal that the concepts of *phronesis* and practical wisdom link knowledge management and leadership, supporting Nonaka and Takeuchi's stance on knowledge management as a primarily social endeavor (Nonaka and Takeuchi, 1995) whose success depends on personal capabilities and the enactment of (tacit) knowledge, both of which are mirrored in *phronesis*. We also find that the concept has hardly spread beyond the boundaries of knowledge management, leadership, and business ethics, although it has become interwoven with other concepts. Of these connections, those to non-rational forms of knowledge and values (e.g., (organizational) spirituality, emotions, virtue ethics) may be of particular relevance to the further development of the knowledge management field. This is also reflected in the recently started discussion on *responsible knowledge management* (Durst, 2021; Rocha *et al*., 2022).

Despite its contributions, this research has limitations. The impossibility of merging databases to measure all research following *The Wise Leader* is the major limitation. Likewise, the bibliometric method itself has limitations, e.g., it is not possible to reach all research supported by *The Wise Leader* because the databases do not list all relevant publications. Concerning the suggestions for future research, besides extending the analysis to all *phronesis* related works of Nonaka and colleagues, our principal recommendation is the development of empirical research on the six characteristics of the wise leader using qualitative data in various cultures. Moreover, the link between *The Wise Leader* and the development of *responsible knowledge management* in organizations is an issue that should be addressed. Furthermore, organizational spirituality and spiritual leadership are topics that are seemingly related to wisdom. Then, understand how they behave in the organizations will bring a relevant perspective in this evolving thematic.

Acknowledgment

This work was supported by the NECE – Research Center in Business Sciences funded by the Multiannual Funding Program of R&D Centers of FCT – Fundação para a Ciência e Tecnologia, Portugal, under Grant UIDB/04630/2020.

References

Ardelt, M. (2003) 'Empirical Assessment of a Three-Dimensional Wisdom Scale', *Research on aging*, 25(3), pp. 275–324. doi: 10.1177/0164027503251764.

Baltes, P. B. and Staudinger, U. M. (2000) 'Wisdom: A metaheuristic (pragmatic) to orchestrate mind and virtue toward excellence.', *American Psychologist*, 55(1), pp. 122–136. doi: 10.1037/0003-066X.55.1.122.

Barile, S. *et al.* (2021) 'Empowering value co-creation in the digital age', *Journal of Business and Industrial Marketing*. doi: 10.1108/JBIM-12-2019-0553.

Beekun, R. I. (2012) 'Character centered leadership: Muhammad (p) as an ethical role model for CEOs', *Journal of Management Development*, 31(10), pp. 1003–1020. doi: 10.1108/02621711211281799.

Broadus, R. N. (1987) 'Toward a definition of "bibliometrics"', *Scientometrics*, 12(5–6), pp. 373–379.

Dattee, B., Alexy, O. and Autio, E. (2018) 'Maneuvering in poor visibility: How firms play the ecosystem game when uncertainty is high', *Academy of Management Journal*, 61(2), pp. 466–498. doi: 10.5465/amj.2015.0869.

Dickson, G. and Tholl, B. (2014) *Bringing leadership to life in health: LEADS in a caring environment: A new perspective*, *Bringing Leadership to Life in Health: LEADS in a Caring Environment: A New Perspective*. Springer London. doi: 10.1007/978-1-4471-4875-3.

Donate, M. J. and de Pablo, J. D. (2015) 'The role of knowledge-oriented leadership in knowledge management practices and innovation', *Journal of Business Research*, 68(2), pp. 360–370. doi: 10.1016/j.jbusres.2014.06.022.

Durst, S. (2021) 'A plea for responsible and inclusive knowledge management at the world level', *VINE Journal of Information and Knowledge Management Systems*, ahead-of-p(ahead-of-print).

van Eck, N. J. and Waltman, L. (2010) 'Software survey: VOSviewer, a computer program for bibliometric mapping', *Scientometrics*, 84(2), pp. 523–538. doi: 10.1007/s11192-009-0146-3.

van Eck, N. J. and Waltman, L. (2014) 'Visualizing Bibliometric Networks', in Y. Ding, R. Rousseau, & D. W. (ed.) *Measuring Scholarly Impact*. Cham: Springer International Publishing, pp. 285–320.

Giudici, A., Reinmoeller, P. and Ravasi, D. (2018) 'Open-system orchestration as a relational source of sensing capabilities: Evidence from a venture association', *Academy of Management Journal*, 61(4), pp. 1369–1402.

Halverson, R. (2004) 'Accessing, documenting, and communicating practical wisdom: The phronesis of school leadership practice', *American Journal of Education*, 111(1), pp. 90–121. doi: 10.1086/424721.

Jones, M. T. and Millar, C. C. J. M. (2010) 'About Global Leadership and Global Ethics, and a Possible Moral Compass: An Introduction to the Special Issue', *Journal of Business Ethics*, 93(SUPPL. 1), pp. 1–8.

Jordan, J. and Jones, P. (1997) 'Assessing your company's Knowledge Management style', *Long Range Planning*, 30(3), pp. 392–398.

Küpers, W. M. and Pauleen, D. (2015) 'Learning wisdom: Embodied and artful approaches to management education', *Scandinavian Journal of Management*, 31(4), pp. 493–500. doi: 10.1016/j.scaman.2015.08.003.

Meynhardt, T. (2019) *Public value: Value creation in the eyes of society*, *Public Value: Deepening, Enriching, and Broadening the Theory and Practice*. Taylor and Francis.

Nayak, A., Chia, R. and Canales, J. I. (2020) 'Noncognitive microfoundations: Understanding dynamic capabilities as idiosyncractically refined sensitivities and predispositions', *Academy of Management Review*, 45(2), pp. 280–303. doi: 10.5465/amr.2016.0253.

Nonaka, Ikujiro *et al.* (2014) 'Dynamic fractal organizations for promoting knowledge-based transformation – A new paradigm for organizational theory', *European Management Journal*, 32(1), pp. 137–146.

Nonaka, I *et al.* (2014) 'Wisdom, management and organization', *Management Learning*, 45(4), pp. 365–376.

Nonaka, I., Hirose, A. and Takeda, Y. (2016) ''Meso'-Foundations of Dynamic Capabilities: Team-Level Synthesis and Distributed Leadership as the Source of Dynamic Creativity', *Global Strategy Journal*, 6(3), pp. 168–182.

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge-creating company: How Japanese companies create the dynamics of innovation*. Edited by O. U. Press. Oxford.

Nonaka, I. and Takeuchi, H. (2011) 'The Wise Leader', *Harvard Business Review*, 89(5), pp. 58–67.

Nonaka, I. and Takeuchi, H. (2019) *The Wise Company: How Companies Create Continuous Innovation*. New York: Oxford University Press.

Nonaka, I. and Takeuchi, H. (2021) 'Humanizing strategy', *Long Range Planning*, 54(4), pp. 1–11.

Rocha, R. *et al.* (2021) 'Organizational phronesis scale development', in *Proceedings of the European Conference on Knowledge Management, ECKM*. Virtual, pp. 631–638. doi: 10.34190/EKM.21.085.

Rocha, R. G. and Ferreira, J. J. (2021) 'Gazelles (High-Growth) Companies: a Bibliometric Science Map of the Field', *Journal of the Knowledge Economy*, (0123456789). doi: 10.1007/s13132-021-00828-4.

Rocha, R. G., Kragulj, F. and Pinheiro, P. (2022) 'Practical wisdom, the (not so) secret ingredient for responsible knowledge management', *VINE Journal of Information and Knowledge Management Systems*, ahead-of-p(ahead-of-print). doi: 10.1108/VJIKMS-09-2021-0211.

Rocha, R. G. and Pinheiro, P. G. (2021) 'Organizational spirituality and knowledge management supporting organizational practical wisdom', *Spirituality Studies*, 7(1), pp. 68–83.

Schiuma, G. *et al.* (2021) 'The transformative leadership compass: six competencies for digital transformation entrepreneurship', *International Journal of Entrepreneurial Behaviour and Research*.

Shotter, John and Tsoukas, H. (2014) 'In Search of Phronesis: Leadership and the Art of Judgment', *Academy of Management Learning & Education*, 13(2), pp. 224–243. doi: 10.5465/amle.2013.0201.

Shotter, J and Tsoukas, H. (2014) 'Performing phronesis: On the way to engaged judgment', *Management Learning*, 45(4), pp. 377–396. doi: 10.1177/1350507614541196.

Spiekermann, S. (2015) *Ethical it innovation: A value-based system design approach*, *Ethical IT Innovation: A Value-Based System Design Approach*. CRC Press. doi: 10.1201/b19060.

Sturm, R. E., Vera, D. and Crossan, M. (2017) 'The entanglement of leader character and leader competence and its impact on performance', *Leadership Quarterly*, 28(3), pp. 349–366. doi: 10.1016/j.leaqua.2016.11.007.

Waltman, L., van Eck, N. J. and Noyons, E. C. M. (2010) 'A unified approach to mapping and clustering of bibliometric networks', *Journal of Informetrics*, 4(4), pp. 629–635. doi: 10.1016/j.joi.2010.07.002.

WHO, W. H. O. (2020) *Coronavirus disease (COVID-19) Pandemic*, *World Health Organization*. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (Accessed: 5 May 2020).

Zacher, H. *et al.* (2014) 'Leaders' Personal Wisdom and Leader-Member Exchange Quality: The Role of Individualized Consideration', *Journal of Business Ethics*, 121(2), pp. 171–187. doi: 10.1007/s10551-013-1692-4.

Zupic, I. and Čater, T. (2015) 'Bibliometric Methods in Management and Organization', *Organizational Research Methods*, 18(3), pp. 429–472. doi: 10.1177/1094428114562629.

Impact on the Transfer of a Management Model in the SMEs of Valle de Aburra, Colombia

Gastón Rodríguez, Jorge Betancur and Fredy Garcés
Facultad de Ciencias Empresariales, Institución Universitaria de Envigado, Colombia
Business school. University of Envigado, Envigado – Colombia
grodriguez@correo.iue.edu.co
jhbetancur@correo.iue.edu.co
jfgarces@correo.iue.edu.co

Abstract: The objective of the study is to show the impact of knowledge transfer from the university, using a model for business transformation in SMEs in Colombia. The research problem arose after making the diagnosis of each business enterprise, evidencing the need to strengthen its management model; by applying a business model designed for SMEs. For this purpose, the Research and Consulting Center (CIC) of The University of Envigado has designed and implemented a Management System for Business Transformation SIGET PROS. The methodology used was based on techniques for the collection and analysis of statistical information, making measurements before the transfer of knowledge and after the implementation of the transferred model. The SIGET PROS is characterized by immersion, which allows diagnostics to be made from within the companies and the construction of strategies, for each one of them, with a team of experts. The findings are presented in two complementary fields: 1) diagnosis of the initial results of each participating SME; and 2) a second diagnosis after the implementation of strategies, for the comparison of the results of appropriation of the transferred knowledge. The usefulness of the findings is in measuring the impact of the transfer of a management model (SIGET PROS), in a group of 50 SMEs. The conclusions indicate that the transfer of knowledge from the universities to the productive sectors allows achieving results that impact each SME.

Keywords: knowledge management, SMEs, Management Scanner, Management model, knowledge transfer.

1. Introduction

The interest in the study of SMEs arose after identifying the business enterprises factors in Aburrá Sur - Colombia, which resulted in the need to design and develop a model to transform and strengthen the management of this type of enterprises.

As an approach, The University of Envigado with its group of researchers took on the task of designing a business management model that would adjust to the needs and facts of SMEs. The objective of this work is to show the impact of the application of the SIGET-PROS, in 50 SMEs from different productive sectors, which took place between the years 2019 and 2021. The time of application of the model in all the SMEs was 10 months, clarifying that not all started the application process at the same time. The implementation of the model began with the collection and processing of information, through questionnaires, interviews and focus groups. The results were classified in the Management Scanner (EG), which allowed comparing the results between the first (EG1) and the second (EG2), after carrying out strategic projects. In the analysis of statistical results, the median was used, as it was a measure of central tendency. The conclusions on the impact of knowledge transfer from the university to SMEs evolved around the results obtained in the EG from the 50 intervened companies, which all showed an increase in their final measurement.

2. Theoretical Framework

Modern Society recognizes the importance of knowledge management as a fundamental resource for Society and organizations (Adelstein & Cleeg, 2014), due to its unlimited potential which contributes to the growth and innovation of companies (Soto, Colomo and Popa, 2014) and its competitive projection in the market (V.H. Lee, Foo, Leong, & Ooi, 2016). In this sense, the collective learning of the company's employee's stands out, which constitutes a competition strategy (Prahalad and Hammel, 1990).

Taking into account the previous concepts, knowledge management in organizations constitutes a human intellectual capital that has the capacity to transform it, through learning, socialization and implementation, creating new strategies and developments (Azyabi and Fisher, 2014). Consequently, knowledge management arises from within organizations, enabling the strengthening of the company's "know how", as a way of strengthening each of its processes.

When organizations prioritize knowledge management within their employees, they have a greater capacity for creativity and innovation, since they are the ones who have the potential to identify and develop new business perspectives, which, supported by information systems, systematize knowledge, nurtured as a continuous flow of capabilities, which trigger learning generated by the same members of the organization. (Kaiser, Kragulj & Grisold, 2016).

Zapata (2004), considers that there are four (4) attributes in knowledge management models that are key to its transfer within the organization: coding, ease of teaching, uncertainty and complexity.

The codification of knowledge is done through company employees who transfer their knowledge (Bueno, 2002), so staff must be trained to develop the ability to spread and share knowledge among all members of the organization. (Argote and Miron-Spektor, 2011).

According to Lewandowski, Salako, and Garcia (2013), the attribute provided by the knowledge transfer of management models is ease of teaching, but without codifying it, teaching remains in the individual and does not transcend the organization as "Know How" of procedures that promote the management of organizational innovation (Arias, Ó., Betancur, J and Rodríguez, G. (2017).

The uncertainty of knowledge refers to the fact that at the time of its transfer it can be ambiguous and even lose context when applied. To eradicate uncertainty, the integration of coding with teaching should be sought, so that the transfer process transcends the organization (Cegarra, J., Sánchez, M. & Cegarra, D. (2011).

Drucker (1993) recognizes the importance of the transfer of knowledge of organizational models, noting that it is a complex process and therefore poses it as a challenge for the executives of the organizations of the future. Senge (1990) indicates that organizations that learn and unlearn and rebuild their paradigms develop capacities to stay in the midst of change, functioning as a complex behavior system.

For more than 13 years of research, this business management model manages to consolidate itself, with design and architecture focused on the needs of Latin American SMEs, as a methodological tool that seeks to contribute to the transfer of knowledge within organizations.

Its structure was designed under the concept of business management model (Ortiz, & Pedroza, 2006) with systems and subsystems of the whole and the parts, made up in its business architecture by: People, Management, Structure and Environment. In turn, each dimension is displayed in 13 attributes; the attributes are displayed in 47 variables and these contain a group of 197 sub variables. The architecture of the model works with the interdependence between the Dimensions, the Attributes, the Variable and sub variables; so that a change in any of the previous components generates new states of order (Watts, 2002). This interaction between the parties operates as an organized whole (Prigogine & Stengers, 2002), enabling the intervention of SIGET PROS in companies, which is evidenced in the results of appropriation of knowledge transferred to Colombian SMEs.

3. Methods

The methodology used in the application of the knowledge management model in 50 SMEs is quantitative, qualitative and descriptive. An open invitation was made to SMEs from different productive sectors starting in 2019, the year in which 19 SMEs participated in the process. In 2020, 18 SMEs participated, and in 2021, 13 SMEs participated. All participating SMEs were the result of the open invitation.

Comparisons were made from the results Using the data, (Wolcott, 2003; Galeano, 2004) obtained in two measurements (EG1 and EG2) applied to each SME.

Scores were recorded in the EG taking the results of the interviews, questionnaires, focus groups and documentary review of each SME. The scores were assigned applying the GA characteristics described in Table 1.

The median was applied to the statistical data, as it is a more objective measure of central tendency than the arithmetic average. (Obando, J. 2007).

Table 1: Characteristics of the EG

The EG applies an information classification scale with 4 levels: Advanced, Viable, Alert and Risk

LEVEL	CHARACTERISTICS
ADVANCED	• These are characteristics of leading SMEs in their industry that create learning dynamics both within and beyond the company. They are constantly updated in all of their processes and make updates in systemic management methods. Its internal structure is dynamic, and high levels of worker participation are valued at all levels; they are a part of the changes at all levels, contributing positively to their economic sector's development. • These are high-quality features that demonstrate the company's success. • All of the characteristics that are considered to have a high grading, between 8 and 10, are listed here.
VIABLE	• Characteristics of SMEs that recognize the value of investing in long-term initiatives, attempt to integrate some areas, and preserve some communication routes to allow for the flow of ideas and proposals. They have some investment plans in place, as well as personnel training and technological investments. They keep the transition going by providing training, updates, and technology transfer at all levels. • They are qualified aspects with a score between 6.0 and 7.9, indicating that the company is performing well, but that it can always do better by implementing improvement plans.
ALERT	• Characteristics of SMEs with some opportunities for management engagement and limited outlets for the dissemination of innovative ideas; Few initiatives are being funded, and those that are, are currently in the short term. • These factors are scored between 4.0 and 5.9 because they reveal oversights in the company's various operations, which result in errors that reduce productivity and competitiveness.
RISK	• They are characteristics of SMEs that have a linear management style, with few open spaces for involvement, a few employees, and low management and modernization methods. • They are usually graded from 0.0 and 3.9, indicating oversights, poor procedures, and major errors, failures that leave a negative impression and worsen and threaten the company's viability.

The application of the knowledge management model lasted 10 months for all SMEs, during which time was implemented its architecture which is made up of Dimensions, Attributes and Variables that are integrated into the EG application.

The SIGET PROS uses a multi-criteria methodology that combines qualitative and quantitative criteria (Valenzuela-Jiménez, Giner-Fillol, & Ripoll Feliu, 2019), as well as a numerical score qualification assignment accompanied by descriptors that clarify and facilitate the analysis of results recorded in the EG. A committee of experts qualifies and classifies these quantitative and qualitative indicators, allowing for the evaluation and quantification of integrated project performance while also demonstrating knowledge transfer and strengthening for each SME.

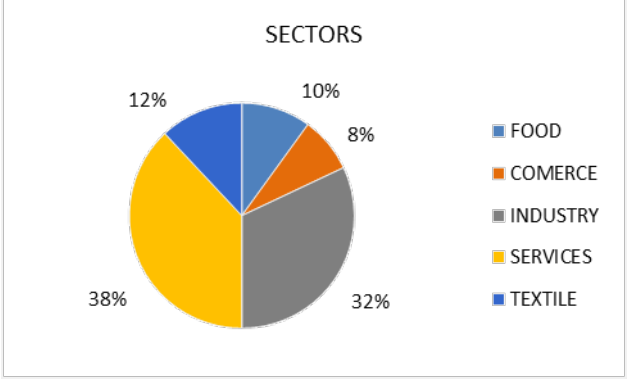
The SIGET PROS architecture is presented in the table 2:

Table 2: SIGET PROS architecture

DIMENSIONS	ATRIBUTES	VARIABLES
People	Human management	Organizational development; human talent development; social welfare
	Organizational Environment	Physical conditions; management style; rewards
	Organizational culture	Coexistence; communication
Structure	Finance	Internal funds generation; liquidity of the company; business cycle; business profitability vs. non-quality costs; fulfilment of the organizational strategic objectives.
	Technology	Clean technology; technological innovation; computer equipment; manufacturing technology or servo manufacturing; software
	Infrastructure	Strategic location; physical structure; space optimisation; security.
Management	Processes	Managerial; mission; support; assessment.
	Functions	Strategic; tactical; operational
	Institutional philosophy	Mission; vision; policies; principles and values
Environment	Political-legal	Legislation; tax and customs policies; business promotion policies
	Context	Clients; providers; competitors
	Social-environmental	National and international policies; local and departmental development plans
	International	Imports; exports

4. Findings and discussion

The SIGET PROS shows how changing one of the sub variables affects the variable, attribute, and dimension to which it belongs; as a result, a comprehensive intervention, that is, intervening in a variety of sub variables with integrated projects aimed at achieving knowledge transfer for each SME, is required (Rodriguez, G and Betancur, J. (2011). To that goal, strategic projects are developed to intervene in the organization at the sites highlighted in EG1, generating results from the SME at an early stage A. EG2 is used again in a second measurement to determine and quantify the rise in the SME's growth in moment B. Depending on the efficiency and resources utilized in the execution of strategic projects, 10 months can elapse between moments A and B. The use of the SIGET PROS in 50 SMEs over a three-year period (2019-2021) is used as a benchmark in this study.



Graph 1: Distribution of companies by sectors.

During this time, the monitoring process was carried out on the 50 participating SMEs, indicating that while not all of them began in the same year, an initial EG1 measurement was applied to all of them, transformation projects were designed, and developed over a ten-month period, at the end of which a second EG2 information

was collected to measure the impact on knowledge transfer. Graph 1 Distribution of companies by sectors, indicates that most of the companies participating in this research 19 SMEs (38%) belong to the services sector; It is followed in participation by the industrial sector with 16 SMEs (32%); with lower percentages are the textile sector with 6 SMEs (12%), the food sector, 5 SMEs (10%) and the trade sector with 4 SMEs (8%). All the companies are SMEs, legally constituted and located in Valle de Aburrá, Colombia.

Table 3: Distribution of SMEs by sector and years.

MEDIAN	2019	2020	2021
FOOD	18,39%	13,90%	25,15%
COMERCE		11,94%	19,16%
INDUSTRY	20,92%	9,77%	13,05%
SERVICES	21,11%	10,63%	6,18%
TEXTILE	18,66%	13,71%	

Next, the analysis of the impact of the results of the EG will be overviewed by years:

In 2019, the sector with the greatest impact (21.11%) was the service sector, closely followed by the industry sector (20.92%). The textile sector and the food sector had a very similar impact (18.66% - 18.39%). This year no company in the commerce sector was intervened.

All sectors presented a positive impact on their results. The food and textile sectors had the highest impact (13.9% - 13.71%), followed by the trade and services sectors (11.94% - 10.63%); and the one with the least impact was the industry sector (9.77%). The confinements caused by the pandemic (year 2021) slowed down the impact and dynamism in the application of the EG in SMEs.

In reference to the year 2021, a growth in the application of the EG is observed, even higher than the year 2019 before the pandemic, in the food sector that presents the greatest rebound (25.15%) followed by the commerce sector (19.16%). In the industry and services sector, a decrease is observed compared to 2019, caused by the slow recovery of these sectors in the post-pandemic. This year there was no implementation of the EG in any SME in the textile sector. In general terms, it is highlighted that in the three (3) years in which the EG was applied, there was a growth in its results.

4.1 Diagnosis results (EG)

The procedure starts with a diagnostic tool called (EG), which is described as an instrument that "allows assessing and detect the transit processes of a strategic trajectory" (Limone, & Marinovic, 2013). The company's strategic initiatives are used, as well as evaluation tools that reflect progress on the projects' development. For this, an information collecting system is used, which allows for the measurement of each of the sub variables' behaviour from the time of diagnosis (EG1) through the implementation phase of the integrated projects and the completion of the established plans.

It is clarified that the results presented in EG1 and EG2, where the median was used as a measure of central tendency and not the mean, since the median is a descriptive measure that has the advantage of not being affected by extreme data, It does not depend on the values that the variable takes, but on the order of them. The median is a middle position statistic that divides a distribution into two halves, leaving the equal amount of values on either side. (Obando, J. 2007).

Taking the characteristics of the EG as a reference, the results are presented in the Table 4:

Table 4 demonstrates that due to the integration of their processes, human training, and an increase in internal demand, SMEs in the food sector progressed from the Alert level (5.81) to the Viable Level (6.65), representing a significant growth of 14.52 %. The commerce sector increased from 6.22 to 7.11, indicating a 14.22 % increase in the impact of knowledge transfer, owing to the expansion of management and technological innovation in information systems, which aided its growth.

Table 4: Results of EG 1 and EG 2.

MEDIAN	EG 1	EG 2
FOOD	5,81	6,65
COMERCE	6,22	7,11
INDUSTRY	6,28	7,10
SERVICES	6,41	7,64
TEXTILE	6,22	7,18

The industry sector increased from 6.28 to 7.11, with a 14.98 % increase in the impact of knowledge transfer, driving its production factor primarily due to an increase in internal demand, producing transformation dynamics, and implementing technology transfer at all levels. Colombia's industrial performance outperforms that of other economies in the region (Andi, 2021).

The services sector increased from 6.41 to 7.64, with an increase of 18.16% in the impact of strengthening knowledge, making it the sector with the biggest growth recorded in both this study and the economy monitoring index - ISE. (Andi, 2021).

In summary, when comparing the results of EG1 and EG2, the services sector grew the most in terms of the impact of knowledge transfer (18.16 %), followed by the textile sector (16.07 %), and a growth that was fairly evenly distributed across the industry (14.98 %), food (14.52 %), and commerce (14.22 %) sectors.

Table 5: Strengthening SMEs by Dimensions

SECTOR	GENERAL	PEOPLE	MANAGEMENT	STRUCTURE	SETTING
FOOD	14,52%	14,72%	21,92%	12,68%	12,59%
COMERCE	14,22%	14,71%	14,85%	10,75%	12,92%
INDUSTRY	14,98%	13,35%	16,92%	15,22%	14,51%
SERVICES	18,16%	14,87%	10,56%	12,11%	13,97%
TEXTIL	16,07%	14,82%	17,75%	14,98%	17,79%

Regarding the results of the SIGET PROS by Dimensions, comparing EG1 and EG2, it is observed:

The Management Dimension had the biggest impact on knowledge transfer, accounting for 21.92 % in the food sector, 17.75 % in the textile sector, and 16.92 % in the manufacturing sector. The rearrangement of SMEs' production and administrative processes, as well as the adoption of integration methods at all levels: managerial, tactical, and operational, reinforced management.

In the case of the People dimension, there was a comparable influence on knowledge transfer between sectors, with 14.87 % of the service sector and 13.35 % of the industry sector. In the food and service sectors, there is less strengthening (2.94 % for each one). This component included staff training to consolidate and develop their abilities and skills, as well as a follow-up and subsequent evaluation of the skills obtained by each SME's personnel.

In terms of the Structure Dimension, the impact of knowledge transfer was strongest in the industry sector (15.22 %), followed by the textile sector (14.98 %), which is closely related to the previous sector. The food and service industries were similar (12.68 % and 12.11 %). This sector has established strategies aiming at good manufacturing practices, such as employing non-polluting raw materials, reducing waste, and recycling unused raw resources.

The textile industry (17.79 %) has the biggest impact on knowledge transfer, followed by the industrial sector (14.51 %), and the service sector (13.97 %), with the commerce and services sector (13.97 %) performing evenly (12.92 % and 12.59 %). Alliances with suppliers were used by SMEs in this industry to avoid excessive increases in raw material prices, to stay competitive in the market, and to grow the number of clients.

4.2 Discussion of the results.

The analysis of the results is presented in the next section, which is done in light of previous studies to provide a variety of references.

Santos-Ferreira et al. (2021) indicated that in industrial enterprises it was possible to verify that the acquisition of knowledge had a positive impact, similar to this Research, since in both studies the enterprises were impacted by the acquisition of knowledge.

Voronov and Lavrinenko (2014) investigated the impact on subjective and objective indicators of competitiveness in SMEs; concluding that transferring and using knowledge in enterprises is considered a competitive advantage. In both investigations, a positive correlation has been established between knowledge management and the competitiveness of enterprises.

Jia, Kang and Gao (2016) design a model to solve problems in the aerospace industry; their model has 5 properties: input definition, reference material, associations, design support and modification element. This work is similar to the present investigation where the characteristics of common problems that need to be solved with the model are identified. Both (Jia, Kang and Gao, 2016 and this research) design management models to solve business problems.

The study of (Surya et al., 2021) examines economic growth as a determining factor in the strengthening of SMEs, in combination with factors such as government policies, capital support in business, and the strengthening of human resources; it is a mixed research methods (MMI) study with quantitative measurements and qualitative descriptions, showing results on the impact of the variables listed in the EG. As a result, the research discussed in this article enables us to identify the outcomes of the techniques applied as part of the SIGET PROS design.

Surya et al. (2021) identified the needs of each SME when doing fieldwork; the current study does so as well. While the aforementioned survey simply reflects the requirements and possibilities of SMEs, the work done in this project results in an intervention with proof of impact. According to Surya et al (2021), growth is only achieved in specific areas; however, growth is realized in all sectors (Table 5) and all engaged SMEs in this project.

Vargas-Garcia et al. (2019) conducted research to identify the impact of internal and external influences on the companies under consideration; a similar study was conducted in this study. Vargas-Garcia et al. (2019) demonstrated activities that must be taken in order for governmental and non-governmental groups to build action plans. This study, it carried out an intervention in the SMEs involved in the project, with the goal of strengthening, as indicated by the measurements acquired (Table 5)

Menne et al. (2022) developed a study focused on improving the performance of SMEs through the implementation of a strengthening model (sharia fintech) that strengthens marketing, human resources, productivity, and finances; this is a population-based study (Makassar, Indonesia), demonstrating the positive impact that the implementation of a government model (sharia fintech) has on strengthening the business enterprise of SMEs. Both studies (Menne et al., 2022 and this study) reflect the impact on strengthening SMEs with a focus on a variety of areas and understand the effect that the intervention of some variables has on the other variables of the business architecture. Both studies demonstrate the favorable impact of model implementation in all sectors and in all companies; both studies reflect the impact on strengthening SMEs with a focus on sustainability over time.

As a result, the cited studies highlight the importance of identifying the external and internal factors that influence SMEs' growth, causing negative consequences in some regions; similarly, the contrasted studies support the current investigation in the positive impact of actions aimed at strengthening, particularly when tools with a holistic approach are used to address various areas or dimensions of SMEs.

5. Conclusions

The results show that the transfer of knowledge of management models contribute to the strengthening of SMEs. The comparison of the findings of EG1 and EG2 reveal the impact of the transfer of the management model (SIGET PROS) in 50 SMEs in the Aburrá Valley, Colombia.

The impact of knowledge management transfer from the university to SMEs, through the application of the management model (SIGET PROS), is evidenced in the results obtained in the EG from the 50 intervened companies, in which all present an increase in its final measurement during the three (3) years, regardless of the surrounding circumstances. The results show that the business model contributes to the strengthening of this type of enterprise. (Betancur, J., Rodríguez G. and Rave, E. (2019).

The findings of EG1 and EG2, backed up by research, reveal that the SIGET PROS had a beneficial influence on knowledge transfer in all 50 SMEs that used it, contributing to their growth and survival in a highly competitive market.

This research, which was developed with the participation of entrepreneurs and with the support of local governments and the region's Chamber of Commerce, indicates that management models can be developed that are tailored to the specific context of regions and countries, contributing to the strengthening of the business enterprise of SMEs.

The entropy in which SMEs find themselves as a result of the growing influence of risk factors (OECD, 2020) necessitates that research and knowledge production centers focus their efforts on the construction of tools based on SMEs' expertise, the region's fabric production, and the countries' capabilities.

References

Adelstein, J., & Clegg, S. (2014). And rewind. Recycling discourses of knowledge work and knowledge society. Management & Organizational History, 9(1), 3-25. https://doi.org/10.1080/17449359.2013.821023

ANDI (2021). Informe De Gestión 2020-2021. http://www.andi.com.co/uploads/INFORME%20ANDI%202020-2021%20FINAL_compressed.pdf

Argote, L.and Miron-Spektor, E. (2011). "Organizational Learning: From Experience to Knowledge". *Organization Science* , *22*(5), 1123–1137.

Arias, Ó., Betancur, J and Rodríguez, G. (2017). "Tacit Knowledge Management in Colombian SMEs". In: Moffett, S. and Galbraith, B. *Proceedings of The 17th European Conference on Knowledge Management*. Ulster University Northern Ireland. Academic Conferences and Publishing International Limited.

Azyabi, N. and Fisher, J. (2014). "Exploration and Exploitation as Knowledge Management Strategic Approaches in Saudi Arabian SMEs", Proceedings of the 25th Australasian Conference on Information Systems Exploration and Exploitation as KM strategy in SMEs.

Betancur, J., Rodríguez G. and Rave, E. (2019). "Soluciones Logísticas Enviexpress S.A. La urgencia de la planeación estratégica en una pyme familiar". En: Rave-Gómez, E.D. (2019). *Análisis de casos empresariales: Una perspectiva para enfrentar los desafíos gerenciales*. ISBN: 978-958-52468-7-4. http://bibliotecadigital.iue.edu.co/jspui/handle/20.500.12717/1689.

Bueno, E. (2002). Creación y gestión del conocimiento en las organizaciones: la era de los intangibles. IADE-CIC.

Cegarra, J., Sánchez, M. & Cegarra, D. (2011). "Balancing exploration and exploitation of knowledge through an unlearning context: An empirical investigation in SMEs", *Management Decision*, v. 49, n. 7, pp. 1099-1119.

Druker, P. (1993). La sociedad poscapitalista. Norma.

Jia, Q.; Kang, L. and Gao, X. A (2016). "Design Rational Knowledge Model Supporting Configuration Management in Aerospace Product Development". *In: Moffett, S. and Galbraith, B. Proceedings of The 17th European Conference on Knowledge Management.* Ulster University Northern Ireland. Academic Conferences and Publishing International Limited.

Kaiser, A., Kragulj, F. and Grisold, T. (2016). "Taking a Knowledge Perspective on Needs: Presenting Two Case Studies Within an Educational Environment in Austria". *The Electronic Journal of Knowledge Management*, Volume 14, Issue 3, Following ICICKM / Aug, pp. 115-127.

Lewandowski, J., Salako, A. and Garcia, A. (2013). "SaaS Enterprise Resource Planning Systems: Challenges of Their Adoption in SMEs", Proceedings of the 2013 IEEE 10th International Conference on e-Business Engineering, pp. 56-61.

Limone, & Marinovic, 2013). The Theory of the Organization and the New Paradigms. Journal of Business and Management 01(02):30-38. DOI:10.4236/ojbm.2013.12005 https://www.researchgate.net/publication/275995598_The_Theory_of_the_Organization_and_the_New_Paradigms

Menne, F.; Surya, B.; Yusuf, M.; Suriani, S.; Ruslan, M.; Iskandar, I. "Optimizing the Financial Performance of SMEs Based on Sharia Economy": Perspective of Economic Business Sustainability and Open Innovation. J. Open Innov. Technol. Mark. Complex. 2022, 8, 18. https://doi.org/10.3390/ joitmc8010018

Obando, J. (2007). Revista de pedagogía ISSN: 0798-9792 Universidad Central de Venezuela. Caracas – Venezuela. https://www.redalyc.org/pdf/659/65908305.pdf

OCDE (2020). Perspectivas económicas de América Latina 2020. OCDE-CEPAL-UNIÓN EUROPEA. https://www.oecd.org/dev/Perspectivas-economicas-America-Latina-2020-Resumen.pdf

Ortiz, & Pedroza, (2006). Sistema de gestion y de Innovación en la Pyme. Journal Technology Management and innovation. https://www.researchgate.net/publication/26446915_Que_es_la_Gestion_de_la_Innovacion_y_la_Tecnologia_GInnT

Prahalad and Hammel, 1990. The Core Competence of the Corporation. This article is reprinted with permission from the Harvard Business Review, 1990.

Prigogine, Il, and Stengers, L. (2002) La nueva alianza Metamorfosis de la ciencia. Versión Española. Revisión de la nueva edición: Diego Rasskin Gutman. Cuarta reimpresión de la segunda edición en «Alianza Universidad»: 2004.

Rodriguez, G and Betancur, J. (2011) Diseño de Modelo de Gestión para PYMES. Institución Universitaria de Envigado, Envigado. http://bibliotecadigital.iue.edu.co/jspui/bitstream/20.500.12717/1820/4/RI-IUE_Fondo_Editorial_Dise%c3%b1o%20Modelo%20Gestion%20Pymes.pdf

Santos-Ferreira, V.H.; Ascensão, Marques, A.M.; Espirito-Santo, P.M. and Fernandes-Da Silva, S. (2021). "The Influence of Knowledge Management on the Result of Innovation of Companies in the Mold Industries". Retrieve in: Garcia-Perez, A. ECKM 2021 22nd European Conference on Knowledge Management. Coventry University.

Senge, P. (1990). The fifth discipline: The Art and Practice of the Learning Organization, Doubleday, New York.

Soto, P., Colomo, R. and Popa, S. (2014). "Web knowledge sharing and its effect on innovation: an empirical investigation in SMEs", Knowledge Management Research & Practice, n. 12, pp. 103-113.

Surya, B.; Menne, F.; Sabhan, H.; Suriani, S.; Abubakar, H.; Idris, M. "Economic Growth, Increasing Productivity of SMEs, and Open Innovation". *J. Open Innov. Technol. Mark. Complex*. 2021, 7, 20. https://doi.org/10.3390/joitmc7010020.

V.H. Lee, Foo, Leong, & Ooi,. 2016. . ¿Se puede lograr una ventaja competitiva a través de la gestión del conocimiento? Un estudio de caso sobre las PYME. Sistemas Expertos con Aplicaciones , 65, 136-151. https://www-ucsiuniversity-edu-my.translate.goog/lee-v-h-foo-t-l-leong-l-y-ooi-k-b-2016-can-competitive-advantage-be-achieved-through-nowledge?_x_tr_sl=en&_x_tr_tl=es&_x_tr_hl=es&_x_tr_pto=sc

Valenzuela Jiménez, L. F., Giner Fillol, A. y Ripoll Feliu, V. (2019) «Una propuesta metodológica para la gestión integral de los puertos marítimos», Criterio Libre, 17(30), pp. 257–277. doi: 10.18041/1900-0642/criteriolibre.2019v17n30.5822. https://revistas.unilibre.edu.co/index.php/criteriolibre/citationstylelanguage/get/apa?submissionId=5822&publicationId=5143

Vargas-Garcia, L.M; Perdomo-Jacanamejoy , J.D.; Hernandez-Cordoba, M.A.; Gomez-Lopez, J. M. "Factors that influence the competitiveness of SMEs in the commerce and services sector in the Municipality of Palmira, Colombia". *Problems and Perspectives in Management*, Volume 17, Issue 4, 2019. https://orcid.org/0000-0002-2367-9832.

Voronov, V. and Lavrinenko, O. (2014) "Knowledge management and the incresase of SME competitiveness: a case study". *Baltic region*. 2014. No 3 (21). P. 22—32. https://www.researchgate.net/publication/279274838.

Watts, D., (2002). "A Simple Model of Global Cascades on Random Networks". *Proceedings of the National Academy of Sciences* 99(9):5766-71. DOI:10.1073/pnas.082090499.

Wolcott, H. (2003). Mejorar la escritura de la investigación cualitativa, Editorial Universidad de Antioquia, Medellín.

Zapata, L. (2004). Los determinantes de la generación y la transferencia del conocimiento en pequeñas y medianas empresas del sector de las tecnologías de la información de Barcelona (Tesis doctoral). Universidad Autónoma de Barcelona. Barcelona, España. Recuperado de http://www.tesisenred.net/handle/10803/3955

Advancing Urban Regeneration Projects for Sustainable Development and Intellectual Capital

Mauro Romanelli[1], Maria Ferrara[1], Concetta Metallo[2], Rocco Reina[3], Luisa Varriale[4], Marzia Ventura[3], Walter Vesperi[3] and Filomena Buonocore[5]
[1]Department of Business and Economics, University of Naples "Parthenope", Naples, Italy
[2]Department of Science and Technology, University of Naples "Parthenope", Naples, Italy
[3]Department of Law, Economics, and Sociology, University of Catanzaro "Magna Graecia", Catanzaro, Italy
[4]Department of Sport Science and Wellbeing, University of Naples "Parthenope", Naples, Italy
[5]Department of Law, University of Naples "Parthenope", Naples, Italy
mauro.romanelli@uniparthenope.it
maria.ferrara@uniparthenope.it
concetta.metallo@uniparthenope.it
rreina@unicz.it
luisa.varriale@uniparthenope.it
marziaventura@unicz.it
vvesperi@unicz.it
filomena.buonocore@uniparthenope.it

Abstract: The study aims to investigate how urban regeneration projects contribute to achieving sustainable development through an intellectual capital (IC) perspective for driving growth within urban communities and improving quality of life. Literature has shown that urban regeneration projects help support urban change. The IC helps drive sustainable development and competitiveness of regions, cities and communities. Urban regeneration projects contribute to better quality of life and drive social and economic renewal of urban communities. This exploratory study proposes a research framework addressed to join urban regeneration projects with IC view on cities and urban communities. This paper can contribute to the extant literature focused on the relationship between urban regeneration processes and the role of intellectual capital as driver of sustainable development. This qualitative study, using a multiple case study methodology, provides a comparative analysis of two urban regeneration projects that help the redevelopment of urban environments and support human and social capital within communities. The findings show that urban regeneration projects significantly contribute to revitalising urban spaces, supporting the components of IC that drive social and economic growth of communities.

Keywords: urban regeneration projects, sustainable development, intellectual capital

1. Introduction

Today, urban regeneration is advancing as a key issue for urban change and sustainability. Promoting urban regeneration projects helps rethink a second life for marginalised urban spaces and declining neighbourhoods. Urban regeneration projects help for sustainable urban development without compromising the natural environment by equally managing social, environmental and economic dimensions (Korkmaz and Balaban, 2020). Sustainable urban regeneration projects concern economic, social, environmental and physical issues (Yau and Chan, 2009). Neighbourhoods do matter for neighbourhood satisfaction (Neal, 2021). Urban regeneration projects help to address a pathway for sustainable neighbourhood (Blanco, Raskin and Clergeau, 2022). As a means for urban policy (Griffiths, 1995), urban regeneration projects help drive urban change and development, improving economic and social conditions of urban spaces (Roberts and Sykes, 2000). Specifically, urban regeneration supports sustainable development, improving urban healthy growth and quality of life, and environmental regeneration (Couch and Denneman, 2000). Promoting sustainable development relies on urban regeneration projects that support social capital and community engagement (Kim, Newman and Jang, 2020; McDonald, Malys and Maliene, 2009; Deakin and Allwinckle, 2007) and empower the community to actively contribute to local transformation (Piber, Demartini and Biondi, 2019). Achieving sustainable urban development relies on urban regeneration projects that revitalise villages and neighbourhoods as communities,

driving partnerships and collaborative ways for social and economic innovation (Neal, 2003; Evans and Jones, 2008; Banks and Shenton, 2001), strengthening local community participation (Cento Bull and Jones, 2006).

Understanding how urban regeneration processes contribute to sustainable urban development helps to address the fourth stage of intellectual capital (IC) within social ecosystems (Dumay, 2013). The component parts of IC concern human, relational and organisational resources as emerging within urban regeneration processes that contribute to building social capital and shaping healthy and safe communities. IC helps to drive organisations, communities and cities to support for sustainable development. IC plays a key role for urban competitiveness, reputation and sustainability (Alfaro-Navarro, López-Ruiz and Peña, 2017). The future of IC develops within urban ecosystems. IC is the major factor for economic growth within communities (Dumay, 2013; Bonfour and Edvinsson, 2005; Ståhle and Bonfour, 2008). IC supports for urban community development within knowledge economy (Bonfour and Edvinsson, 2005). Recently, the IC scholarly perspective is looking at the fourth stage of IC that focuses on the benefits for regions, communities and cities within knowledge economies (Charzkel, 2006), and «combines human, relational and structural capital into a new vision that considers the social aspect of IC» (Secundo, Del Vecchio, Dumay and Passiante, 2017, p. 8). Following the fourth stage of IC, the knowledge is emerging by the dialogue between the organisations and their ecosystems (Bonfour and Edvinsson, 2005; Dumay and Garanina, 2013).

This study aims to investigate how urban regeneration projects contribute to shaping sustainable urban development pathways and advancing IC perspective. For this reason, the following research question (RQ) was formulated. RQ: can urban regeneration pathways have a direct impact on the development of IC within the urban context? Using a multiple case study methodology, in this qualitative study two case studies in the Southern Italy (Campania and Calabria Regions) have been analysed and compared. While some studies focus on the role of IC within urban communities and cities, and exam how urban regeneration processes contribute to urban development and social capital, only few studies combine both an urban regeneration view and IC perspective in understanding the dynamics of urban regeneration pathways as drivers of urban development by urban projects of redevelopment and social renewal within urban environments and neighbourhoods.

The remainder of the study is structured as follows. Section 2 provides a literature review and background on urban regeneration meaning and IC perspective. Section 3 briefly describes the methodology adopted. In the Section 4 short description and main results about the two case studies investigated are presented and discussed. Finally, Section 5 outlines main implications and conclusions.

2. Literature review

2.1 Urban regeneration and sustainability

Urban regeneration helps drive urban policy and growth (Griffiths, 1995) to solve urban problems, enhance community participation and reinforce social capital (Cento Bull and Jones, 2006), enabling collective public-private actors' efforts to improve the quality of life within communities. Urban regeneration is viewed as a long-term, strategic and continuous process driving urban change and development (Roberts and Sykes, 2000), fostering social sustainability, community development, innovation and communication (Evans and Jones, 2008).

Achieving sustainable development goals relies on revitalising villages and neighbourhoods, reinforcing the community meaning and social capital within urban settlements (Neal, 2003). Urban regeneration initiatives contribute to sustainable development for healthy growth and quality of life improvements (Couch and Denneman, 2000). Urban regeneration projects support participatory and community engagement within urban spaces (Biondi *et al.*, 2020). Sustainable urban regeneration processes improve quality of life and develop urban growth, driving social and organisational capacity through collaborative spaces involving public and private actors (Healey, 1995). Urban regeneration projects open up to social capital development, civic value and community participation, making environmentally-friendly settlements as villages and neighbourhoods, following a community-led view for sustainable urban transformation (Deakin, 2009; Deakin and Allwinckle, 2007). Creative urban regeneration helps to develop hub of innovation and creativity (Da Cunha and Selada, 2009). Viewing sustainability as a shared territory supports multi-actor commitment and stakeholder creativity in order to develop «long-term regeneration project which has kept all of its major stakeholders on-board while radically transforming social, economic, and environmental standards» (Evans and Jones, 2008, p. 1428). Urban regeneration projects support social cohesion, enabling a participatory framework, empowering the community

to actively participate in the local transformation process, supporting social capital building, innovation issues and local stakeholder engagement (Piber, Demartini and Biondi, 2019). Smart urban regeneration projects develop on local identity, territorial vision, collaboration and dialogue within communities (Huston, Rahimzad and Parsa, 2015). The academic debate on urban regeneration is still in infancy and with a multidisciplinary approach. In fact, an increasing number of studies focused on critical success factors for urban regeneration projects (Yu and Kwon, 2011; Mavi and Standing, 2018) and on public-private collaboration (Calabrò and Della Spina, 2019). Consequently, this variety of perspectives causes difficulties in framing the phenomenon. At the same time, there is a literature gap on the role of IC in the urban regeneration project.

2.2 Intellectual capital within urban environments

IC embraces any valuable intangible resource gained through experience and learning to produce further wealth (Marr and Moustaghfir, 2005). IC develops in some components (Marr, 2007): skills and competencies of people (human capital); relationships with customers and other stakeholders (relationship capital); organisational culture, routines and practices (structural capital). IC refers to hidden values of individuals, enterprises, institutions, local communities as potential sources of value creation consisting of intangible resources available that provide future benefits (Bontis, 2004). While the third stage of IC focuses on strong organisations, and the value incorporates worth and importance of services for stakeholders (Dumay, 2009), «the fourth stage concentrates on building strong economic, social and environmental ecosystems» (Dumay, 2013, p. 8) and «combines human, relational and structural capital into a new vision that considers the social aspect of IC» (Secundo, Del Vecchio, Dumay and Passiante, p. 8), enabling organisations to evolve in a sustainable way. The knowledge created by communities develops within social ecosystems (Dumay and Garanina, 2013). The IC view for communities, regions and cities strengthens the collective action within and around organisations (Bonfour, 2005). Investing in knowledge assets to drive value creation processes helps to restore the social relationships' value and develop knowledge capital of communities and collective intelligence within social systems, fostering intangible resources to develop social growth and cohesion of communities (Bounfour and Edvinsson, 2005). Managing IC helps drive community development, social and economic growth of cities and regions. IC plays a key role in advancing sustainable development (Secundo, Ndou, Del Vecchio and Pascale, 2020). Managing IC helps drive value creation and enable intangible assets within urban spaces (Viedma, 2004). IC is viewed as a driver of sustainability and urban competitiveness (Matos and Vairinhos, 2017; Ståhle and Bounfour, 2008), improving quality of life and developing communities (Alfaro-Navarro, López-Ruiz and Peña, 2019). IC is a critical factor for urban competitiveness. Human capital (individual and collective competences, and community social values), relational capital (community and organisations' networking, city partnership and image) and structural capital (organisational resources, processes and innovation) are the components of IC framework for cities (Uziene, 2013). Literature highlights the role of IC for urban spaces but does not clearly analyse how urban communities help advance an IC view to social and economic growth.

3. Methodology

This qualitative and exploratory study adopts a multiple case study methodology (Yin, 2009), indeed, two case studies emerging from urban regeneration projects developed in the Southern Italy (Campania and Calabria Regions) have been investigated describing the process through which the phenomena take place (Taylor et al. 2011). To investigate and compare the two specific experiences we use several techniques to collect data and information. Specifically, primary and secondary data sources have been used, we collect data and information through websites, archival data analysis (internal documentation, reports, etc.), social network page analysis and in-depth interviews (members of the board of directors interviewed via the Google MEET platform). Regarding the in-depth interviews, we carry out semi-structured interviews, where we prepared a list of predetermined questions based on previous studies, mentioned above, on the topic investigated, that is specific question regarding ways, actions and measures for promoting urban regeneration following IC view. Also, during the interviews to the main actors involved in both urban regeneration projects, that is the main coordinator for each project and the responsible persons for each organisation involved in both projects as organisational units with regards to specific network collaboration created. Data collection and information about the case studies under observation occurred in 2018 and 2022. This procedure helps to describe the process through which urban regeneration and IC can develop. Analysing case studies helps to clarify both the similarities and differences in the approach used in the two urban regeneration projects and the variety of solutions leading to social and economic issues that enable urban development towards sustainability. Specifically, the methodology based on case studies refers to research concerning the relationships between the issues drawn by urban regeneration projects and the impact on IC as related to urban development and benefits for communities (McDonald, Malys and Maliene, 2009; Piber, Demartini and Biondi, 2019). Indeed, analysing a case study helps to clarify the role of

urban regeneration projects for advancing sustainable urban development (Korkmaz and Balaban, 2020). Studying a case drawn by urban neighbourhood aims to highlight regeneration strategies and interventions. Case studies help to outline the advancements in urban regeneration planning and implementation (Schenkel, 2015). This technique helps to ensure appreciable information and develop a deep understanding of the cases study in addition to leading to sound scientific conclusions. It is also a tool for doing evaluation (Yin, 2009; Reischauer, 2015). Following Yin's (2009) guidelines that ensure the regularity of the construct, planning, and execution of the case study, this methodology aims to provide a comprehensive understanding of the phenomenon at hand without the rigidity of a predefined structure for observations and analysis.

4. Case study analysis: description and results

4.1 Case studies

4.1.1 Case study NPO "XXX"

In January 2018, the non-profit organisation "XXX" (NPO "XXX") was founded by the initiative of three under 35-year-olds. The association's headquarters is in a small historical village in the hinterland of one of the Southern Italian regions. Historical village has a population of over 7,000 inhabitants with an average age of over 62 (demoistat, demo.istat.it). Historical village consists of an urban agglomeration made up of four rural communities. The social and economic context of the historical village is characterised by a socially weak population, both for territorial requirements and for socio-health assistance. NPO "XXX" was created with the aim of assisting and taking care of the "weak" sections of the population (elderly, disabled and poor) through the enhancement of culture. In June 2018, he was granted a concession by the religious authorities of places in a historical building. The historical building is characterised as a partially used building complex. Some parts of the property have historical value, as they date back to the beginning of the last century. The places granted to the NPO "XXX" had been in disuse for over 15 years, and therefore, not used for any activity. It has now been revalued in some parts and made available again to the community.

Two places are for the exclusive use of NPO "XXX". The first place is 20 sqm and the second is 8 sqm. The places managed by the NPO "XXX" have been equipped with various technological assets and equipment (e.g., 3D printers, PC workstations, laser engraver, cutting plotter, CNC milling machine). The NPO "XXX" has additional places available in common with the religious authority (e.g., meeting room). Within this historical building, the NPO "XXX" has launched various training activities with the aim of carrying out activities to promote culture and the recovery of arts and crafts through the use of the most advanced technologies. The various training activities allowed the non-profit organisation to significantly increase the number of members and especially the number of beneficiaries of the activities. The training courses are created and managed by members and volunteers.

The training courses were held in the premises made available to the ecclesiastical authority. During the Lockdown phase, the NPO "XXX" produced Personal Protective Devices using its own equipment and a group of volunteers from the historical village (Table 1). Specifically, over 1000 plexiglass visors and ear protectors were produced using the 3d printer.

Table 1: The main training activities carried out by the NPO "*XXX*"

Training activity denomination	Main contents	Target	Training hours	Technological assets
Robotics engineering	Arduino-based open-source robot design	12-15 years old	12 hours in three days	Arduino micro controller, Thinkercad Circuit, Modules for sensors and various electronic components, Robot kits
Arduino	Introduction to micro controllers, electronics and electrical engineering to use Arduino	University students	6 hours in two days	Arduino micro controller, Thinkercad Circuit, Sensor modules and various electronic components
Welding base	Introduction to electrical engineering, electronics and Printed Circuit Board Manufacturing Process	University students	4 hours in one days	Welding Equipment and Accessories

Graphic (Beginner level)	Basic Photoshop commands, interface and main tools for creating graphics and advertising posters.	High school students	8 hours in two days	Photoshop Software
3D printing	3D object design with Thinkercad and Cura. Transfer to 3D printer and realization of the print.	No condition	8 hours in two days	3D printer, 3D pens, 3d design software

Source: own elaboration

4.1.2 Case study SMAC Project

The activities of SMAC Project have begun in March 2022. SMAC, the project's name, indicates School Museum of Ceramic Art for emphasising the recovery and reuse of the old building of the former Art school of Calitri, partially renovated with public funds.

SMAC born for providing specialist knowledge for the protection, enhancement and innovation of local traditions linked to the production of terracotta and ceramics, for supporting the development of national and international markets through the driver of the "Città della Ceramica" (City of Ceramics), with a synergistic approach with respect to the production context local.

Calitri is a small historical village on top of the hills of High Irpinia (Italy, Campania region), with about 4.000 inhabitants. The Antico Borgo is in the oldest section of the village, at the top of which are the remains of a castle that predates the 12th century. The Borgo is a labyrinth of historic houses that have, over the centuries, been built into the hillside. Following the earthquake in November 1980, its inhabitants have started to leave the area and the Borgo has only been partially rebuilt. For the clays present in the soils of its territory, this area has seen a proliferation of the work of potters since the IV century B.C. The first local artisans were highly educated and respected people, and those who made pottery stood out in a special class. They were called "Faenzari" because they came from the village of Faenza. Unfortunately, with the great emigration, this millenary practice has gradually disappeared and, to date, there are few laboratories that produce the processing of this material. Despite this, the trend of recent years has seen an increasingly frequent return to these ancient traditions.

Smac is a fablab, a collaborative space that, also thanks to the training courses present, allows makers to live experiences of co-design and production of products. In this collaborative space, users can study or collaborate in various co-working initiatives, such as to encourage the birth of digital startups or 3D crafts, and offers a series of services for the community.

Within SMAC take place and self-construction and co-design experiences for the continuous redevelopment of the building. This place will be the subject of analysis and study in order to place this experience, with proposals for re-setting and redevelopment of internal and external spaces, not only in the training field but also as an example of urban regeneration. In fact, self-construction and co-design are of the elements of greater protection and safeguarding of projects, investments and sustainability of the initiatives implemented especially in fragile communities.

One of the project's aims is to bring out the heritage of handcrafted products, created by professors and students of the former Art school of Calitri since 1959, and share it with the local community, through participatory action by students and citizens.

Moreover, the SMAC acts as knowledge intermediaries, contributing to the enhancement and protection of local manufacturing traditions, linked in particular to the production of terracotta and ceramics, through the definition of actions aimed at the creation, sharing and preservation of knowledge and the development of relationships with institutions, professionals, hobbyists and sector operators. SMAC allows enhancing traditions, processing techniques linked to ancient crafts and local knowledge that generally are transmitted between generations through the sharing of working practices.

The SMAC has undertaken further initiatives aimed at enhancing the local context such the definition of tourist routes for improving knowledge of the places of art, terracotta and ceramics of Calitri, providing e-bikes for users, in line with the objective's environmental sustainability as well as cultural enhancement of the territory.

The training activities offered by the SMAC aim to train the figure of the Designer 4.0. Through a multidisciplinary course, divided into theoretical-practical modules and innovation workshops, students will deepen the historical, anthropological, aesthetic aspects of local productions, will develop methodological and practical aspects of traditional and digital design and production, with the advanced methods and tools of visual communication, from graphics, to photography, to video-making.

Finally, the SMAC also provides an area with free access with co-working stations and areas for leisure and socialization of users, which will find expression in bars and space for accommodating cultural events. The future development of the activities provides a municipal library on production of terracotta and ceramics and a communication centre of the design product.

Therefore, the SMAC Calitri aims to become a hub of the City of Ceramics, acting as a driver for urban, economic, and social regeneration.

Table 2: The main services offered by the SMAC Project.

Services for the community	Description
Self-construction and co-design experiences	The old building of the ex Art school of Calitri, today named SMAC, will be the subject of analysis and study with proposals for re-setting and redevelopment of internal and external spaces.
Cultural heritage enhancement	Enhancement of the ceramics made since 1959 by professor and students of the former art school
Preservation of knowledge and practices	Local manufacturing traditions, linked to the production of terracotta and ceramics, are preserved through the sharing of working practices.
Local context enhancement	A tourist-thematic itinerary with e-bikes that allows knowing place of art and ceramics
Training activities for Designer 4.0	The knowledge transfer takes place through practical and theoretical activities, in which the learner performs the direct actions of knowledge, such as cataloging, transfer of objects, their analysis, acquiring collateral notions to the objects but necessary for their enhancement.
Events	Thematic exhibitions, multimedia productions, urban graphics projects, performances, etc. Students, citizens and other local realities will be involved according to the activities that will be identified.
Co-working and socialization	Co-working stations where makers can live experiences of co-design and production of products, and spaces of aggregation for citizens

Source: own elaboration

5. Discussion and conclusions

The regeneration projects for the case studies investigated have been developed in very small historical villages in the Southern Italy. As social infrastructures both projects contribute to more sustainable local development, following an integrated vision and action (Roberts, 2000). Both experiences focus on the development, preservation, and transfer of knowledge about local practices and traditions of the specific territory, “ceramics art” (handcrafted art), strengthening the local identity within the community. Moreover, these projects offer a varied range of services to meet several social needs within small villages characterised by geographical, economic and social isolation, and typically geographically dispersed micro-enterprises and a limited supply of essential services. These municipalities are not easily accessible and far from urban centres and infrastructures, being located in mountainous areas or on the smaller islands, which characterise most of the Italian territory. However, historical villages help preserve historical-cultural heritage and landscape, promoting alternative lifestyles and fostering the development of innovative economic and social models between tradition and contemporaneity. Findings show that these projects allow to remove (or reduce) some factors of social hardship such as the absence of meeting places, access to basic services (health, education and mobility), urban decay and the inadequacy of network infrastructures for Internet access. These factors generally characterise the most disadvantaged areas, such as the municipalities of the rural areas and small villages.

Furthermore, the results show that urban regeneration projects help driving IC as an enabler of sustainable development, supporting the growth of human, social, cultural, and organisational capital within urban communities. Urban regeneration pathways can trigger the diffusion of new IC through the launch of training

projects. Urban regeneration projects contribute both to new knowledge assets for the development of IC within communities and drive social and economic issues within communities, improving the quality. Urban regeneration projects work as training centres of human capital. The study can provide social, organisational, and managerial implications. Urban regeneration projects support local community involvement and development, reinforcing social capital. Urban regeneration projects help to enable knowledge sources and organisational capabilities that involve all the stakeholders and the organisations involved in the urban regeneration process. Successful urban regeneration relies on public-private partnerships as organisational and collaborative frameworks that support urban development and regeneration strategies. This study presents some limitations. First of all, it is a first step of a multi-step analysis on ongoing project. In fact, the SMAC project has not yet started. Thereby, the expected results of this project focus on developing source and competences that relate urban regeneration to social and economic growth and IC capital. Thereby, some trends are emerging. The pathway leading to urban regeneration as an engine of social and economic sustainable development is still in infancy too. Further research perspectives imply to consider more case studies in the analysis and develop much more in-depth interviews with actors involved in urban regeneration projects.

References

Alfaro-Navarro, J.-L., López-Ruiz, V.-R., & Peña, D.N. (2017). A New Sustainability City Index Based on Intellectual Capital Approach. *Sustainability, 9.*

Alfaro-Navarro, J.-L., López-Ruiz, V.-R., & Peña, D.N. (2019). An Intellectual Capital Approach to Citizens' Quality of Life in Sustainable Cities: A Focus on Europe. *Sustainability, 11*.

Banks, S., & Shenton, F. (2001). Regenerating neighbourhoods: a critical look at the role of community capacity building. *Local Economy*, *16*(4), 286-298.

Biondi, L., Demartini, P., Marchegiani, L., Marchiori, M., & Piber, M. (2020). Understanding orchestrated participatory cultural initiatives: Mapping the dynamics of governance and participation. *Cities, 96,* 102459.

Blanco, E., Raskin, K., & Clergeau, P. (2022). Towards regenerative neighbourhoods: An International survey on urban strategies promoting the production of ecosystem services. *Sustainable Cities and Society, 80,* 103784.

Bonfour, A., & Edvinsson, L. (2005). *Intellectual Capital for Communities. Nations, Regions, and Cities*. Elsevier.

Bontis, N. (2004). National Intellectual Capital Index: A United Nations Initiative for the Arab region. *Journal of Intellectual Capital, 5*(1), 13-39.

Calabrò, F., & Della Spina, L. (2019). The public-private partnership for the enhancement of unused public buildings: an experimental model of economic feasibility project. *Sustainability, 11*(20), 5662.

Charzkel, J. (2006). The 1st World Conference on Intellectual Capital for Communities in the Knowledge Economy. Nations, Regions and Cities. *Journal of Intellectual Capital, 7*(2), 272-282.

Cento Bull, A., & Jones, B. (2006). Governance and Social Capital in Urban Regeneration: A Comparison between Bristol and Naples. *Urban Studies, 43*(4), 767-786.

Couch, C., & Dennemann, A. (2000). Urban regeneration and sustainable development in Britain. The example of the Liverpool Ropewalks Partnership. *Cities, 17*(2), 137-147.

Da Cunha, I.V., & Selada, C. (2009). Creative urban regeneration: the case of innovation hubs. *International Journal of Innovation and Regional Development*, *1*(4), 371-386.

Deakin, M. (2009). A community-based approach to sustainable urban regeneration. *Journal of Urban Technology, 16*(1), 91-112.

Deakin, M., & Allwinckle, S. (2007). Urban Regeneration and Sustainable Communities: The Role of Networks, Innovation, and Creativity in Building Successful Partnerships. *Journal of Urban Technology, 14*(1), 77-91.

Dumay, J. (2009). Intellectual capital measurement: a critical approach. *Journal of Intellectual Capital, 10*(2), 190-210.

Dumay, J. (2013). The third stage of IC: towards a new IC future and beyond. *Journal of Intellectual Capital, 14*(1), 5-9.

Dumay, J., & Garanina, T. (2013). Intellectual capital research: a critical examination of the third stage. *Journal of Intellectual Capital, 14*(1), 10-25.

Evans, J., & Jones, P. (2008). Rethinking sustainable urban regeneration: ambiguity, creativity, and the shared territory. *Environment and Planning A, 40*(6), 1416-1434.

Griffiths, R. (1995). Cultural strategies and new modes of urban intervention. *Cities*, *12*(4), 253-265.

Healey, P. (1995). The institutional challenge for sustainable urban regeneration. *Cities, 12*(4), 221-230.

Huston, S., Rahimzad, R., & Parsa, A. (2015). 'Smart' sustainable urban regeneration: Institutions, quality and financial innovation. *Cities, 48,* 66-75.

Kim, G., Newman, G., & Jiang, B. (2020). Urban regeneration: Community engagement process for vacant land in declining cities. *Cities*, *102*, 102730.

Korkmaz, C., & Balaban, O. (2020). Sustainability of urban regeneration in Turkey: Assessing the performance of the North Ankara Urban Regeneration Project. *Habitat International, 95.* 102081.

Marr, B. (2007). What is Intellectual Capital? In L.A. Joia, *Strategies for Information Technology and Intellectual Capital: Challenges and Opportunities* (pp. 1-9). Herschey: Information Science Reference.

Marr, B., & Moustaghfir, K. (2005). Defining intellectual capital: a three-dimensional approach. *Management Decision, 43*(9), 1114-1128.

Matos, F., & Vairinhos, V.M. (2017). Intellectual Capital Management as a Driver of Competitiveness and Sustainability. *Journal of Intellectual Capital, 18*(3), 466-469.

Mavi, R.K., Standing, C. (2018). Critical success factors of sustainable project management in construction: A fuzzy approach. *Journal of Cleaner Production, 194*, 751-765.

McDonald, S., Malys, N., & Maliene, V. (2009). Urban regeneration for sustainable communities: A case study. *Technological and Economic Development of Economy*, *15*(1), 49-59.

Neal, P. (2003). *Urban Villages and the Making of Communities.* London and New York: Spon Press.

Neal, P. (2021). Does the neighbourhood matter for neighbourhood satisfaction? A meta-analysis. *Urban Studies, 58*(9), 1775-1791.

Piber, M., Demartini, P., & Biondi, L. (2018). The management of participatory cultural initiatives: learning from the discourse on intellectual capital. *Journal of Management and Governance, 23*, 435-458.

Reischauer, G. (2015). Combining artefact analysis, interview and participant observation to study the organizational sensemaking of knowledge-based innovation. *Historical Social Research/Historische Sozialforschung*, 279-298.

Roberts, P. (2000). The evolution, definition and purpose of urban regeneration. In P. Roberts, & H. Skyes (Eds.), *Urban regeneration: A handbook*. London: Sage.

Roberts, P., & Sykes, H. (2000). *Urban Regeneration. A Handbook*. London: Sage.

Schenkel, W. (2015). Regeneration strategies in shrinking urban neighbourhoods—Dimensions of interventions in theory and practice. *European Planning Studies*, *23*(1), 69-86.

Secundo, G., Ndou, V., Del Vecchio, P., & De Pascale, G. (2020). Sustainable development, intellectual capital and technology policies: A structured literature review and future research agenda. *Technological Forecasting & Social Change, 153,* 119917.

Secundo, G., Del Vecchio, P., Dumay, J., & Passiante, G. (2017). Intellectual capital in the age of Big Data: establishing a research agenda. *Journal of Intellectual Capital, 18*(2), 242-261.

Ståhle, P., & Bonfour, A. (2008). Understanding dynamics of intellectual capital of nations. *Journal of Intellectual Capital, 9*(2), 164-177.

Taylor, J.E., Dossick, C.S., & Garvin, M. (2011). Meeting the burden of proof with case-study research. *Journal of construction engineering and management*, *137*(4), 303.

Uziene, L. (2013). City's Intellectual Capital Framework: The Performance Measurement Point of View. *Economics and Management, 18*(2), 198-208.

Viedma, J. M. (2004). CICBS: a methodology and a framework for measuring and managing intellectual capital of cities. A practical application in the city of Mataró. *Knowledge Management Research & Practice*, *2*(1), 13-23.

Yau, Y.S. Chan, H.L. (2008). To rehabilitate or redevelop? A study of the decision criteria for urban regeneration projects. *Journal of Place Management and Development, 1(3*), 272-291.

Yin, R. K. (2009). *Case study research: Design and methods*(Vol. 5). *Sage.*

Yu, J.H. Kwon, H.R. (2011). Critical success factors for urban regeneration projects in Korea. *International Journal of Project Management, 29*(7), 889-899.

Smart Cities and Intellectual Capital for Urban Innovation and Future

Mauro Romanelli
University of Naples Parthenope, Department of Business and Economics, Napoli, Italy
mauro.romanelli@uniparthenope.it

Abstract: Cities are constructing a wealthy future, adopting a smart view in order to support urban development and strengthen the intellectual capital for better quality of life within urban communities. Smart city and intellectual capital help shape cities as engines of innovation. The study aims to elucidate how cities adopt a smart city view to shape a sustainable future, enabling all the components of intellectual capital, driving the city as a smart innovative community. Advancing intellectual capital perspectives helps address a management-oriented view to smart city community. Sustainable urban future and innovation rely on smart cities and smart communities. Intellectual capital is a driver of sustainable urban growth and competitiveness. A smart city enables citizen participation and collaborative spaces for innovation. The study elucidates how smart cities contribute to urban development and intellectual capital as a strategic asset for urban innovation. As engines of innovation, cities evolve as smart, collaborative and sustainable communities.

Keywords: smart cities and communities, urban innovation, intellectual capital

1. Introduction

Cities of tomorrow will be smart and inclusive communities, using technologies to drive innovation-led and sustainable urban growth, improving the quality of life and sustainable socio-economic systems, for a wealthy future (Nam and Pardo, 2011; Martinez, Mikkelsen and Phillips, 2021). Cities drive a continuous change, shaping a community, developing a sustainable urban future by technologies (Yigitcanlar, 2021), promoting multi-actor innovation through civil society-research-companies-public authority collaboration (Hartley, Sørensen and Törfing, 2013; Meijer and Thaens, 2018; Sørensen and Törfing, 2018). Cities become smart innovative urban communities, developing the potential of information technology to support urban competitiveness and improve the quality of life within communities in long-term (Caragliu and Del Bo, 2019). Smart cities as communities drive sustainable-inclusive growth, empowering the citizens as co-producers of services and policies (Paskaleva, 2011; Martin, Evans and Karvonen, 2018). A smart city helps shape the city of the future where technology serves for quality of life improvement (Lazariou and Roscia, 2012). City is net action and space of innovation (Czarniawska, 2002). Smart communities enable cities as smart innovative, collaborative and sustainable communities relying on citizen involvement, companies and public authorities (Lindskog, 2004; Eger, 2005; Lara, Da Costa, Furlan and Yigitcanlar, 2016). Digital technologies help support a collaborative framework and enable cities to develop a smart urban innovation ecosystem (Appio, Lima and Paroutis, 2019; Paskaleva, 2011; Zygiaris, 2013).

The research question refers to how cities are rethinking the urban future, designing a smart community as an engine of urban innovation. The aim of this study is to elucidate how cities adopt a smart city a view in order to build a wealthy future, enabling all components of IC, and shaping a smart, sustainable and innovative community. Cities are developing a smart community as a driver of collaborative innovation.

Intellectual capital (IC) plays a key role for urban competitiveness, quality of life and sustainability. It helps drive sustainable smart urban development of communities (Rodríguez-Nuñez and Periáñez-Cañadillas, 2017). In the knowledge economy intangible assets and IC drive future urban development (Viedma, 2004). Smart city and IC framework help shape knowledge-based, project-oriented and network-led cities strengthening competitiveness, sustainability and quality of life. Advancing IC perspectives helps address a management-oriented view to smart city community (Dameri and Ricciardi, 2015). Cities are managing intellectual shaping a more sustainable and balanced society to improve quality of life. The study elucidates how smart and sustainable cities contribute to knowledge-based urban development and IC as a strategic asset for urban sustainable growth and innovation. Sustainable urban future relies on smart cities as communities developing IC as a driver for sustainable growth and innovation, collaborative networking and social interaction (Secundo, Ndou, Del Vecchio and Pascale, 2020).

Cities are rethinking a smart-driven urban future to drive the city as a smart and innovative community. The study is structured as follows. After introduction and methodology, in the third paragraph, the case studies

related to smart city planning of Paris, Wien and Florence are reported and described. In the fourth paragraph the relationship between cities and IC within smart cities is analysed. In the fifth paragraph, cities as smart, sustainable and innovative communities are elucidated. Finally, findings and conclusions are outlined.

2. Methodological section

The study analyses the city as smart and sustainable community driving urban innovation and development. The study is qualitative, exploratory and descriptive. Methodology relies on case studies' analysis (Yin, 2009). The study relies on considering three case studies (Paris, Florence and Wien) that refer to cities redesigning its urban development planning by adopting a smart strategy as a vision for driving the city to be a sustainable urban community. Smart city planning of Paris, Florence and Wien are data reported, considered and analysed. The study is also theoretical and relies on a review of contributions that refer to understanding the concept of inclusive city, smart city and smart community as drivers of urban innovation, inclusive and sustainable community. Smartness, sustainability and community help drive urban innovation and development. Referred journal articles were selected from *Google Scholar* as the main web source and database. The reported articles were selected with regard to the concepts of smart and sustainable city, smart community and smart innovation by using technology within urban context. The selected contributions are analysed and interpreted in a narrative synthesis (Joss *et al.*, 2019) in order to accommodate the differences between questions, research design and the context. They will also contribute to elucidating new perspectives and advancing theoretical frameworks on emerging issues (Denyer and Tranfield, 2006; Dixon-Woods, Agarwall, Young, Jones and Sutton, 2004).

3. Towards smart cities as smart innovative communities

The smart city plans and visions of three European cities (Paris, Wien and Florence) are considered and analysed. The reported documents relate to: Paris Smart and Sustainable. Looking ahead to 2020 and beyond (2015); Firenze Smart City Plan (2015); Smart City Strategy Vienna (2022). Cities are rethinking a smart-driven urban future in order to drive the city of the future as a smart and innovative community. Technology helps support information and participation as sources that enable collaborative processes that open up to innovation.

3.1 Paris Smart and Sustainable. Looking ahead to 2020 and beyond

The role of a city becoming smart and sustainable using technology to contribute to improve the quality of life within urban communities. Smartness is a means to drive the city to proceed towards a sustainable future related to quality of life improvement. Smart and sustainable city acts as a platform that is open, resolutely future driven and eager for experimentation, disruption and the development of new services that put technology, data, interoperability and interconnected networks front and centre. Developing the city of the future means to bring together social, technological and organizational dimension for driving a smart and sustainable that relies on three pillars: the *connected city* stresses the importance of technological infrastructures such as communication networks, connected devices and sensors, continually integrating technological advances; the *open city* supports citizen participation and collaborative projects, promoting public innovation ecosystem; collaborative processes involve academia, research and public administration; the *sustainable city* is a goal. It is a place where technology supports social inclusion and helps people to contribute to creating public services and policy decision-making processes. Smart cities enable people to play a proactive role in building the urban future. In particular, a smart city helps include people in the city life, bridging the gap between new public services and policymaking.

3.2 Smart City Strategy Vienna

The *Smart City Strategy Vienna* relies on some key concepts to be developed and implemented in actions: quality of living, sustainability, prosperity, opportunities for education and workplaces. The role of information technology is to simplify the life of people. Promoting smartness is viewed as a change process. A city going to the future and becoming smart should: not let anybody down; integrate the social component in the development process; let people have access to the same degree of participation. The goal is to ensure top-level quality of living focusing on social participation and inclusion, safety and security, leisure quality and culture, openness, diversity of gender roles, and an equally high degree of social participation as key factors that enable urban development. Promoting a smart and sustainable city strategy relies on rethinking urban governance models strengthening co-ordination and cooperation as ways for constructing shared collaborative and governance processes that involve all the stakeholders within the urban community. In particular, it is necessary to strengthen the cooperation on Vienna smart city issues with universities and research centres and institutions in order to stimulate social innovation vision and engender opportunities for experimenting new opportunities

for urban value creation. Developing a smart strategy relies on strengthening the participation possibilities of citizens and experts promoting co-determination and management go together via technology's potential. Wien smart city also means social inclusion, meeting the needs of many different population groups, recognising this diversity, maintaining high levels of social security and high standards of public services, strengthening co-determination and participation to ensure democratically modes of governance for urban development, stimulating social innovations, through technological developments strongly inspired by the needs of citizens, and taking particular account of the individuals-organizations interaction.

3.3 Planning Firenze as a Smart City

In the *Firenze Smart City Plan*, cities put people first and support urban transformation leading to intelligent urban communities. The proactive role of citizens is to identify the pathway of urban development to improve the quality of life for each and every citizen living in urban environments. In particular, planning a smart urban vision helps the city as a community of people which is able to create meanings, produce culture, creativity, and thinking by enabling the people as the first driver and contributor of human and civil progress. Promoting smartness implies always using technology to make cities more intelligent, sustainable, capable to drive innovation, and reinforcing social relationships within the urban community.

A smart city refers to a city that is changing and constructing new social, urban, and economic responses to environmental and historical pressures. The smart city plan is an open space for debate, confrontation, exchange of information, and knowledge among all urban stakeholders interested in contributing to urban, social, and economic development. A smart city master plan helps the city to drive continuous urban innovation, improve the quality of life within community and to develop urban sustainable planning that relies on clear and strong distributed and collective leadership and vision. A smart city implies that all the elements of the city are interrelated and connected. A smart city relies on promoting collaboration among all the involved stakeholders (public administration, research centres, cultural institutions, businesses, associations, groups, citizens) along the urban value chain. A smart city strategy develops by promoting an open innovation view to ensure the stakeholders' involvement by embracing the four *Is*: the *integration* of all possible aspects and sectors in charge of a municipality's competences; the *innovation* for developing new services and approaches, and relying on digital and interactive information technology; the *involvement* as a means to urge stakeholders to identify, plan, share, and implement strategic, long-terms vision and goals more ambitious than the present situation; and the *information,* as related to the use of information technology as a way to reinforce and consolidate the relationships between municipality and citizens to monitor the implementation of urban smart strategy. Technologies emerge as a critical successful factor and facilitators of all the initiatives indicated in the smart city plan.

4. Cities and Intellectual Capital within smart communities

IC plays a key role for improving urban competitiveness, quality of life and sustainability. It helps drive sustainable smart urban development of communities (Rodríguez-Nuñez and Periáñez-Cañadillas, 2017). In the knowledge economy, intangible assets and IC help drive future urban development (Viedma, 2004). Smart city and IC framework help shape knowledge-based, project-oriented and network-led cities, strengthening competitiveness, sustainability and quality of life. Advancing IC perspectives helps address a management-oriented view to smart city community (Ricciardi and Dameri, 2015). Managing structural capital helps support smart city competitiveness and sustainability (Matos, Vairinhos, Dameri and Durst, 2017). As stated by Dumay (2013) while the third stage of IC focuses on strong organizations, «the fourth stage concentrates on building strong economic, social and environmental ecosystems» (p. 8) that enable organizations to evolve and survive in a sustainable way. Following the third stage of IC the value incorporates worth and importance of services for stakeholders (Dumay, 2009) while the fourth stage of IC focuses on ecosystems for value creation (Dumay, 2013). The knowledge created by communities develops within social ecosystems (Dumay and Garanina, 2013). The fourth stage of IC «combines human, relational and structural capital into a new vision that considers the social aspect of IC» (Secundo, Del Vecchio, Dumay and Passiante, 2017, p. 8). An IC view for regions and cities helps to advance a community perspective that strengthens the collective action within and around organizations (Bounfour and Edvinsson, 2012). Investing in knowledge assets to drive value creation processes helps to restore the social relationships' value and develop knowledge capital of communities and collective intelligence emerging within social systems, fostering intangible resources. Managing IC is a means to develop social growth and cohesion of communities, leading to social and economic growth of cities and communities (Bounfour and Edvinsson, 2012). Managing IC of cities helps to drive urban value creation and enable the importance of intangible assets within urban spaces (Viedma, 2004). IC is viewed as a driver of sustainability and

urban competitiveness (Matos and Vairinhos, 2017; Ståhle and Bounfour, 2008). IC plays a key role in advancing sustainable development (Secundo, Ndou, Del Vecchio and Pascale, 2020). IC plays a key role for local competitiveness and urban sustainability. In the IC framework for cities by Uziene (2013), human capital refers to individual and collective competences, and community social values. Relational capital concerns community and organizations' networking, and urban connections in terms of city partnership and image. Structural capital refers to organizational resources, processes and innovation. An IC view helps to advance towards sustainable development and clarify the relationships between sustainability of cities and citizens' quality of life (Lòpez-Ruiz, Alfaro-Navarro and Nevado Pena, 2019).

5. Cities as smart, innovative and sustainable urban communities

Following the *UN 2030 Agenda for Sustainable Development* and the *New Urban Agenda* (United Nations, 2017) cities will be inclusive, safe, resilient, and sustainable urban communities. Cities develop the potential of technologies to identify smart and sustainable solutions in order to improve the quality of life, promoting smartness as a human-centred vision to urban development and innovation in management, governance and policy options, shaping smart urban communities as better places for life, work and play (Lara, Da Costa, Furlan and Yigitcanlar, 2016; Nam and Pardo, 2011). Sustainable urban development relies on a smart city as engine of public value creation (Pardo, Gil-Garcia, Gascó-Hernández, Cook and Choi, 2021), «using a healthy mixture of smart people, policies and technologies» (Yigitcanlar *et al.*, 2019, p. 360). Smart cities develop open innovation (Paskaleva, 2011), empowering the citizen as a proactive co-producer of inclusive and sustainable urban growth, innovation and policies (Martin, Evans and Karvonen, 2018). The smart city concept enhances human, social and institutional components of the city as urban community (Nam and Pardo, 2011). A smart city supports a smart community (Yigitcanlar *et al.*, 2019), and fosters community development (Stratigeia, 2012). A smart city refers to «a continuum in which local government officials, citizens, and other stakeholders could think about the initiatives that attempt to make the city a better place to live» (Gil-Garcia, Pard, and Nam, 2016, p. 5). Cities advance as *loci* of innovation and innovative milieus (Shearmur, 2012). The future of urban development relies on smart cities and communities driving sustainable, smart and inclusive urban growth and supporting collaborative innovation, enabling multi-level, multi-sector interactions between different stakeholders (European Commission, 2012; European Commission, 2017). As spaces for collaborative innovations, cities support the active participation of all urban stakeholders (private, public, nonprofit sectors, citizens) in interactive arenas that develop new solutions to improve the city in significant and positive ways (Hartley, Sørensen and Törfing, 2013; Lindskog, 2004; Eger, 2005), fostering a mutual-constructive interaction for collaborative innovation and design (Andreani, Kalchschmidt, Pinto and Sayegh, 2019). Cities drive smart urban innovation through stakeholder collaboration for community development (Meijer and Thaens, 2018; Nilssen, 2019). A smart city vision supports community entrepreneurship and enables citizens to promote innovations and technological advancements (Kummitha and Crutzen, 2017).

6. Findings and conclusions

Smart cities help cities to identify a potential pathway for urban innovation and development in order to improve the quality of life. European cities are rethinking the urban future by adopting a smart city vision to urban development and shaping an innovative and collaborative urban community. Paris sustainable city vision stresses the connected city as a tool, the open city as method and sustainable city as a goal. Wien smart vision relies on the use of technology as a means to enhance co-participation, co-decision-making and inclusion as strategic views to sustainable urban development. Florence's smart city planning focuses on bringing together integration, innovation, involvement, and information. The case studies analysed elucidate that smart city vision and smart community enable all the components of IC and help cities to support technology-led and collaboration-driven urban innovation that relies on strengthening people, community and collaboration. Common elements emerge from the analysis. The role of information technology is to serve for collaborative processes that support innovation. Several approaches are identified. In the Paris smart city vision the focus is on: information technology, participation and collaboration; social inclusion for innovation and policy making. The smart city is viewed as a technology-enabled, collaborative and inclusive community able to drive social innovation. Florence's smart city planning focuses on using information technology as a means for better coordination among all the components of urban community. Technology helps support better information and contribute to citizen involvement to drive innovation. The smart strategy of Wien helps shape the city as an inclusive and innovative community. The smart city is a smart collaborative and innovative community where co-determination and participation support value creation processes. Technology enables citizen and community participation and engagement to promote continuous innovation as a driver of urban sustainability.

As engines of innovation, cities evolve as smart, collaborative and sustainable communities. As following an information-driven approach, the use of information technology helps support the development of a smart city and smart community along a continuum from a technology-enabled view to a community-oriented view. While a smart city helps enhance services innovation, a smart community enables the urban stakeholders to engenders collaborative processes driven by technology. As following a knowledge-oriented view to urban development, the smart city view supports the urban community as a collaborative space and engine for continuous technological, organizational and social innovation. European Cities are following a smart city vision and smart community view in order to make the city as an effective engine of innovation and collaborative urban community. Smart urban communities contribute to innovation and value creation by strengthening participative, cooperative and collaborative processes by adopting a human- and community- centred view to urban development. Smart city and smart community help enhance the IC of a city. The smart city view helps develop the city as innovation-driven, socially inclusive, open and knowledge-oriented community. Participatory, collaborative and cooperative processes are the main issues of smart-driven and community-oriented cities as engines of urban innovation. There are some limitations in this study. Some illustrative case studies are considered and analysed. Future research perspectives imply to further develop the relationship between smart city development, IC and the city as a smart innovative community.

References

Andreani, S., Kalchschmidt, M., Pinto, R. & Sayegh, A. (2019). Reframing technologically enhanced urban scenarios: A design research model towards human centered smart cities. *Technological Forecasting* & *Social Change, 142*, 15-25.

Appio, F.P., Lima, M., & Paroutis, S. (2019). Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting* & *Social Change, 142,* 1-14.

Bounfour, A., & Edvinsson, L. (2012). *Intellectual Capital for Communities. Nations, Regions, and Cities.* Elsevier Butterworth-Heinemann.

Caragliu, A., & Del Bo, C.F. (2019). Smart innovative cities: The impact of Smart City policies on urban innovation. *Technological Forecasting and Social Change*, *142*, 373-383.

City of Vienna (2022). *Smart City Strategy Vienna. Our way to becoming a model climate city.*

Comune di Firenze (2015). *Firenze Smart City Plan*.

Czarniaskwa, B. (2002). *A Tale of Three Cities: Or the Glocalization of City Management.* Oxford University Press.

Dameri, R.P., & Ricciardi, F. (2015). Smart city intellectual capital: an emerging view of territorial systems innovation management. *Journal of Intellectual Capital, 16*(4), 860-887.

Denyer, D., & Tranfield, D. (2006). Using qualitative research synthesis to build an actionable knowledge base. *Management Decision*, *24*, 213-227.

Dixon-Woods, M., Agarwall, S., Young, B., Jones, D., & Sutton, A. (2004). Integrative Approaches to Qualitative and Quantitative Evidence, Health Development Agency, London, available at www.hda.nhs.uk

Dumay, J. (2013). The third stage of IC: towards a new IC future and beyond. *Journal of Intellectual Capital, 14*(1), 5-9.

Dumay, J., & Garanina, T. (2013). Intellectual capital research: a critical examination of the third stage. *Journal of Intellectual Capital, 14*(1), 10-25.

Dumay, J. (2009). Intellectual capital measurement: a critical approach. *Journal of Intellectual Capital, 10*(2), 190-210.

Eger, J.M. (2005). Smart communities, universities, and globalization: educating the workforce for tomorrow's economy. *Metropolitan Universities, 16*(4), 28-38.

European Commission (2017), Report from the Commission to the Council on the Urban Agenda for the EU, COM(2017) 657 final, 20.11.2017

European Commission (2012). Smart cities and communities – European Innovation Partnership, C (2012) 4701 final, Brussels, 10.7.2012

Gil-Garcia, J.R, Pardo, T.A., & Nam, T. (2016). A Comprehensive View of the 21 Century City: Smartness as Technologies and Innovation in Urban Contexts. In Gil-Garcia, J.R. *et al.* (eds), *Smarter as the New Urban Agenda. A Comprehensive View of the 21st Century, City* (pp. 1-21). Public Administration and Information Technology, Cham: Springer.

Hartley, J., Sørensen, E., & Torfing, J. (2013). Collaborative innovation: A viable alternative to market competition and organizational entrepreneurship. *Public administration review*, *73*(6), 821-830.

Joss, S., Sengers, F., Schraven, D., Caprotti F., & Dayot, Y. (2019) The Smart City as Global Discourse: Storylines and Critical Junctures across 27 Cities. *Journal of Urban Technology, 26*(1), 3-34.

Knox, H. (2010). Cities and organisation: The information city and urban form. *Culture and Organization, 16*(3), 185-195.

Kummitha, R.K.R., & Crutzen, N. (2017). How do we understand smart cities? An evolutionary perspective. *Cities 67,* 43-52.

Lara, A.P., Da Costa, E.M., Furlan, T.Z., & Yigitcanlar, T. (2016). Smartness That Matters: Towards a Comprehensive and Human-Centred Characterisation of Smart Cities. *Journal of Open Innovation: Technology, Market and Complexity*, *2*(2),1-13.

Lazariou. G.C., & Roscia, M. (2012). Definition methodology for the smart cities model. *Energy, 47*(1), 326332.

Lindskog, H. (2004). Smart communities initiatives. In *Proceedings of the 3rd ISOneWorld Conference* (Vol. 16).

López-Ruiz, V. R., Alfaro-Navarro, J. L., & Nevado-Peña, D. (2019). An intellectual capital approach to citizens' quality of life in sustainable cities: A focus on Europe. *Sustainability*, *11*(21), 6025.

Mairie de Paris (2015). *Paris Smart and Sustainable Looking Ahead to 2020 and Beyond.*

Martin, C. J., Evans, J., & Karvonen, A. (2018). Smart and sustainable? Five tensions in the visions and practices of the smart-sustainable city in Europe and North America. *Technological Forecasting and Social Change*, *133*, 269-278.

Martinez, J., Mikkelsen, C.A., & Phillips, R. (2021). Introduction: Quality of Life and Sustainability, Sociospatial, and Multidisciplinary Perspectives. In Martinez, J., Mikkelsen, C.A., & Phillips, R., Handbook of Quality of Life and Sustainability (pp. 1-14). Cham: Springer.

Matos, F., & Vairinhos, V.M. (2017) Intellectual Capital Management as a Driver of Competitiveness and Sustainability. *Journal of Intellectual Capital, 18*(3), 466-469.

Matos, F., Vairinhos, V.M., Dameri, R.P., & Durst, S. (2017). Increasing smart city competitiveness and sustainability through managing structural capital. *Journal of Intellectual Capital, 18*(3), 693-707.

Meijer, A.J., & Thaens, M. (2018). Urban Technological Innovation: Developing and Testing a Sociotechnical Framework for Studying Smart City Projects. *Urban Affairs Review 54*(2), 363387.

Nam, T., & Pardo, T.A. (2011). Smart city as urban innovation with dimensions of technology, people and institutions. In *Proceedings of the 5th international conference on theory and practice of electronic governance* (pp. 185-194). ACM.

Nilssen, M. (2019). To the smart city and beyond? Developing a typology of smart urban innovation.
Technological Forecasting & Social Change, 142, 98-104.

Pardo, T.A., Gil-Garcia, J.R., Gascó-Hernández, M., Cook, M.E., & Choi, I. (2021). Creating Public Value in Cities: A Call for Focus on Context and Capability. In Estevez, E., Pardo, T.A., Scholl, H.J., *Smart Cities and Smart Governance. Towards the 22nd Century Sustainable City* (pp. 119140). Cham: Springer.

Paskaleva, K.A. (2011). The smart city: A nexus for open innovation? *Intelligent Buildings International, 3*(3), 153-171.

Rodríguez-Núñez, E., & Periáñez-Cañadillas, I. (2017). Intellectual capital as the fostering factor for sustainable smart urban development in the Basque Autonomous Community. In B. Ortiz and D.P.B. Yàbar, *Sustainable Smart Cities* (pp. 31-47). Cham: Springer.

Secundo, G., Ndou, V., Del Vecchio, P., & De Pascale, G. (2020). Sustainable development, intellectual capital and technology policies: A structured literature review and future research agenda. *Technological Forecasting and Social Change*, *153*, 119917.

Secundo, G., Del Vecchio, P, Dumay, J., & Passiante, G. (2017). Intellectual capital in the age of Big Data: establishing a research agenda. *Journal of Intellectual Capital, 18*(2), 242-261.

Shearmur, R. (2012). Are cities the font of innovation? A critical review of the literature on cities and innovation. Cities, *29,* S9-S18.

Sørensen, E., & Törfing, J. (2018). Co-initiation of collaborative innovation in urban spaces. *Urban Affairs Review*, *54*(2), 388-418.

Ståhle, P., & Bounfour, A. (2008). Understanding dynamics of intellectual capital of nations. *Journal of Intellectual Capital, 9*(2), 164-177.

Stratigeia, A. (2012). The Concept of 'Smart Cities'. Towards Community Development? *Networks and Communication Studies, 36*(3-4), 375-388.

United Nations (2017). The New Urban Agenda. United Nations Conference on Housing and Sustainable Urban Development (Habitat III), Quito, Ecuador, 20 October 2016.

Uziene, L. (2013). City's Intellectual Capital Framework: The Performance Measurement Point of View. *Economics and Management, 18*(2), 198-208.

Viedma, J.M. (2004). CICBS: a methodology and a framework for measuring and managing intellectual capital of cities. A practical application in the city of Mataró. *Knowledge Management Research & Practice*, *2*(1), 13-23.

Yigitcanlar, T. (2021). Smart City Beyond Efficiency: Technology-Policy-Community at Play for Sustainable Urban Futures. *Housing Policy Debate, 31*(1), 88-92.

Yigitcanlar, T., Kamruzzaman, Md., Foth, M., Sabatini-Marques, J., da Costa, E., & Ioppolo, G. (2019). Can cities become smart without being sustainable? A systematic review of the literature. *Sustainable Cities and Society, 45,* 348-365.

Yin, R.K. (2009). *Case study research: Design and methods*(Vol. 5). *Sage.*

Zygiaris, S. (2013). Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. *Journal of the Knowledge Economy*, *4*(2), 217-231.

Social Innovation as a Paradigm of Change in Organisational Management

Anna Rybak
University of Technology, Czestochowa, Poland
Anna.rybak@pcz.pl

Abstract: The paper contributes to the debate on the future of social innovation (SI). The aim of the research was to determine the influence of the subsidy market leader on the valuation of IS by organizations participating in the PROO and NEWFIO competitions. The Stackenberg leadership model was used for this purpose. The research has shown that organisations applying for grants, in most cases, follow the leader, regardless of the competition that sets the price (maximum grant value) for SI. In the futere, use of game theory to describe the role of a leader allows for the strengthening and better adjustment of competition offers to future social and technological challenges, e.i. "Green Deal" for Industry 5.0.

Keywords: Social Innovation, Green Deal, Industry 5.0, non-profit organisations.

1. Introduction

Social innovation (SI) has become an issue of great interest to researchers and scientists. The tasks that are set for SI include practical solutions to social problems such as access to education, culture, health care, but also protection of the natural environment or professional and environmental integration of excluded people (both in terms of where they live, the environment they come from, or whether they are an ethnic and/or national minority). Such a wide range of tasks to be solved by SI poses a colossal challenge for actors and organisations working for the benefit of society. The debate on the paradigms of exchange related to the "Green Deal" within Industry 5.0, or Green Industry (European Commission 2022, 2021), forces innovators to align society and the integration of people with industry so that the challenges of sustainable development, resource-efficiency or the circular economy do not negatively impact and reinforce divisions within economies and nations. As Banholzer (2021) stated, society, and thus also politics, are in the midst of a shift that, given the crisis phenomena caused by pandemics, climate change, as well as foreign policy conflicts between the economic and technological blocs of the US, Russia, China and Europe, at the same time highlights the need to prepare society for the coming changes. To this end, SI should be used as an incubator to support government agencies in improving various stakeholders' social and organisational integrity so that the coming changes are socially acceptable while not expanding the number of socially excluded groups. This paper is framed within the issue of SI leadership's role as a facilitator of change in organisational management. The research hypothesis put forward by the author is: *H: Organizations are following the donation leader in order to evaluate the amount of SI*.

The Stackelberg and Nash models will be used to verify the hypothesis.

The notion of paradigm is ambiguous and has been so since the beginning of Kuhn-inspired discussion on this topic. A paradigm is assumed to be a particular set of general, coherent cognitive assumptions shared by most researchers in a given scientific discipline. In the contemporary definition of a paradigm, it is often emphasised that it is a set of beliefs, theories, and empirical research methodologies shared by the scientific community. These communication practices serve as a basis for future research efforts of scientists in a given discipline (Faria et al.2011).

The paradigm provides a framework for knowledge growth and theory refinement in cumulative, incremental development periods. However, there are also revolutionary, discontinuous changes in science caused by the mismatch between theory and researched reality. According to Kuhn (1970), a manifestation of revolution is a paradigm - shift, replacing the "old" with a "new" paradigm (Czekan 2011).

The theme of paradigm shifts in organisational management undertaken is a consequence of the introduction, Industry 5.0, based on three main pillars, namely (Buchinger 2021):

- People-oriented: Encourages diversity, diverse talents and empowerment;
- Resilience: Organised adaptability and the ability to cope with uncertainty and change;
- Sustainable development: Environmental responsibility and preserving the ecological niche people need for future generations.

The formulated new paradigms are a "response" to these often breakthrough changes, which in turn imply revolutionary changes in the principles of functioning and tools used in managing organisations. Characteristically, regardless of the author proposing a new paradigm (Lies 2020, Howald et al.2016, Bathelt and Glückler 2011), it most often emphasises the role of flexibility, the need to react quickly to changes, to improvement or simply the need for innovation. The organisational paradigm determines a specific model of the organisation's functioning. If it undergoes radical changes, it entails changes in many areas of activity (if not all), including - in the processes of generating product, process and management innovations, or market positioning (changes resulting from social expectations and environmental challenges). We are dealing with such radical changes concerning the organisation paradigm in the introduction of Industry 5.0. The unique role of innovations also lies in the fact that they may not only imply a specific stream of innovations of other types but also change the model (and philosophy) of the activity itself (Kraśnicka 2018). The inclusion in the SI change paradigm stems from the conviction that social sensitivity is an essential element in creating a new organisational culture in contemporary organisations, especially in terms of the concept of the "Green Deal" for Industry 5.0.
The concept of the paradigm of change adopted by the author is based on the following assumptions:

- The organisation's environment is randomly disordered, but even an insignificant change caused by SI directly affects the entire environment - deterministic chaos;
- Networks of relationships determine the actions of entities, these networks are unstable, but some exert more influence than others hence the introduction of the SI Leader - the logic of relationships;
- Models of links between organisations depend on the degree of coordination and reciprocity of relationships - leadership models;
- Research methods refer to change, the depth and quality of change, and its impact on organisations and the environment, while being consistent and not mutually exclusive (complimentary) while adapting to unexpected changes.

It is clear from the above that radical changes are expected in management science due to a new understanding of the role an organisation should play in social life. In the following discussion, we will look at the role of the SI leader in this change.

2. Theoretical background

The topic of innovation has been introduced into the language through solutions in industry and services. A broad approach to innovation is a novelty in specific temporal and spatial conditions, presented in culture, economics, technology or nature. A narrow approach to the definition of innovation introduces a semantic framework for the concept of novelty in the form of subject restrictions (what they concern, e.g. the economy, society, or organisation), subject restrictions (what they include, e.g. the product, the environment, the members of the organisation), temporal limits (within a limited period of time, e.g. within the last 3 years, etc.), and uniqueness and discontinuity. (Stanisławski 2017) According to the above, innovation is a change that modifies activities of a permanent nature, transferring solutions to selected areas, constantly changing their usefulness, dependence or their perception. For an organisation to innovate effectively and sustainably, it must focus on four key factors to sustain change, namely: culture, collaboration, strategy and systems (Schröder 2013).

The concept of SI has become central to policy debates at national and supranational levels. In the United States, President Obama established the Office of SI and Civic Participation at the White House in 2009 to engage citizens and civil society in finding new ways to solve social problems. At the European level, SI covers a range of policy areas. Under the Social Innovation Initiative, it has been developed to mainstream SI policy in the Horizon 2020 Strategic Framework for Research and Innovation (Massey and Johnston-Miller 2016). SI is an innovation paradigm (Have and Rubalcaba 2016, Nicholls and Murdock 2012) that recognises that innovation is not only about developing new technologies and business models but also about ways of directly addressing social problems and grand societal challenges (Ghazinoory et al. 2020, Pol and Ville 2009). SI carried out within business organisations can be defined as the active contribution of actors to improving the governance capacity of society (European Commission 2011). Business organisations can thus be persuaded to abandon their belief in the market as the overarching mechanism for allocating resources efficiently and instead be persuaded to develop the capacity to identify and find solutions to solve or prevent future unmet social needs. Moreover, to improve existing solutions to achieve a transformative change in institutional contexts and social practices (Wijk el al.2019, Cajaiba-Santana 2014) in order "to improve either the quality or the quantity of life," especially for those living on the margins of society (Pol and Ville 2009,). If we focus on SI as a critical contributor to a better

contribution of business to society, some specifications and concrete proposals of what is meant by SI are necessary. (Martinez) According to researchers (e.g. Manning and Vavilov 2022, Wijk et al.2019, Cajaiba-Santana 2014), SI is a multi-level process of developing, implementing and scaling innovative solutions to solve social problems in specific institutional contexts. In contrast, Phills et al. (2008) considers SI to be "a new solution to a social problem that is more effective, efficient, sustainable or equitable than existing solutions and for which the value created belongs primarily to society as a whole rather than to individuals". As Cajaiba-Santana (2014) emphasised, "the outcomes of SI can be diverse, taking the form of new institutions, new social movements, new social practices or different collaborative structures". The Locus SI is not a specific organisation but usually a social system where innovators live (Phillips et al.2015). When introducing SI, it is expected that all parties involved will be beneficiaries. Some organisations can play an essential role in mobilising and coordinating key socially engaged stakeholders. Such intermediaries can be government agencies (Audretsch et al.2021), non-profit organisations (Maclean et al.2013), social enterprises (Phillips et al. 2019), universities (Bellandi et al.2021; Arocena and Sutz 2021) and corporations (Mirvis and Googins 2018, Dionisio and Vargas 2020). They are motivated to engage in SI by their governmental mandates (e.g. development agencies), their social mission and responsibilities to supporters (e.g. NGOs) or stakeholder expectations (e.g. companies). Because government institutions tend to focus on creating social value for various disadvantaged beneficiaries, they are usually not designed to benefit the innovator primarily but the social groups with whom the innovator works. By introducing SI into an organisation, the very context in which collaboration based on engaging with social needs is changed, but also for the benefit of the innovators. Through its core purpose, SI changes the organisation itself, taking into account the social nature of its operations. Later in this paper, we will introduce a model describing the role of the SI leader in shaping change in organisational management.

3. Research methodology

3.1 Research model

Management science is searching for an appropriate research model that can reliably represent and interpret the changes taking place. This paper uses the strategic games of the Stackelberg (2011) leadership model to describe behaviour in the SI market. On the one hand, the model features organisations that dispose of financial resources to implement SI-related projects, and on the other hand, organisations that implement them. The common market for these organisations is services and products that meet societal needs, which are a challenge for SI. The presented issues generate the problem of describing the model and trying and solving it using appropriate tools. These problems arise in situations that combine both the element of conflict, conflicting interests (the organisation that has the resources is interested in having as many problems as possible solved within the competition) and aspirations, as well as the element of cooperation, the need to cooperate and establish a common strategy. The model describes the phenomenon of duopolistic competition. The leader knows the follower's potential response, and both players make a quantitative decision regarding the planned size of the maximum grant at a given level of demand. In the Stackelberg game model, the leader is always in a privileged position (first-mover advantage), being able to determine such a size, which will allow him to have a more significant influence on the market than the follower, whose (rational) response is somehow forced, by the initial decision of the leader.

Formally, this can be written as follows. Let x_L and x_F denote player A's (leader) and B's (follower) grant amounts. The functions $f_L(x_L, x_F)$ and $f_F(x_L, x_F)$ denote the market shares that players obtain due by setting the grant levels at x_L and x_F. Player A, the leader, knows that as a result of setting his grant at the level x_L, player B will set such an amount of capital demand in response: $x_F = r_F(x_L)$, for which the follower's market share function - $f_F(x_L, x_F)$ will take the maximum value:

$$\max_{xF} f_F(x_L, x_F) = f(x_L, r_F(x_L)) \quad (1)$$

in which $r_F(x_L)$ denotes the so-called follower response function to a specific decision x_L by the leader. Knowing the nature of the follower's response (by knowing his reaction function $r_F(.)$, the leader determines the value of the grant x_L, which, taking into account the response of the follower, will maximise his market share:

$$x_L = arg \max_{x_L} f(x_L, r_F(x_L)). \quad (2)$$

The leader's advantage is sometimes interpreted as an informational advantage: the leader knows what the follower's response will be and has the possibility of communicating his decision or making an irrevocable commitment to make a specific move. With this interpretation, the leader, de facto, does not have to make a

move first but only makes an irrevocable and credible declaration of choosing a specific strategy (choosing such determinants of the contest that the follower will match the offer). Then the follower's move, which is, in fact, the first move in the game, must depend on the declared move of the leader. Hence the formulated mathematical model of the two parties in the Stackelberg game. Both the resource of the leader and the followers can continuously adjust their strategies to maximise their reward (a grant of an appropriate amount). In particular, the goal of the Stackelberg game is to find a Nash equilibrium. Nash equilibrium is the optimal outcome of a game in which no player has an incentive to deviate from his strategy. At the same time, no player can unilaterally change his strategy without affecting the others, namely (Gintis 2009):

$$u_i(\sigma_i^*, \sigma_{-i}^*) \leq u_i(\sigma_i^*, \sigma_{-i}) \quad \forall_i = 1, ...n, \quad \forall\sigma_i \in \Sigma_i \qquad (3)$$

where:
$u_i : A \rightarrow R$ - payoff (payoff function) of player i, i = 1, ...n;
σ_i: : Mixed player i strategy game $\sigma_i = (\sigma_{i1}, \sigma_{i2}, ..., \sigma_{imi})$;
$\sigma_{-i} = (\sigma_1, \sigma_2, ... \sigma_{-i}., ., \sigma_N)$ - strategy profile of all players except player i.

The Nash equilibrium creates a dependency between players - the leader has the resources, and he dictates the game's rules. At the same time, the followers must adapt their resources and strategy to the declarative rules of the market.

Selecting appropriate strategies where the payout (at_i) will be satisfactory for all players is a challenge for the leader who, through the maximum value of the grant, forces the followers to adopt appropriate organisational and management strategies. The inclusion of SI in the grant forces followers to adapt their strategy to social needs so that these are best met. Such an approach will strengthen organisations, make them socially sensitive and change the management of available resources. It is also important to remember the Nash equilibrium, where all market (game) participants will be satisfied with the optimal solution.

3.2 Database

To test the Stackelberg leadership model, we will use the SI grant market, implemented in Poland by the National Institute of Freedom - Civil Society Centre. It is a government executive agency responsible for supporting civil society, public benefit activities and volunteering. It serves NGOs by directing substantive and financial support programmes to them (Ustawa et al.2017). Two programmes were used for data analysis, namely: the Government Programme for the Development of Civic Organisations (PROO) (Rzadowy et al.2018) and the Civic Initiatives Fund Programme (NOWEFIO) (Program et al.2017) . Both programmes are planned to be implemented within 3 years, starting from winning the grant competition, with the organisations deciding on the project task's length and implementation (Rzadowy et al.2021, 2022).

The main objective of PROO is to support the institutional development of civil society organisations and increase their participation in public life and the dissemination of democratic norms of citizenship. The competitions selected for analysis were PROO Priority 1a: Support for Mission Activities and Institutional Development and Priority 4: Institutional Development Grants.

Tasks implemented under Priority 1a consist in increasing the participation of civic organisations in public life and dissemination of democratic standards of citizenship, supporting the institutional development of non-governmental organisations, including building stable foundations for their further functioning, creating perspective action and financing plans, raising standards of work and organisation management. Priority 4 - supporting initiatives for institutional development of think tanks - non-profit civic organisations with analytical and research profiles, functioning parallel to formal political processes (both national and regional).

The NOWEFIO programme aims to increase the involvement of citizens and non-governmental organisations in public life by improving social self-organisation, increasing the importance of the civic sector in public life and institutional strengthening the civic sector in Poland. The following priorities were selected for analysis: Priority 2, within which social activity for the common good implemented by citizens acting in non-governmental organisations is supported, as well as Priority 3: Social organisations in public life, and Priority 4: Strengthening the competencies of civic organisations. Projects implemented under Priority 1 should enhance civic activity and self-organisation, contributing to building and increasing social capital and contributing to social responsibility. Implementation of Priority 3 aims to increase the presence of civic organisations in public life, support civic

dialogue and consultation processes, create a forum of public debate, and build the potential of organisations by shaping the image of civic organisations in public space. Under Priority 4, the implemented projects are to contribute to the improvement of management in civic organisations, building their structures, creating and improvement of their resources, creating and developing strategies for their operation (Program et al 2020).

Both the PROO and NOWEFIO programmes support the implementation of social tasks within non-governmental organisations. The functions implemented under the Priorities are of an SI nature. They respond to social needs and force organisations to adopt an innovative approach to the objectives and strategy of their social activity. The selection of appropriate determinants during competitions allows for meeting present and future challenges related to social needs.

The research involves non-governmental organisations registered in Poland as associations, foundations, social enterprises, sports clubs, societies, voluntary fire brigades, and rural housewives' circles. The sample selection is purposeful, as the respondents include representatives of all groups of non-profit organisations operating in Poland.

3.3 Results

The study used data from PROO and NOWEFIO competitions for the 2022 and 2021 editions. The amount of support in PROO and NOWEFIO programmes, as well as the marginal conditions (time and financial) of the grant, the leader set at different levels, which allowed to verify the hypothesis of the Stackelberg leadership model and the Nash equilibrium model.

Table 1: Amount of support and marginal conditions for the PROO Programme in 2022-2021 (thousand PLN)

PROO	2022				2021		
	Total Grant Request		Total Grant per year		Total Grant Request		
	min	max	min	max	min	max	Limited time
Priority 1a	150	600	50	400		700	for 12 to 36 months
Priority 4	150	300	50	100	200	300	to 24 months

Table 2: Amount of support and marginal conditions for the NOWEFIO Programme in 2022-2021 (thousand PLN)

NOWEFIO	2022				2021	
	Total Grant Request		Total Grant per year		Limited time for 18 to 36 months	
	min	max	min	max	min	max
Priority 2	50	300	50	150	50	300
Priority 3	50	300	50	150	50	300
Priority 4	150	400	150	200	100	400

Considering the grants market as the place where the strategic game is played, it is reasonable to assume that the followers' behaviour will follow the leader, i.e. the grant amounts applied for by the organisations will be equal to the maximum values in each Programme.

We will be the first to analyse the PROO programme. The entities applying for grants had to adjust their projects to the values of the amount and time. During the analysed period in the PROO competition, the final criteria changed in particular priorities (Table 1). And so in 2022. In 2022 the requirements of minimum and maximum values were established for specific years of project duration, as well as extreme values for costs of the entire undertaking. In 2021 and 2020, the marginal criteria for the costs of tasks implemented under the projects had limits for the full grant, as well as minimum time limits. The distributions by year are shown in Figures 1 and 2.

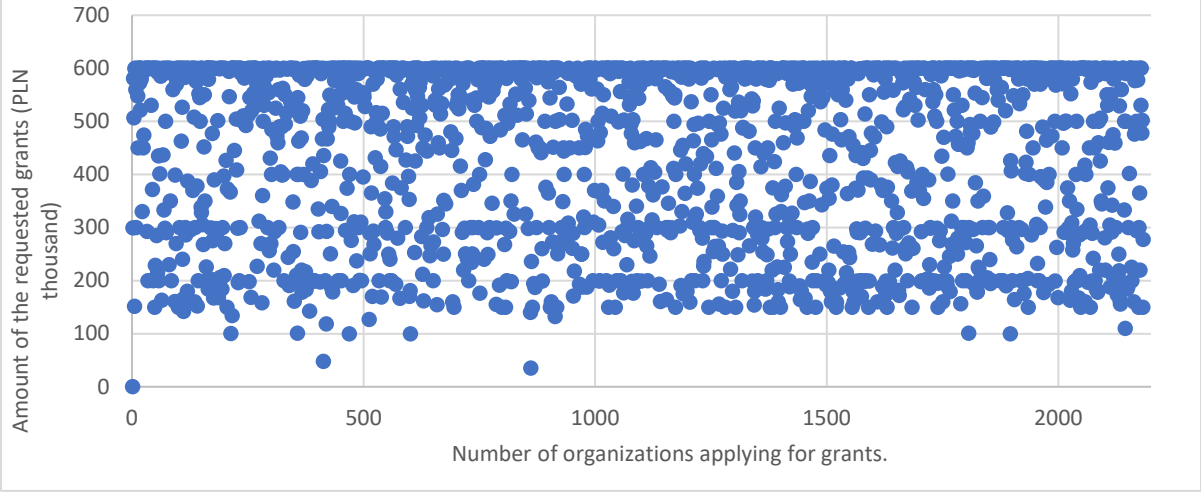


Figure 1: Distributions of requested grant amounts in the PROO Programme in 2022

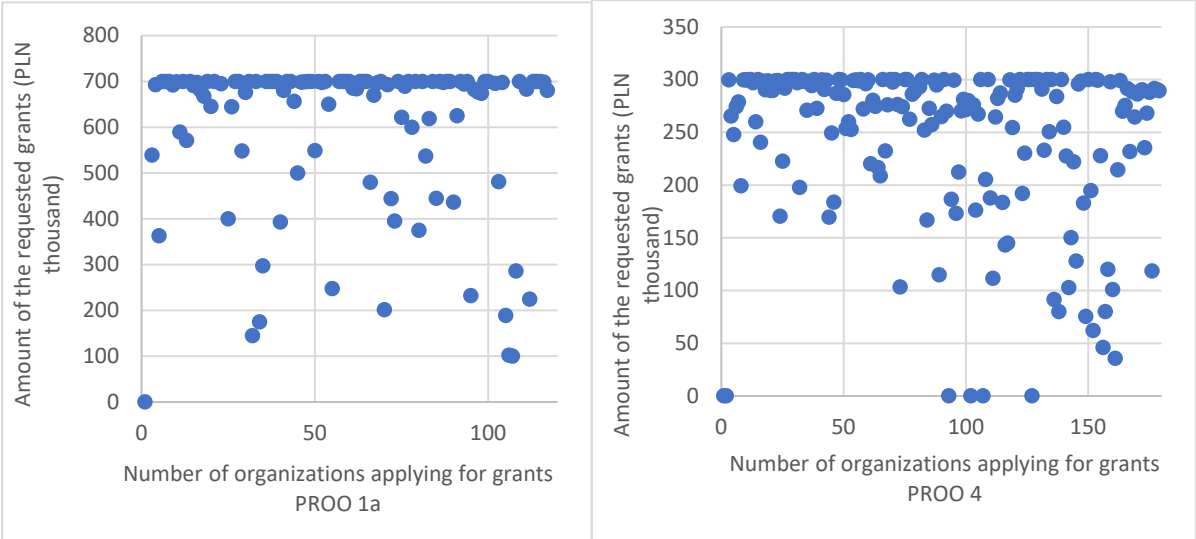


Figure 2: Distributions of requested grant amounts in the PROO Programme for Priorities 1a and 4 in 2021

Comparing the distributions of the PROO programme in 2021 and 2022, it can be seen that the majority of organisations chose the maximum grant amount for the given priorities. The distribution for the 2022 edition is interesting (Fig.1), as some organisations set the capital requirement at 200 thousand PLN, which does not coincide with the maximum grant value. This gives grounds to assume that other considerations guided these organisations. One of the reasons may be the desire to participate in the next edition, and it is conditioned by the end of the current project, which will allow these organisations to free up resources and prepare for the next competitions (in 2022, the leader did not set a time limit for the project). If time constraints were introduced (2021 edition), organisations unequivocally chose the maximum value option (Fig.2). Hence, the conclusion is that the organisations calculate project costs by considering the time and financial criteria. Leaders in subsequent editions should consider this when setting the requirements for competitions.

The PROO and NOWEFIO programmes differed in their approach to SI implementation. The PROO programme reinforces the organisation's strategic goals, while the NOWEFIO programme focuses on realising SI tasks. It seems interesting to ask whether organisations have changed their strategy for determining the amount of capital required?

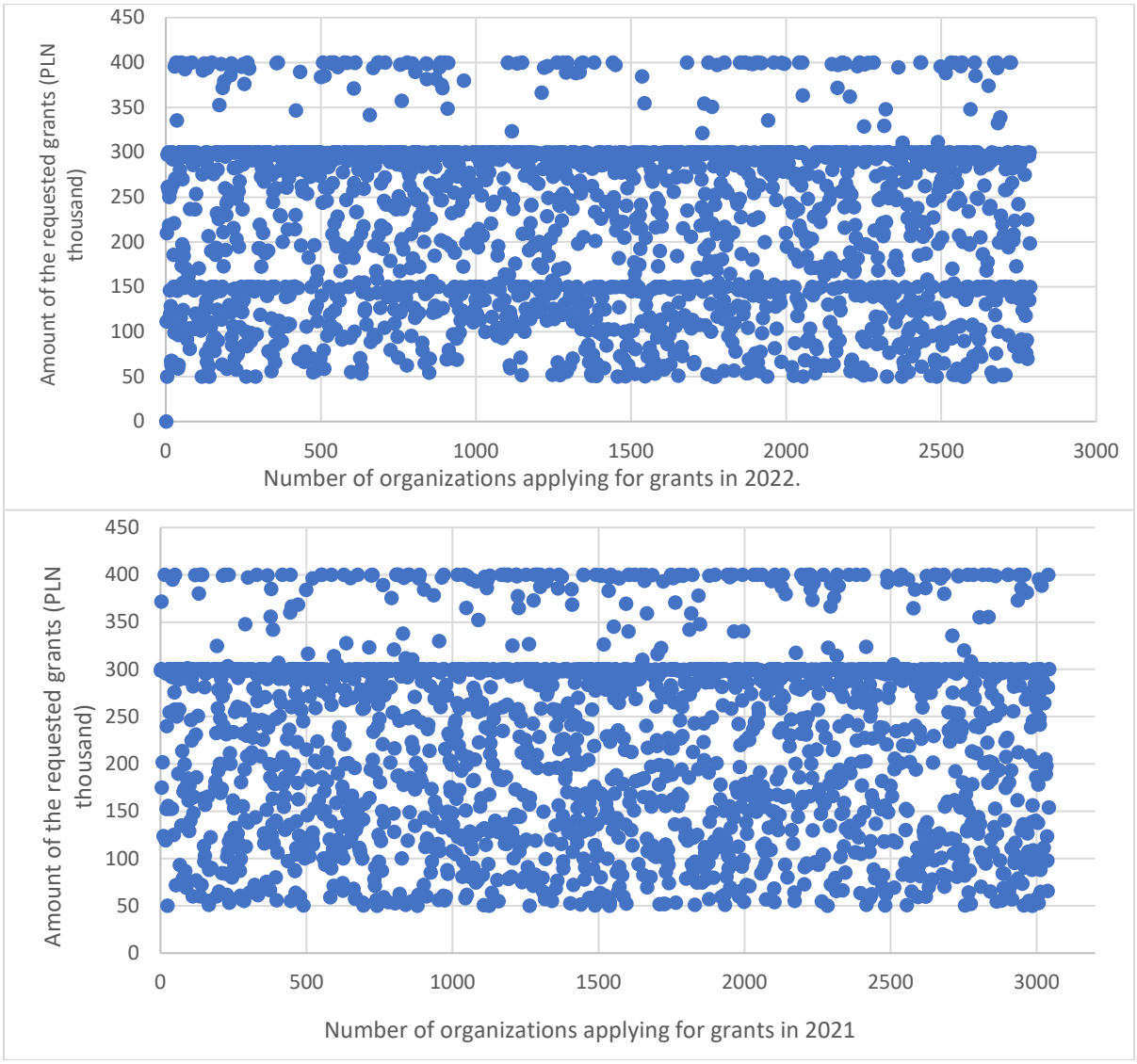


Figure 3: Distribution of grant amounts applied for in the NOWEFIO Programme

When analysing the number of grants from the NOWEFIO Programme (Fig. 3), both in 2021 and 2022, one can clearly see the limits between successive maximum values of grants. Thus, in 2022, three boundaries concentrated the values of maximum grants in the examined Priorities, namely PLN 150,000, PLN 300,000 and PLN 400,000. The value of PLN 150,000 is the maximum amount of grant one can apply for in a year (2022 edition). This gives rise to a suspicion that some organisations, as was the case in the PROO programme, applying for grants are planning to participate in the next edition of the competition (the condition for entering the next competition is completing the project from the previous edition). Such a strategy of entering the annual edition of the NOWEFIO contest increases the budget by 50% (instead of the maximum value of PLN 300,000, they will receive PLN 450,000). Such a conclusion can also be drawn from comparing the 2021 edition of the NOWEFIO contest, where there was no minimum value of the grant and only maximum values, i.e. PLN 300,000 and PLN 400,000, were clear boundaries. To sum up the research, the organisation announcing the competition for the SI behaves like a market leader who sets the price for the service (in the case of the SI, it is the cost of implementing social tasks). In contrast, the others act like followers, i.e. set the project costs in maximum values for particular Priorities. THEREFORE, the SI market leader should take care to introduce criteria in individual projects to strengthen the preparatory activities for future changes related to the “Green Deal” for Industry 5.0 and force organisations applying for grants to take an innovative approach to social problems.

4. Conclusion

SI researchers often focus on how social problems are solved, the measures of innovation, or innovation vehicles. This paper focuses on using the lead as a facilitator of change in managing organisations. Organisations applying

for grants from PROO and NEWFIO programmes were used for the study. The Stackelberg game leadership model was applied. It was found that organisations applying for grants, in most cases, follow the leader, regardless of the competition that sets the price (maximum grant value) for SI. It was also taken into account that every Stackelberg game strives for Nash equilibrium, which was also the case in our sample. The consequence of our research is a new approach to how SI is implemented as a new paradigm of change in the management of organisations, forced by market leader behaviour. Our findings make it possible to minimise the adverse impact on change resulting from the 'Green Deal' for Industry 5.0 in the future by using the market leader. The article does not end the debate on the role and importance of SI in contemporary and future societies. Still, it allows us to see and use the role of leaders in creating change in all organisations.

References

Arocena, R. and Sutz, J. (2021) ''Universities and social innovation for global sustainable development as seen from the south'', *Technological Forecasting and Social Change*, Vol 162.

Audretsch, D.B., Eichler, G.M. and Schwarz, E.J. (2021) ''Emerging needs of social innovators and social innovation ecosystems'', *International Entrepreneurship and Management Journal*, pp 1- 38.

Banholzer, V.M. (2022) ''From „Industry 4.0" to „Society 5.0" and „Industry 5.0": Value- and Mission-Oriented Policies. Technological and Social Innovations – Aspects of Systemic Transformation'' *IKOM WP* 3 (2) Technische Hochschule Nürnberg Georg Simon Ohm. [online] https://www.th-nuernberg.de/fileadmin/fakultaeten/amp/amp_docs/Workingpaper_2_2022_Industry_50_Banholzer.pdf/

Bathelt, H. and Glückler, J. (2011) *The Relational Economy: Geographies of Knowing and Learning*, Oxford University Press, New York

Bellandi, M., Donati, L. and Cataneo, A. (2021) ''Social innovation governance and the role of universities: Cases of quadruple helix partnerships in Italy'', *Technological Forecasting and Social Change*, Vol 164.

Buchinger, M. (2021) ''Industrie 5.0 – eine längst fällige Korrektur'' [online] https://industriemagazin.at/expertenpool/industrie-50-wir-haben-da-etwas-vergessen/

Cajaiba-Santana, G. (2014) ''Social innovation: Moving the field forward. A conceptual framework'', *Technological Forecasting and Social Change*, Vol 82, pp 42-51.

Czekan, W. (2011) ''Paradygmat sieciowy w naukach o zarzadzaniu'', *Przegląd Organizacji*, Vol 11, No. 862, pp 3-6.

Dionisio, M. and de Vargas, E.R. (2020) ''Corporate social innovation: A systematic literature review'', *International Business Review*, Vol 29, No.2.

European Commission (2021), Industry 5.0. Towards a sustainable, human-centric and resilient European industry. Directorate-General for Research and Innovation. Brüssel:[online] https://data.europa.eu/doi/10.2777/308407

European Commission (2022) Industry 5.0, a transformative vision for Europe. Governing systemic transformations towards a sustainable industry. ESIR Policy Brief No.3, Directorate-General for Research and Innovation. Brüssel:[online] https://data.europa.eu/doi/10.2777/17322

Faria, J., Besancenot, D. and Novak, A. (2011) ''Paradigm depletion, knowledge production and research effort: Considering Thomas Kuhn's ideas''. *Metroeconomica*, Vol 62, pp 587–60.

Ghazinoory, S., Nasri, S., Ameri, F., Montazer, G.A. and Shayan, A. (2020) ''Why do we need 'Problem-oriented Innovation System (PIS) for solving macro-level societal problems?'' *Technological Forecasting and Social Change,* Vol 150.

Gintis, H. (2009) ''*Game Theory Evolving: Problem-Centered Introduction to Modeling Strategic Interaction'',* Princeton University Press.

Have, R.P. and Rubalcaba, L. (2016)''Social innovation research: An emerging area of innovation studies?'' *Research Policy*, Vol 45, No.9, pp 1923-1935

Howald, J. , Domanski, D., Kaletka, Ch. (2016)''Social Innovation: towards a new innovation paradigm'', *Mackenzie Management Review*, Vol 17, No.6, Special Edition, pp 20-44.

Kraśnicka, T. (2018) *Innowacje w zarządzaniu*. Wydawnictwo Beck, Warszawa.

Kuhn, T.S. (1970) ''*The Structure of Scientific Revolutions*'', 2d ed University of Chicago Press, Chicago.

Lies, J. (2020) ''Imagining Niklas Luhmann as a "change manager": scrum as an example of a closed system for the self-organized stabilization of corporate agility'', *Journal of Organizational Change Management*, Vol 33 No. 7, pp 1417-1429.

Maclean, M., Harvey, C. and Gordon, J. (2013) ''Social innovation, social entrepreneurship and the practice of contemporary entrepreneurial philanthropy'', *International Small Business Journal,* Vol 31, No.7, pp 747-763.

Manning, S., Vavilov, S. (2022) ''Organizing Projects for Social Innovation'', in: Davies, A., Lenfle, S., Loch, C., Midler, C. eds., *Handbook of Innovation and Project Management*, Elgar, pp 1-23.

Martinez, F., O'Sullivan, P., Smith M., Esposito M. (2017) ''Perspectives on the role of business in social innovation'', *Journal of Management Development,* Vol 36, No.5, pp 681-695.

Massey, A. and Johnston-Miller, K. (2016) ''Governance: public governance to social innovation?'', *Policy and Politics*, Vol 44, No. 4, pp 663-675.

Mirvis, P. and Googins, B. (2018) ''Engaging employees as social innovators'', *California Management Review*, Vol 60, No.4, pp 25-50.

Nicholls, A. and Murdock, A. (2012) The nature of social innovation. In: Social innovation. Palgrave Macmillan, London, pp 1-30.

Phillips, W., Alexander, E.A. and Lee, H. (2019) ''Going it alone won't work! The relational imperative for social innovation in social enterprises'', *Journal of Business Ethics*, Vol 156, No. 2, pp 315-331.

Phills, J., Deiglmeier, K. and Miller, D. (2008) ''Rediscovering social innovation'' *Stanford Social Innovation*, Vol 6, No. 4, pp 34-43.

Pol, E. and Ville, S. (2009) ''Social innovation: Buzz word or enduring term?'' *The Journal of socioeconomics*. Vol 38, No. 6, pp 878-885.

Programu Fundusz Inicjatyw Obywatelskich na lata 2014–2020 w latach 2018-2020 (Dz. U. z 2018 r. poz. 1813, z późn. zm.)

Program Fundusz Inicjatyw Obywatelskich NOWEFIO na lata 2021–2030, Załącznik do uchwały nr 194/2020 Rady Ministrów z dnia 22 grudnia 2020 r.

Rządowy Program Rozwoju Organizacji Obywatelskich na lata 2018–2030 PROO, Uchwałą nr 104/2018 Rady Ministrów z dnia 7 sierpnia 2018 r.

Schroeder, H. (2013) ''Strategic innovation for business performance: the art and science of transformation'', *Technology Innovation Management Review*, Vol 3, No. 9, pp 6-12.

Stackelberg, H. (2011) *Market Structure and Equilibrium*, Springer, Berlin, Heidelberg.

Stanisławski, R. (2017) ''*Open innovation a rozwój innowacyjnych mikro, małych i średnich przedsiębiorstw*'', Politechnika Łódzka, Łódź.

Therace, A., Hubert, A., Dro, I. (2011) *Empowering people, driving change: social innovation in the European Union*. Bureau of European Policy Advisers. European Commision. Luxembourg. [online] https://op.europa.eu/en/publication-detail/-/publication/4e23d6b8-5c0c-4d38-bd9d-3a202e6f1e81

Ustawy z dnia 15 września 2017 r. o Narodowym Instytucie Wolności – Centrum Rozwoju Społeczeństwa Obywatelskiego (Dz.U. z 2018 r. poz.1813, z późn. zm.).

Wijk, J., Zietsma, C., Dorado, S., De Bakker, F.G. and Marti I. (2019) ''Social innovation: Integrating micro, meso, and macro level insights from institutional theory'', *Business and Society,* Vol 58, No.5, pp 887-918.

Knowledge Management and Dynamic Capabilities: A Digital Embracing of Interrelated Processes

Mohammad Omar Sabri
Business Information Technology, Zarqa University, Jordan
msabri@zu.edu.jo

Abstract: Exploration and exploitation are the main processes that work concurrently to achieve an organisation's evolution and success. Knowledge Management (KM) and Dynamic Capabilities (DCs) are significant fields that share these processes. The application of exploration and exploitation processes is still implicit in organisations, and it is not formally represented in technical configuration levels. Mapping these processes to Information technology (IT) creates an advanced robust translation of their use. It also identifies a tangible role for KM and DCs. The idea of deconstructing dynamic capabilities into three levels has been adopted in this mapping. Levels are high-order learning capabilities with the highest exploration learning activities, first-order ordinary capabilities with the highest exploitation learning activities, and lower-order functional capabilities, intermediate between both levels. The digital embracing of the exploration and exploitation model has been proposed to translate all levels of capabilities into different digital configurations. Automated functions of *search/browse*, *create/add*, *modify/update*, *remove/delete* and *read/revise* are utilised to present these digital configurations in this model. Search/browse and create/add reflect the higher-order level. Modify/update and remove/delete mirror the intermediate level. Read/revise matches the first-order level. These IT configurations are simple and would be sufficient to assess exploration and exploitation processes. It can also support a new vision for measuring organisational ambidexterity. A near-future case study of an educational institution will be accomplished to evaluate this model. Two main domains, which involve internal systems (strategies, policies, and regulations) and educational materials, will be assessed with their e-resources and the use of the proposed digital functions that represent exploration and exploitation. A quantitative approach using an online survey will be used in this evaluation. The survey will be distributed to academics with administrative positions in all institution departments. The findings of this evaluation would expect to assess the extent of using online search in finding and creating new e-resources which present the two nominated evaluation domains. It would also appraise updating, deleting, and reading available e-resources according to these domains' new requirements or traditional proceeded routines.

Keywords: knowledge management processes, dynamic capabilities, digital exploration and exploitation

1. Introduction

Different studies state the effects of Knowledge Management (KM) and Dynamic Capabilities (DCs) on Competitive Advantage (Mahdi, 2019; Ferreira, 2020). They also clarify the link between these two fields and identify knowledge-related processes in DCs studies as one of two main approaches (Eriksson, 2014). Furthermore, KM and DCs concepts share insights about organisational learning, and the contrast between them is related more to their terms than their essence (Vera, 2009).

An emerging shift in modern industry is using Digital Technologies (DTs). DTs are highly interconnected capacities that support and enhance the processing of information (Bican and Brem, A. 2020). DTs have played an important role in enabling service innovation and structural transformation, in addition to a reformulation of industry competition (Ardolino et al., 2018). Using technological functionalities to translate new types of processes in KM that overlap with a significant field such as DCs, can support the organisational learning domain and different research disciplines and achieve organisational ambidexterity (Soto-Acosta et al., 2018). It also engages KM and DCs disciplines in real application technology functions.

The application of Knowledge Management Processes (KMPs) concerning DTs still requires more research. Furthermore, specific KMPs such as knowledge sharing, application, and acquisition are the only standard processes in KM studies (Al-Emran, 2018). This paper aims to present a model that links the exploration and exploitation of interrelated processes of KM and DCs to DTs. This model will be applied at a university in Jordan to measure its internal system and educational materials using the corresponding digital services of exploration and exploitation.

2. Knowledge management

A Resource-Based View (RBV) considers knowledge a strategic asset for organisations. Knowledge implies different terms such as information, competencies, capabilities, experiences, and skills. KM definition is broad-ranging and can have different interpretations. One of the most cited definitions refers to KM as a strategy that

makes the right individuals reach the proper knowledge at the right time and support them to share information and place it into actions that achieve organisational performance (Girard and Girard, 2015). It is obviously about knowledge creation and capturing to utilise and make it available to decision-makers upon their request. Hislop and Others (2018) used two common perspectives in KM definitions; one as an object and the other as a process. The objectivist perspective regards knowledge as an asset pooled, stored, inspected, and accessed by individuals. The process perspective considers knowledge encapsulated in humans and requires social interaction to facilitate knowledge sharing and dissemination. Efficient utilisation, creation, development, and reuse of knowledge depends on organisational KM capabilities. KM capabilities are composed of Knowledge Management Enablers (KMEs) and KM processes (Gold et al., 2001).

2.1 Knowledge management enablers

KMEs are motivational factors that facilitate the launching and encouragement of KM activities (Yasir and Majid,2017). These factors develop knowledge creation and sharing besides affecting other organisational knowledge processes. Critical Success Factors and Infrastructure Capabilities were also referred to KMEs in different studies (Gold et al., 2001; Migdadi, 2009). Arthur Anderson and the American Productivity and Quality Centre (APQC) defined four main KMEs: culture, leadership, performance measurement, and IT (Andersen et al., 1996). The organisation structure was also addressed along with leadership and IT to be the pillars for KM Implementation (Bixler, 2002). A semantic representation of these pillars, including significant KMEs such as culture, business repository, and knowledge context, was implemented using ontologies (Sabri et al., 2017). This approach has defined a formal representation of KMEs in the KM domain and supported a dynamic and knowledge-based business process architecture modelling (Sabri and Odeh, 2019).

2.2 Knowledge management processes

KM processes are a sequence of activities that an organisation applies to facilitate the utilisation of knowledge (Igbinovia and Ikenwe, 2017). Jafari and Maleki (2013) reviewed KM process models developed for two decades. These models were applied to improve the efficiency of operations and the organisation's competitive advantage. They are also related to three basic KM processes; creation, sharing, and application of knowledge which appeared to be crucial to the KM implementation program. On the other hand, Martelo-Landroguez and Cepeda-Carrión (2016) also identified four main KM processes related to the previous review. These processes are; creation, transfer, storage, retrieval, and application.

3. Dynamic capabilities

A Dynamic Capability appeared as a criterion and extension to the resource-based view to define the organisation's processes, skills, decisions, rules, and abilities to sense and capture the value and new opportunities. In addition, it would reform and secure its knowledge base, competencies, and technology to sustain a competitive advantage. These criteria determine the capacity of the enterprise to reproduce, merge, and utilise its external and internal resources in a rapidly changing environment (Teece, 2010) and consequently change the organisation's resource base (Helfat et al., 2007). DCs are strategic and differ from ordinary capabilities related to current activities; they promote the organisation's ability to position the right product in the right market to address customers' needs and set up the enterprise's systematic methods to modify operating routines (Teece, 2012). In so doing, they become successful and exhibit leadership among their competitors.

Applying KM capabilities concurrently with dynamic capabilities is recommended to respond to environmental changes and thus enhance performance and competitive advantage (Tseng and Lee, 2014). Easterby-Smith and Prieto (2008) identified overlapping fields in KM and DCs. These fields include learning underpinning KM and DCs, exploration and exploitation, and knowledge infrastructure. Learning capabilities provide a source of DCs and can be presented in KM processes such as creating, sharing, and applying knowledge. Exploration and exploitation lead to knowledge evolution that dynamic capabilities depend on. The exploration process is the generator of the new ideas, while exploitation concerns merging existing methods in new condition(s) or context(s). Thus, DCs are obvious in organisations where exploration and exploitation of knowledge and competencies occur concurrently. Lastly, knowledge infrastructure, which implies knowledge, individuals' skills, technical and managerial systems, and culture, are crucial cornerstones in setting up DCs. According to this identified relationship between KM and DCs, Easterby-Smith and Preito (2008) built their model, which employs learning as the central mediating element between KM and DCs. It also links two essential learning processes: exploration and exploitation. These are considered crucial learning processes (Zollo & Winter,2002). Learning

should also be balanced between exploration and exploitation and utilised in a model to reconfigure resources and operational routines and thus achieve sustained performance.

4. Exploration and exploitation

The capability to run both exploration and exploitation activities concurrently involves organisational success (Easterby-Smith and Prieto, 2008). In addition, exploration and exploitation are the main processes in the organisational knowledge evolution cycle (Zollo and Winter, 2002). The exploration covers search, discovery, risk-taking, observation, and innovation, whilst exploitation involves procedures and assessments such as implementation, selection, productivity, efficiency, and execution (March, 1991). Specifically, exploration depends on new knowledge, technologies, and products with uncertain needs, whereas exploitation is associated with using and refining existing knowledge (Guisado-González et al., 2017). Therefore, sustaining a balance between exploring the capabilities that might need to be known and exploiting the capabilities that an organisation already knows is necessary to reach an intelligent adaptation (March, 2003).

Studies that link organisational factors or KMEs to exploration and exploitation are not remarkable. Gonzalez and de Melo (2018) studied several organisational context factors that impact innovation through KM exploration and exploitation. Exploration was more affected by factors such as IT systems, autonomy, and learning culture, while exploitation is related to factors of supportive leadership and learning culture. This paper highlights the connection between IT KME and exploration and exploitation processes using digital services. A model is developed and will be demonstrated later on at a university in Jordan.

5. Deconstruction of dynamic capabilities

Higher-order capabilities impact corporation strategy; however, success and achievement depend on managing lower-order and ordinary capabilities to run processes effectively. Dynamic capabilities can be deconstructed into high-order dynamic learning capabilities with high levels of knowledge exploration, lower-order dynamic functional capabilities with high levels of knowledge exploitation, and first-order ordinary capabilities with routine activities. Dynamic learning capabilities include an in-depth inspection view that supports an organisation to capture essential values of outside resources. Dynamic functional capabilities are change-focused and described as using less-patterned routines, becoming more patterned over time. Ordinary capabilities present a normal situation and cause no change in an organisation (Hine et al., 2014).

According to previous division and based on the definition of dynamic capabilities that implies sensing, creating, extending, and modifying the organisation's primary resources (Helfat et al., 2007), in addition to the role of functional capabilities in organisation processes development through product improvement and repeated processes (Hine et al., 2014), exploration and exploitation processes can be translated into specific services in the digital technology field. High knowledge exploration or sensing levels are implemented through *searching* or *browsing* online to *create* or *add* new automated resources, ideas, innovations, and alternatives. High levels of knowledge exploitation are applied by *modifying* or *updating* existing automated resources or even *removing* or *deleting* them. In addition to exploration and exploitation levels, we also have a first-order level which includes *reading* or *revising* the use of automated resources of an organisation. These suggested digital services are the main techniques in changing organisational automated resources, such as files, folders, tools, shared platforms, and disruptive and enabling technologies. However, e-resources affected by these services should improve capturing and extending value-added services to effectively develop the value cycle (Porter and Heppelmann, 2014). Subsequently, the proposed model that combines all these elements and translates exploration and exploitation processes is presented in figure 1.

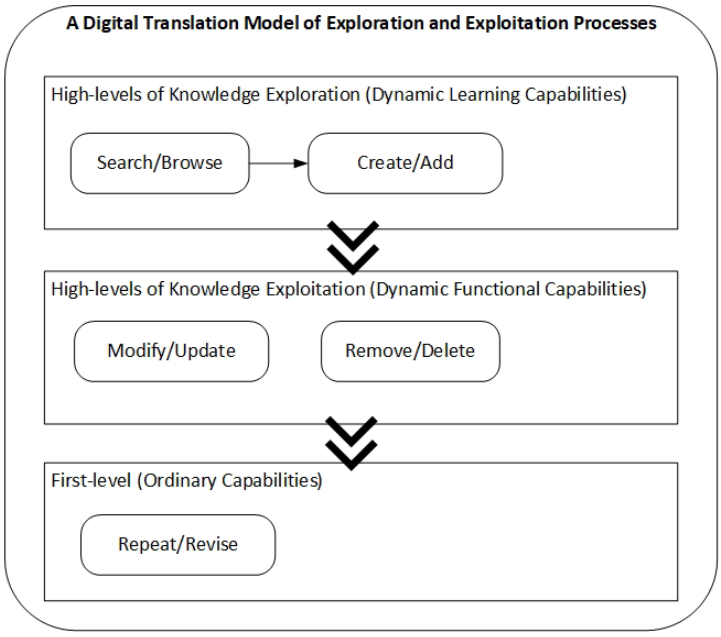


Figure 1: A digital translation model of exploration and exploitation processes

6. Research Methodology

Evaluation of the previous model requires an empirical case study of an institution that has clear evidence of dependency on IT to complete its work. The educational sector in Jordan, especially after the Covid-19 dilemma, has shown a significant shift towards IT. This trend was also promoted by regulations from the ministry of higher education regarding e-learning. Therefore, a demonstration of this paper model using a university in Jordan could be sufficient to address this evaluation. Two main domains of the university were chosen to achieve the proposed model evaluation; the internal system that includes uploaded e-documents of strategies, policies, regulations, and the online educational materials and documents which the instructors are using in the educational process. A quantitative method is the main approach in this evaluation. An online questionnaire will be distributed using email to administrative academics in the university, including 13 faculties and 37 departments. The main sections of the questionnaire are suggested to include the paragraphs in Table 1. Likert scale of five-point type will be used to assess these paragraphs, which reflect the digital variables of the model (search/browse, create/add, modify/update, remove/delete, read/revise), knowledge exploration and exploitation regarding the case study domains, and ordinary routines.

Table 1: Suggested paragraphs for evaluating the digital translation model of exploration and exploitation

Paragraph No.	Paragraph	Variable
Digital Knowledge Exploration		
1.	New strategic orientations and policies of the world's universities are often discovered through the received online information.	Search/Browse
2.	Regulations of other competitors' universities are learned and explored by browsing and inspecting their websites and online announcements.	Search/Browse
3.	The internet and the official online announcements of the ministry of education are one of the primary sources for creating e-documents for new regulations in the university.	Search/Browse + Create/Add
4.	Any new strategies, policies, or regulations will be e-documented once the faculty agrees.	Create/Add
5.	Academics mainly use the internet to find new resources for their educational materials.	Search/Browse
6.	E-documents of different materials generally depend on internet resources that lecturers develop.	Search/Browse + Create/Add
7.	The electronic folder is created for each subject taught to students in the department.	Create/Add

Paragraph No.	Paragraph	Variable
Digital Knowledge Exploitation		
8.	Every change made to strategies, policies, or regulations is reflected on the e-documents where these elements are stored.	Modify/Update
9.	E-documents of no more extended used policies and regulations are deleted or archived.	Remove/Delete
11.	Any updates on educational materials are aligned with changes on their e-documents	Modify/Update
12.	The excluded educational materials are followed by the removal or archiving of their e-documents stored in the internal system.	Remove/Delete
Digital Ordinary Routines		
13.	Staff usually read and revise existing e-documents of policies and regulations to apply them accurately.	Read/Revise
14.	Existing online educational materials are the leading resource for reading and revising before lectures and exams.	Read/Revise
Knowledge Exploration		
15.	The faculty management is flexible to learn and adopt new strategies, policies, or regulations.	
16.	The academic staff considers new subjects' materials and adds to their course plan if they are necessary.	
Knowledge Exploitation		
19.	The faculty management welcomes any changes to its current strategies, policies, or regulations if they find them better.	
20.	The academic staff does not resist the development and updates on subjects' existing materials whenever required.	
Ordinary Routines		
21.	Strategies, policies, and regulations become common and a daily practice after the faculty management applies after a while time.	
22.	The existing educational materials of a subject are taught in a straightforward common practice by academics after teaching them more than one time.	

7. Conclusion and future work

Adoption of digital services in translating KM processes is a priority request that facilitates the engagement of KM in a natural working environment. Exploration and exploitation are two crucial processes of KM that require to be identified by these services and technologically simulated to assess their impacts on organisations. Deconstructing dynamic capabilities into three levels where exploration and exploitation processes exist can support this simulation and identify exploration and exploitation roles in their levels. Search or browse online followed by creating automated resources are performed at the dynamic learning capabilities level, including knowledge exploration. Modifying or removing automated resources is applied at the dynamic functional capabilities level with knowledge exploitation. This distribution of digital functions between exploration and exploitation has led to a digital translation model embracing both processes.

The digital translation model of exploration and exploitation processes is the main contribution of this paper. An evaluation of this model demands demonstration using an empirical case study. A future case study of a university in Jordan is proposed to proceed with this evaluation and extend this work. Further studies are suggested to identify different knowledge processes using other digital services or IT practices.

References

Al-Emran, M., Mezhuyev, V., Kamaludin, A., & Shaalan, K. (2018) "The Impact of Knowledge Management Processes on Information Systems: A Systematic Review", *International Journal of Information Management*, Vol 43, pp 173-187.

Andersen, A., Productivity, T. and Center, Q. (1996) "The Knowledge Management Assessment Tool: External Benchmarking Version", [online], Chicago, IL, http://docs.lib.purdue.edu/cgi/viewcontent.cgi? article=1425 &context=iatul

Ardolino, M., Rapaccini, M., Saccani, N., Gaiardelli, P., Crespi, G., & Ruggeri, C. (2018) "The Role of Digital Technologies for the Service Transformation of Industrial Companies", *International Journal of Production Research*, Vol 56, No. 6, pp 2116-2132.

Bican, P. M., & Brem, A. (2020) "Digital Business Model, Digital Transformation, Digital Entrepreneurship: Is There A Sustainable "Digital"?", *Sustainability*, Vol 12, No. 13, pp 5239.

Bixler, C. H. (2002) "Applying the Four Pillars of Knowledge Management", *KM World*, Vol 11, No. 1, pp 10-20.

Easterby-Smith, M. and Prieto, I.M. (2008) "Dynamic Capabilities and Knowledge Management: An Integrative Role for Learning?", *British Journal of Management*, Vol 19, No. 3, pp 235-249.

Eriksson, T. (2014) "Processes, Antecedents and Outcomes of Dynamic Capabilities", *Scandinavian Journal of Management*, Vol 30, No. 1, pp 65-82.

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*, Vol 92, p 102061.

Girard, J., & Girard, J. (2015) "Defining Knowledge Management: Toward an Applied Compendium", *Online Journal of Applied Knowledge Management*, Vol 3*,* No*.* 1, pp 1-20.

Gold, A.H., Malhotra, A. and Segars, A.H. (2001) "Knowledge Management: An Organizational Capabilities Perspective", *Journal of Management Information Systems*, Vol 18, No. 1, pp.185-214.

Gonzalez, R. V. D., & de Melo, T. M. (2018) "The Effects of Organization Context on Knowledge Exploration and Exploitation", *Journal of Business Research*, Vol 90, pp 215-225.

Guisado-González, M., González-Blanco, J., & Coca-Pérez, J. L. (2017) "Analysing the Relationship between Exploration, Exploitation and Organizational Innovation", *Journal of Knowledge Management*, Vol 21, No. 5, pp 1142-1162.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2007) *Dynamic Capabilities: Understanding Strategic Change in Organizations*, John Wiley & Sons.

Hine, D., Parker, R., Pregelj, L. and Verreynne, M. (2014) "Deconstructing and Reconstructing the Capability Hierarchy", *Industrial and Corporate Change*, Vol 23, No. 5, pp 1299.

Hislop, D., Bosua, R., & Helms, R. (2018) *Knowledge Management in Organisations: A Critical Introduction*, Oxford University Press.

Igbinovia, M. O., & Ikenwe, I. J. (2017) "Knowledge Management: Processes and Systems", *Information Impact: Journal of Information and Knowledge Management*, Vol 8, No. 3, pp 26-38.

Jafari, M., & Maleki, M. (2013) "A Review on Knowledge Management Process Models in Former Two Decades", *International Journal of Information, Business and Management*, Vol 5, No. 2, pp 263-273.

Mahdi, O. R., Nassar, I. A., & Almsafir, M. K. (2019) "Knowledge Management Processes and Sustainable Competitive Advantage: An Empirical Examination in Private Universities", *Journal of Business Research*, Vol 94, pp 320-334.

March, J. G. (2003) "Understanding Organisational Adaptation", *Society and Economy*, Vol 25, No. 1, pp 1-10.

March, J.G. (1991) "Exploration and Exploitation in Organizational Learning", *Organization Science*, Vol 2, No. 1, pp 71-87.

Martelo-Landroguez, S., & Cepeda-Carrión, G. (2016) "How Knowledge Management Processes Can Create and Capture Value for Firms?", *Knowledge Management Research & Practice*, Vol 14, No. 4, pp 423-433.

Migdadi, M. (2009) "Knowledge Management Enablers and Outcomes in the Small-and-Medium Sized Enterprises", *Industrial Management & Data Systems*, Vol 109, No. 6, pp 840-858.

Porter, M. E., & Heppelmann, J. E. (2014), "How Smart, Connected Products Are Transforming Competition", *Harvard business review*, Vol 92, No. 11, pp 64-88.

Sabri, M. O., & Odeh, M. (2019) "The Impact of Knowledge Management on the Development of Innovative Business Process Architecture Modelling: The Case of Banking in Jordan", *International Journal of Technology Management & Sustainable Development*, Vol 18, No. 2, pp 197-220.

Sabri, M., Odeh, M. and Saad, M. (2017) "A Semantic Representation of the Knowledge Management Enablers Domain: The aKMEOnt Ontology", *Proceedings of the 18th European Conference on Knowledge Management*, *ECKM,* Spain, 7-8 September, pp 1196-1204.

Soto-Acosta, P., Popa, S., & Martinez-Conesa, I. (2018) "Information Technology, Knowledge Management and Environmental Dynamism as Drivers of Innovation Ambidexterity: A Study in SMEs", *Journal of Knowledge Management*, Vol 22, No. 4, pp. 824-849.

Teece, D. J. (2010) "Technological Innovation and the Theory of the Firm: The Role of Enterprise-level Knowledge, Complementarities, and (Dynamic) Capabilities", In *Handbook of the Economics of Innovation*, Vol 1, pp 679-730.

Teece, D. J. (2012) "Dynamic Capabilities: Routines versus Entrepreneurial Action", *Journal of management studies*, Vol 49, No. 8, pp 1395-1401.

Tseng, S. M., & Lee, P. S. (2014) "The Effect of Knowledge Management Capability and Dynamic Capability on Organizational Performance", *Journal of Enterprise Information Management*, Vol 27, No. 2, pp 158-179.

Vera, D. (2009) "On Building Bridges, Facilitating Dialogue, and Delineating Priorities: A Tribute to Mark Easterby-Smith and his Contribution to Organizational Learning", *Management Learning*, Vol 40, No. 5, pp 499-511.

Yasir, M., and Majid, A. (2017) "Impact of Knowledge Management Enablers on Knowledge Sharing", *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol 13, No. 1, pp 16-33.

Zollo, M., & Winter, S. G. (2002) "Deliberate Learning and the Evolution of Dynamic Capabilities", *Organization Science*, Vol 13, No. 3, pp 339-351.

T-shaped Capabilities of the next Generation: Prospecting for an Improved Model

Juha Saukkonen and Pia Kreus
School of Business, JAMK University of Applied Sciences, Jyväskylä, Finland
juha.saukkonen@jamk.fi
pia.kreus@jamk.fi

Abstract: Modern companies are in constant search of ways to improve the integration of the various departments and business processes into a coherent entity. Changes made to the organizational structure and deployment of common company-wide ICT solutions such as Enterprise Resource Planning (ERP) and cloud infrastructure are some means that enable better internal collaboration and transparency, compared to siloed structures and modes of operating. However, infrastructural or management system changes cannot foster a holistic view, and collaboration between different parts of the organization is not possible if the stakeholders in company processes do not possess capability profiles that match the need. Human Resource Management (HRM) and knowledge management (KM) research has introduced and elaborated on the concept of T-shaped capabilities as an answer to the needs of a modern knowledge-era employee. A T-shaped capability profile is highlighting the need of employees (and managers alike) to build broad combinatory capabilities (the horizontal line on the top of the letter T) between the firm´s processes in addition to their specific expertise in one area (the vertical line in the letter T - so-called I-shape capability). Our paper introduces a prospective evolutionary step to T-shaped capabilities that we call the T^2 capability model. The model adds another horizontal layer to the model. This layer is made of generic i.e., not industry- or firm-specific capabilities, as imposed by megatrends and mindsets needed across all areas of economic activity. Examples of such generic capabilities are sustainability and ethics as well as financial and technical literacies. The second horizontal line consists of the firm´s business processes such as sales and marketing, supply chain, research, and development, etc. We will also introduce some practices on how T^2-shaped capabilities could be fostered in education and the company- and industry-level actions.

Keywords: capability, interprofessional, skills, interaction, composability, knowledge sharing

1. Introduction

Employees in modern organizations are assumed to possess capability sets that are wider in their scope than those needed earlier. The knowledge era in which companies currently operate, calls for new capabilities in both technological and behavioural dimensions and in combining these (Haapasalo and Kess, 2001). The demand for agility urges a firm to be capable of proact and react with speed to anticipated or experienced changes in the operating environment. Thus, an agile and adaptive firm can be assumed to be more resilient to demanding internal and external forces of change. A concept of composable business has been introduced (Gartner, 2020) to propagate an enterprise architecture where an organization is made from interchangeable building blocks. This modularity allows a business to rearrange and reorient when facing external (or internal) factors like sudden shifts in customer values or supply chains (ibid.).

If the new era asks for change in enterprise architecture and its flexibility, how do these demands affect the employees and capabilities asked of them? An early response to address the need for connecting diverse knowledge areas and to improve the integration of the different parts and functions of an organization was a communal one. The ideas of interacting multidisciplinary teams were introduced in many fields from noticeably different organizations like ones in social and health care (Atwal and Caldwell, 2005; Ke et al., 2013) to the oil and gas industry (van der Vegt and Bunderson, 2005). As Jackson (1996) pointed out, the underlying logic of diverse teams was rather straightforward: “Increasing popularity of team-based organizational structures reflects the widely shared belief that teamwork offers the potential to achieve outcomes that could not be achieved by individuals working in isolation”. In addition to moving to team-based organizations, many companies have nominated task force groups to operate outside the frame of the normal organigramme on a given task calling for swift analysis, decision making, and solution implementation i.e., to solve emerged or imminent business challenges. As Tropman and Johnson already in 1992 defined: “Task forces arise out of a crisis-oriented environment and are time-limited, action-oriented groups (…) formed when the situation is very complex, where resistance is expected, or when the system involved is very large, speed is essential, and one cannot wait for the normal channels of implementation to work". All these postulates are very typical in any business in the 2000s plagued by dot-com crashes, economic recession resulting from the financial system´s crisis in 2007, and, lastly, the Russian aggression in Ukraine.

An increasing interest in Human Capital (HC) and Knowledge Management (KM) research has shifted the focus from the collective capability of diverse employees organized to work together towards the capability profile that everyone should possess to contribute successfully to the joint operations within the company. In the information era that was characterized by the increase in volume and complexity of technology (especially ICT technologies), the employees were assumed to be specialized and master their own area of expertise on a deeper and deeper level. As a result, an I-shaped capability profile was preferred. An I-shape professional is an expert in their own domain but lacks cross-functional and collaborative capabilities (Elayan et al, 2022). The capital letter "I" given to this capability set symbolizes the vertical depth of skill and simultaneously the lack of width.

The literature has introduced various new models of modern capability profile demands. For example, Elayan et al. (ibid.) proposed increased capacity to innovate emerging from the π-shaped capabilities, where the two vertical lines (of the letter "pi" in the Greek alphabet) represent two domains mastered and the horizontal line the ability to combine these two different domains in one´s work.

The most referred to capability profile for professionals in the knowledge era has been one of the T-shaped capabilities (Barile et al., 2012; Barile, Saviano and Simone, 2015; Demirkan and Spohrer, 2018) that sees a need for deep skill (I- shaped expertise) still relevant but additional combinatory capability needed for professional success.

This conceptual paper elaborates on earlier work on the T-shaped capability profile and proposes a new conceptual model of T^2-shaped emerging from observations of the current development trends of business and societal environments. The conceptual development is based on the study of the earlier research and various discussions with practitioners in management and human resource management in companies with an international scope and technology intensity, as well as discussions and observations on the current directions in Higher Education Institutions (HEIs) curricula and study program developments. As Kothari (2004) defines, conceptual research aims at creating new models and/or re-interpretations of the existing ones before having full empirical evidence or validation for them. The paper discusses and proposes the potential improvements based on the new model particularly needed for business education and practice as well as offers ground and directions for further research on the model created. As Squires et al. (2011) state, conceptual research is lacking clear indicators of reliability and validity, and thus conceptual research is an early explorative step in the development of new models for research and management practice.

2. Literature review

The prior-art research on capability management and its recent developments gets briefly reviewed in this chapter with aim to define the core constructs linked to the issue area and to review the work done on the core element of this paper, capability profiles.

2.1 On talent, skill, and capability

Not surprisingly, in the era of the knowledge economy researchers have paid attention to the knowledge possessions of individuals – labelled as Human Capital by Reed, Lubatkin and Srinivasan (2006) – as well as focused on the resulting (from the integration and collaboration of individuals working together) structural capital of the company as subsets of intellectual capability. Another stream of research pays attention to the psychological capital i.e. capacity of an individual in dimensions of "self-efficacy, hope, optimism, and resilience… linked with a range of desirable work attitudes, behaviours, and other outcomes" (Nolzen, 2018). However, individual and organizational success requires also the members of the working community to possess social capital. According to Martin et al. (2020), individuals may achieve their goals independently but the additional resources attainable in their social network provide an asset to goal achievement: "In addition to whom an individual knows, what the people in the individual's social network know is also critically important." Thus, the capabilities of an individual are partly made of communal capabilities.

Parallel to the interest in elaboration on the human capital construct, organizations have shown a growing interest in finding, nurturing, and utilizing talent. Talent management typically focuses on developing the skills of the workforce to execute strategic priorities (Hicks, 2008). The whole life-cycle view on talent management contains segments such as talent strategy, acquisition, development, engagement, and retention (Tavis, 2008).

At the level of an individual, the question of what makes a relevant talent for a job and career is a complicated issue. As Kravatiri and Johnston (2020) point out, "…workers along the competency spectrum will need to plan for a much longer life span with many career and life transitions. They will have to be prepared for more uncertain employment prospects, be able and willing to take care of themselves and build more resilient work-life scenarios." An important dimension to the discussion caused by the existing cultural and organisational context.

As can be seen from the above-mentioned definitions, the boundaries between constructs are blurring. One potential additional element to the confusion are the ones of skills and competency. Skills and competencies are defined in knowledge management (KM) and Human Resource Management (HRM) literature in various ways, many of wh are overlapping. Skills are commonly tied to a particular job and tasks and situations arise when performing in the job. At the same time, skills may be seen either bounded by the context where the task or situations appear or as being independent of the context (Attewell, 1990). In the latter view, the skill will stick to the individual even though the context changes, but its relative value in the new context may change. A fresh view of Stanley and Williamson (2017) makes an important point: The skills get their manifestations as knowledge (on how to perform) as well as in using that knowledge in practice. In other words, skills have the capacity as well action-based nature. Kumar, Peng and Chen (2018) call these two facets of skills as potential and actual skills. Another division of skills in the literature (e.g., Gilbert et al., 2018) can be identified when skills are seen as 1) generic, a set of skills that are transferable to many domains and situations, and 2) specific, needed, and relevant in the situation and context-bound manner.

This leads us to the final and core constructs relevant for this study capability, and profiles of capability that use the construct as the identifier for the central building blocks for the different profiles. Capability is a very wide term. Enterprises need and require their employees to have specific capabilities to be able to implement strategies efficiently and achieve business value. Stephenson (1998) stated that capable individuals possess specific professional skills, are able and motivated to take that knowledge into use and assess the righteousness of the actions they take. Capabilities are also discussed both as a characteristic of organizations and systems, not only as a construct involving individuals.

This paper synthesizes these fragmented and at times contradictory definitions as follows:

- Talented individuals have the potential to learn new skills
- The skills learned work for the organization and the individual a) in a way that serves immediate situational and contextual needs with immediate rewards as specific goals are met, and 2) as a potential to use the skill, adjust or improve it in new situations and context
- For the organization, skills that can be communally shared and combined, have more value than independent and non-connected skills
- For the sharing of the skills, both the company and individuals need a platform and processes for interaction, that transform to social capital for an individual and structural capital for a company
- Capability is an overarching concept that combines the individual's potential to do well in specific tasks, the potential to succeed (and assist others in succeeding) in new tasks as well as the mindset and motivation to develop and expand the scope of action
- Capability profiles depict these characteristics for an individual by looking at 1) specific and generic skills and 2) active and potential skills.

2.2 T-shaped vs. I-shaped capability models

Much of the latest discussion on the developments and research has circled around the transition from I-shaped capability profiles to T-shaped ones. The I-shaped capability profiles for an individual and an organization consisting of individuals possessing the I-shaped capabilities provide companies with deep expertise on different functions and jobs but fall short in the capacity to interchange and communally elaborate on the knowledge possessed (Figure 1).

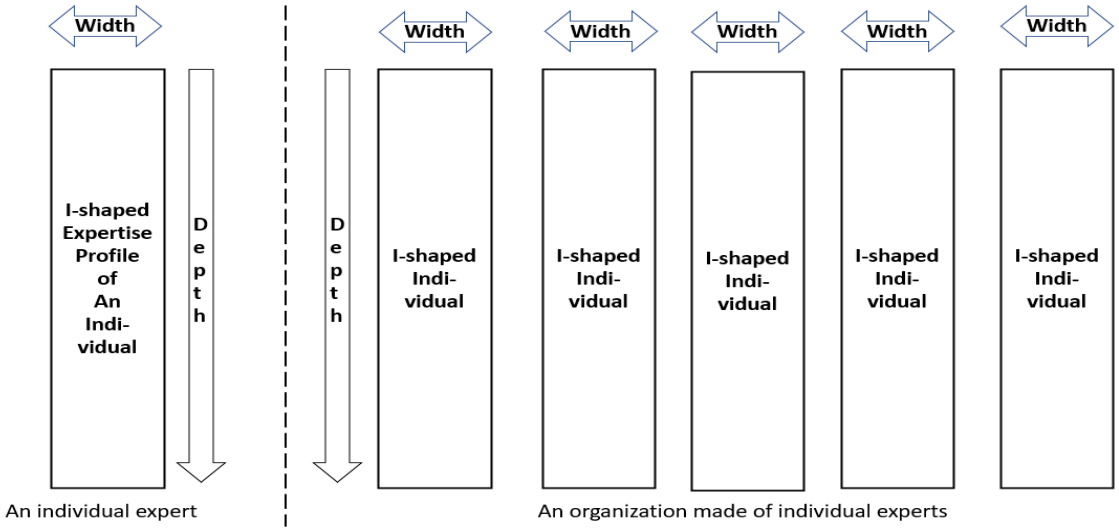


Figure 1: I-shaped capability profiles for an individual and an organization

By hiring and cultivating special (I-shaped) expertise an organization seems to cover the essential areas of knowledge needed, but due to the limited width of these experts to share and interact with others´ knowledge domains, the company does not reach an optimal width of shared knowledge (e.g., Barile et al., 2012), i.e. it is siloed.

The need for building boundary-crossing and combinatory capabilities has been expressed both at the level of corporate knowledge management (e.g. Barile, Saviano and Simone, 2015) as well as in the education in disciplines such as software engineering (Boehm, 2018), engineering in general (Kulkarni et al., 2022), entrepreneurship (Rippa et al., 2020), medical education (Donofrio et al., 2010) as well as in the cross-disciplinary capability to manage projects (Martinez, di Nauta and Merola, 2016) and in the context of different industries like in textile and apparel industry (Leiby and Zhao, 2020).

The requested new capability set has been named the T-shaped capability profile. As the symbolic letter T proposes, the need for a domain- and/or function-specific expertise (the vertical line in the letter) but in addition to that, true professionals should possess width in their knowledge. This horizontal width offers the individual and organization flexibility via "empathy, breadth of knowledge, skills, experience, and complex communication abilities" (Demirkan and Spohrer, 2018).

From the organizational point of view, the growth and interaction of T-shaped individuals widen the shared knowledge pool of the organizations (Figure 2).

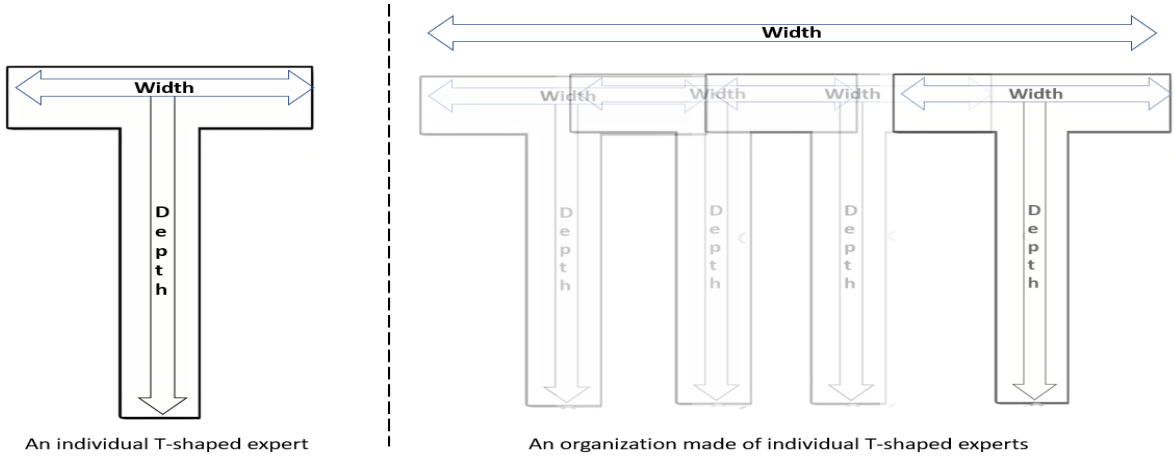


Figure 2: T-shaped capability profiles for an individual and organization

The T-shaped capabilities have been proposed to impact positively on different processes and functions in organizations, e.g., for innovativeness (McIntosh and Taylor, 2013), service design and fulfillment (Barile, Saviano and Simone, 2015) and the combination of the two – service innovation (Demirkan and Spohrer, 2015). The need to move toward T-shaped capabilities has also been recognized in public and non-profit organizations, where the concept of interprofessional approach e.g. in social work has been promoted (Hammick et al., 2009).

2.3 Extensions on the T-shaped capability model

The T-shaped model emerged in research and KM and HRM practice in the early 2010s. Since then, various modifications or upgrades to the model have been proposed.

The concept of a π-shaped (Greek letter "pi") capability profile (Elayan et al., 2022) propagates for an individual to master two distinct knowledge areas and combine those two (Figure 3

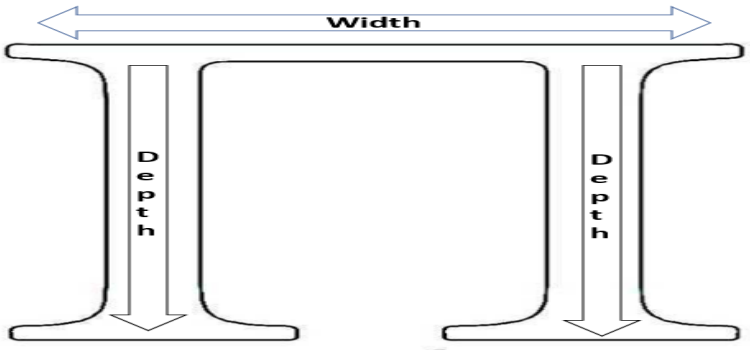


Figure 3: A π-shaped capability profile

A practical instantiation of the model could be for example a digital marketing expert who has generic technological capabilities combined with up-to-date knowledge on marketing processes that together help the individual to navigate the changing landscape of technologies and markets. It can be logically assumed, that having this type of capability possessions by individuals allows an organization to cover the needed knowledge areas with a lower number of employees.

The π-shaped capability profiles can be assumed to be cultivated 1) in start-up companies due to the lack of human resources and the lack of financial resources to buy and hire knowledge from outside the founding entrepreneurial team and, 2) because of the changes in the career trajectories of Generations X and Y. Employees of the future are not expected to gradually improve in their original area of expertise and functions, but also start new careers both in terms of job context and contents (e.g., Kerka, 2003). The nearby concept of multiple careers is one of the boundaryless careers that refers to "career paths wherein individuals respond to decreased organizational resources by seeking resources or opportunities from outside their current employer, such as by changing employers or building an external professional network" (Wiernik and Kostal, 2019).

The birth of extension to the T-shaped capabilities can thus be traced back to personal actions, organizations' demands, and wider societal discontinuities in the way careers develop.

Another prospective model to expand the coverage of the T-shaped model has been that of conserving the T-shape but adding parallel elements to both vertical in-depth expertise and horizontal combinatory integrative capabilities (Figure 4). The models of extended T-shaped capabilities see the vertical dimension of the letter T consisting of different systems or processes. The horizontal dimension, in its turn, is made of expertise from different operational environments and cultures. As a result, individuals have expanded both the area where they are deep and where they are wide. That way, they are more flexible to adapt to new circumstances and have wider usability for their employers. The question can be posed whether in a global market a collection of experiences for the horizontal layer is a way to enlarge one´s capability coverage or would a more generic skillset better services the individual and the organization that the individual works for. Also, the notion of two truly deep expertise areas may be in practice difficult to reach in the modern environment where the function-specific knowledge and accumulation of research on each area is increasing.

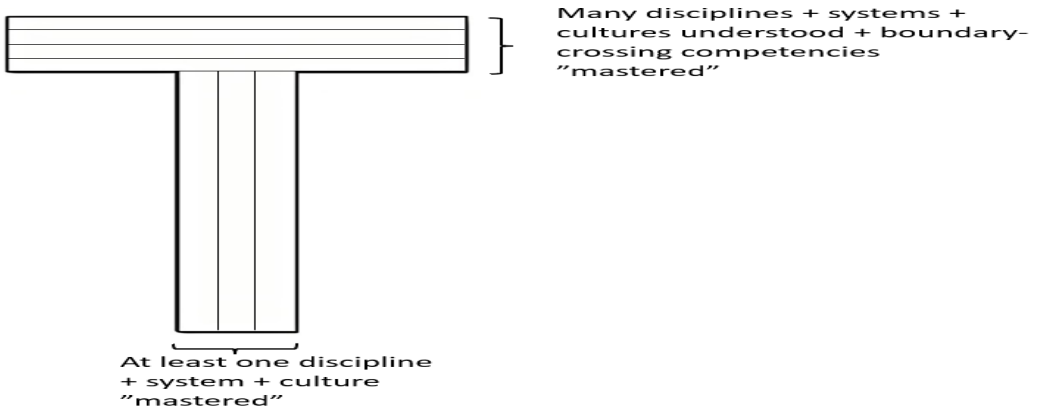


Figure 4: Extended T-shaped model (adapted from Demirkan and Spohrer, 2015)

Perhaps the most advanced version of extensions on the T-shaped capability model is the one by Heikkinen (2018) presented in Figure 5. In the model, the idea of mastering more than one system is preserved, but interestingly the horizontal lines also describe different disciplines and systems, but on the level of understanding rather than in expertise. On top of disciplinary and system-level understanding, a layer of boundary-crossing generic skill has been added. The critical view of the model asks whether the depth in more than one system, is already a boundary-crossing capability. Also, the presence of communications and systems in two different layers and dimensions is somewhat confusing. Furthermore, the definition of "understanding and communication" in the lower horizontal layer gives an impression the skill level in these issues is (naturally) inferior to the areas of deep knowledge. However, the same qualitative assessment requirement for the skill level is not given to the upper horizontal layer of boundary-crossing skills.

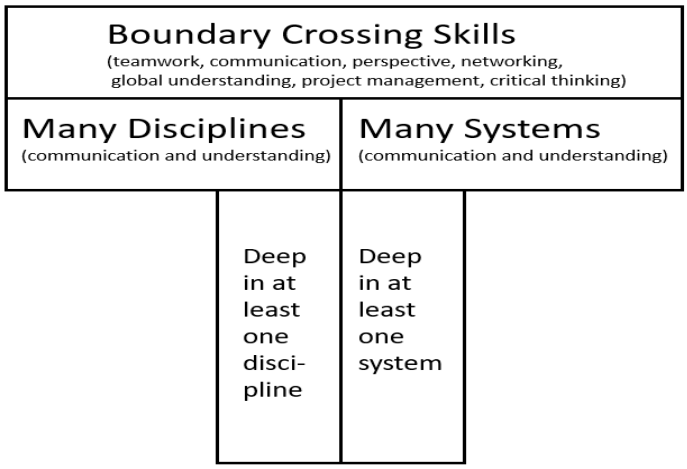


Figure 5: Extended T-shaped capability model (adapted from Heikkinen, 2018)

3. Findings – proposal for a new T^2- capability model

The models proposed by earlier research are built on a solid foundation of the fundamental shifts taking place in the world of work. The dilemma of the T-shaped models – the dominating depiction of a capacity profile of the future expert is that they are either so generic (like the basic idea of T-shape: Combining knowledge depth to width) or to a certain extent overloaded with layers and capability areas. In both cases, they fall short in usability for HRM and KM practitioners both in organizations and educational institutions developing the young talents towards future skills and competencies and finally, employability and career success.

Based on the analytical assessment of the prior-art models and our discussions with and observations of modern organizations, we propose a new model called T^2- capability profile (the basic form of it shown in Figure 7), that is built on the following pre-assumptions:

- despite the expressed needs for interchangeability of information and flexibility of the workforce, deep expertise skills possessed by an individual are still a valid demand for competitiveness

- the number of skills and competencies with deep expert-level knowledge cannot be many since the time and other resources of an individual and organization to prepare for multiple areas of expertise are constrained
- the interdependent nature of business functions in a modern organization set demands for the experts to understand the context-dependent (on the industry- and company-level) processes beyond one´s expertise area
- in addition to deep expertise and context-dependent capabilities, there is a layer of context-independent competencies, that are needed across domains and industries

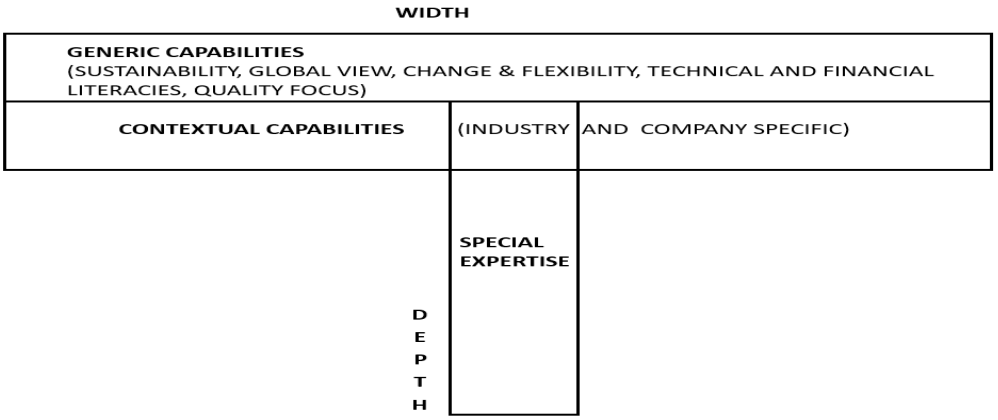


Figure 7: The base model of T^2- capability profile

The base model is lacking detail in 1) what are the processes included in the contextual capability area, 2) what kind of practical instantiations the model would have for the true unit of analysis in capability development research and practice – an individual professional employee, and 3) what are the different and relative to each other skill levels needed in different layers,

To specify the model further and implement it to the level of an individual employee/job, two examples were created (Figures 8 and 9) for the professions of a software engineer and a digital marketing lead, both in an industrial company.

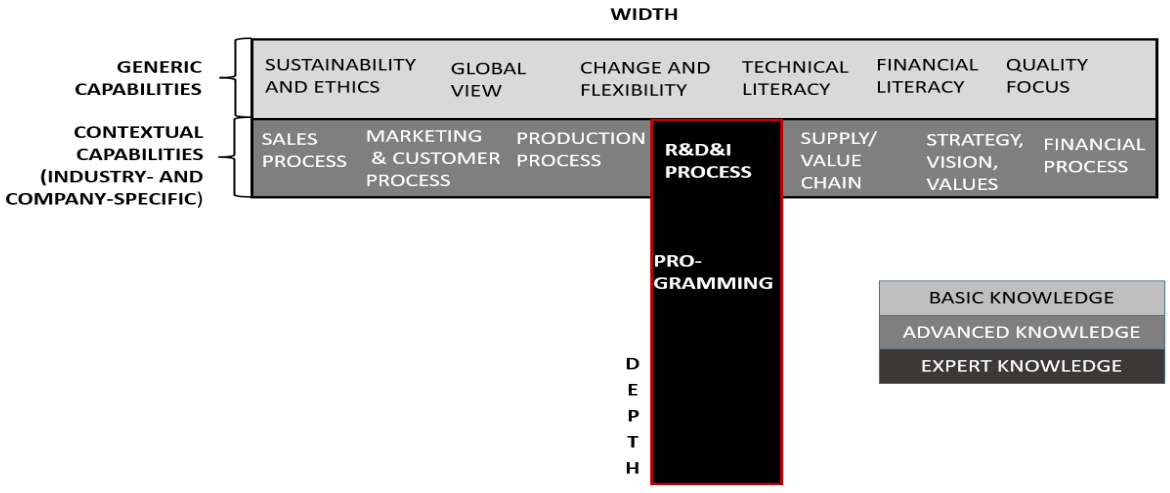


Figure 8: An instantiation of the T^2-capability profile for a software engineer in an industrial company

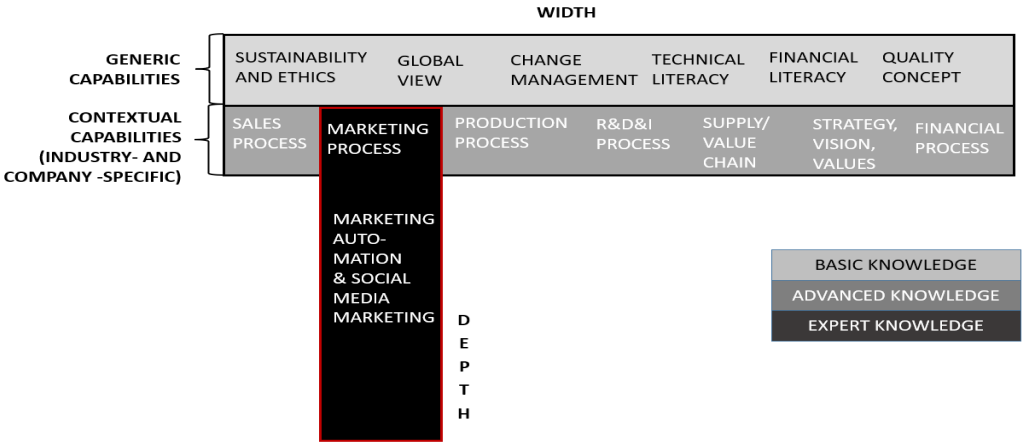


Figure 9: Instantiation of T^2-capability profile for a digital marketing lead in an industrial company

The examples shown above can naturally be adjusted based on the size and type of the organization. For example, in small and medium-sized companies or start-ups the distances between functions and resulting contextual capabilities are likely to be shorter as well as resources to address all different capabilities to different experts are likely to be limited. This sets the demand level for the contextual combinatory capabilities even higher than they would be in an established large enterprise. So, even within the categories of advanced and basic knowledge, there are variations.

4. Conclusions

The authors have elaborated on a construct under development in the research and practitioner community for over a decade. During this relatively short period there have occurred changes in the ways companies are organized and individuals working in them educated in both educational institutions´ programs and corporate-level training events and programs. Thus, a final all-conclusive model is out of reach, as the accelerating pace of change has prevailed in organizations already since the 1990s (Fine, 1999) and is likely to continue. Thus, further work in the development of the model and its implementations is in need.

The role of educational institutions in the build-up of T^2 capabilities is an interesting one. Especially in higher education institutions (HEIs) the boundaries between areas of knowing crosscut the whole operation from dividing the organization into faculties and schools down to the contents of individual courses. The depth of expertise is targeted, expected, and assessed from educators as well as from the students. On the other hand, the coverage of non-context-specific basic skills is also sought in the curricula design in HEIs. This leaves the middle layer in T^2-model to the responsibility of the organizations to work on, either as specific training or on-the-job learning. The instruments of such learning are often either slow to yield the required wider capabilities (e.g., job rotation) or one-off events with limited continuity (project task forces, company hackathons.

Based on our study we encourage the knowledge area experts in HEIs and their counterparts in the world of work to jointly map the relevant content for their specific T^2- model and a process to act on the capability needs identified. The continuation of this paper will be the assessment and development of sector-specific T^2-profiles, starting from the fields of business and engineering. The process is likely to require recognition of soft skills more widely than in this work and most of the other studies referred. That way the move towards V-shaped capabilities introduced e.g., by Oetrher (2022) would produce “humanitarian technologists” to the resource pool of the organizations.

In addition, the process of the capability profile definition by industries or companies offers a topic of research, as the idea of dynamic capabilities, i.e., proactivity and reactivity to changes in the operating environment by the transformation of capabilities (Helfat et al., 2007) are likely to prevail as a core tool for competitive advantage, survival, and success of organizations. The authors, due to their positions in academia where they both educate future professionals and act with (especially SME-) organizations to improve their competitive positioning by upskilling and knowledge pool extensions, are also aiming at pragmatic deployments of the model in curriculum design and lifelong learning programs. To support this target action research approach would be a logical choice, as it would allow the learning-by-doing and continuous improvement mindset. Since cross-sectional studies can’t be harnessed to studies on capability growth and alteration, the remaining option of

longitudinal research designs means the next steps of the research process will take time, and reported findings can be expected approximately at the two-year milestone from the start.

Finally, the authors have seen the academic views and model proposed in this paper to resonate with the voices coming from the industry in what comes to the need for new capability profiles. In a recent webinar, a "holistic skill taxonomy" by the HRM consultant and digital HRM system/tool supplier Workday (n.d.) was referred. The model, interestingly, builds on three layers like our model but uses a somewhat different lexicon to describe the skill profile for the future. In Workday's pyramid-shaped model the bottom is called "core" – skills that every modern employee needs. On top of that, skills that are needed in a "specific part of the business" are of need. Lastly, advanced skills are needed in the frame of a single role. Thus, we see potential in uniting the needs of future workers, institutions educating them, and organizations recruiting and developing them to elaborate on the model proposed.

References

Atwal, A., & Caldwell, K. (2005). Do all health and social care professionals interact equally: a study of interactions in multidisciplinary teams in the United Kingdom. *Scandinavian Journal of Caring Sciences*, *19*(3), 268-273.

Barile, S., Franco, G., Nota, G., & Saviano, M. (2012). Structure and dynamics of a "T-Shaped" knowledge: From individuals to cooperating communities of practice. *Service Science*, *4*(2), 161-180.

Barile, S., Saviano, M., & Simone, C. (2015). Service economy, knowledge, and the need for T-shaped innovators. *World Wide Web*, *18*(4), 1177-1197.

Boehm, B. (2018). Education and Social Development of T-Shaped Software Engineers. In *Proceedings of the 4th Annual International Conference on Management, Economics and Social Development* (pp. 745-749).

Demirkan, H., & Spohrer, J. (2015). T-shaped innovators: Identifying the right talent to support service innovation. *Research-Technology Management*, *58*(5), 12-15.

Demirkan, H., & Spohrer, J. C. (2018). Commentary—cultivating T-shaped professionals in the era of digital transformation. *Service Science*, *10*(1), 98-109.

Donofrio, N., Spohrer, J., Zadeh, H. S., & Demirkan, H. (2010). Driven medical education and practice: A case for T-shaped professionals. *MJA Viewpoint*.

Elayan, M. B., Hayajneh, J. A. M., Abdellatif, M. A. M., & Abubakar, A. M. (2022). Knowledge-based HR practices, π-shaped skills, and innovative performance in the contemporary organizations. *Kybernetes*.

Fine C.H. (1999). *Clock speed: Winning Industry Control in the age of Temporary advantage.* Perseus Books, New York.

Gartner (2020): Gartner keynote – the future of business is composable. Accessible at: https://www.gartner.com/smarterwithgartner/gartner-keynote-the-future-of-business-is-composable#:~:text=Composable%20business%20means%20creating%20an%20organization%20made%20from,or%20materials.%20The%204%20principles%20of%20composable%20business. Retrieved 20th March 2022.

Haapasalo, H., & Kess, P. (2001). In search of organisational creativity: The role of knowledge management. *Creativity and innovation management*, *10*(2), 110-118.

Hammick, M., Freeth, D. S., Copperman, J., & Goodsman, D. (2009). *Being interprofessional*. Polity.

Heikkinen, K.-P. (2018). Exploring studio-based higher education for T-shaped knowledge workers, case LAB studio model. (Doctoral dissertation). University of Oulu, Oulu, Finland.

Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., & Winter, S. G. (2009). *Dynamic capabilities: Understanding strategic change in organizations*. John Wiley & Sons.

Hicks, K. (2008), "*Construct validation of strategic alignment in learning and talent development*", Performance Improvement Quarterly, Vol. 28 No. 4, pp. 71-89, doi: 10.1002/piq.21210

Jackson, S. E. (1996). The consequences of diversity in multidisciplinary work teams. *Handbook of work group psychology*, 53-75.

Ke, K. M., Blazeby, J. M., Strong, S., Carroll, F. E., Ness, A. R., & Hollingworth, W. (2013). Are multidisciplinary teams in secondary care cost-effective? A systematic review of the literature. *Cost Effectiveness and Resource Allocation*, *11*(1), 1-13.

Kerka, S. (2003). Preparing for multiple careers. *Adult, Career, and Vocational Education*, *29*, 3-4.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*. New Age International.

Kravariti, F., & Johnston, K. (2020). Talent management: a critical literature review and research agenda for public sector human resource management. *Public Management Review*, *22*(1), 75-95.

Kulkarni, V. A., Dhanvijay, M. R., Bewoor, A., & Malathi, P. (2022). Effectiveness of CO-PSO Formulation and Attainment with T-shape Engineer for Aligning Students Learning Outcomes with Alumni Profiles. *Journal of Engineering Education Transformations*, *35*(Special Issue 1).

Kumar, A., Peng, P., & Chen, M. (2014). Is there a relationship between potential and actual skill?. *Monthly Weather Review*, *142*(6), 2220-2227.

Lee, Y. C., & Lee, S. K. (2007). Capabilities, processes, and performance of knowledge management: a structural approach. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *17*(1), 21-41.

Leiby, N., & Zhao, L. (2020). T-Shaped Person for the Textile and Apparel Industry? Analysis of Cross-functional Skills. In *International Textile and Apparel Association Annual Conference Proceedings* (Vol. 77, No. 1). Iowa State University Digital Press.

Martin, J. P., Stefl, S. K., Cain, L. W., & Pfirman, A. L. (2020). Understanding first-generation undergraduate engineering students' entry and persistence through social capital theory. *International Journal of STEM Education*, *7*(1), 1-22.

Martinez, M., Di Nauta, P., & Merola, B. (2016). Dynamic Capabilities and T-Shaped Knowledge in Project Management. A Viable Systems perspective. *Governing Business Systems. Theories and Challenges for Systems Thinking in Practice*, 41.

McIntosh, B. S., & Taylor, A. (2013). Developing T-shaped water professionals: reflections on a framework for building capacity for innovation through collaboration, learning and leadership. *Water Policy*, *15*(S2), 42-60.

Oerther, D. B. (2021, October). Humanitarian technologists as prototypical V-shaped professionals. In *2021 IEEE Global Humanitarian Technology Conference (GHTC)* (pp. 253-257). IEEE.

Rippa, P., Landi, G., Cosimato, S., Turriziani, L., & Gheith, M. (2020). Embedding entrepreneurship in doctoral students: the impact of a T-shaped educational approach. *European Journal of Innovation Management*.

Reed, K. K., Lubatkin, M., & Srinivasan, N. (2006). Proposing and testing an intellectual capital-based view of the firm. *Journal of Management studies*, *43*(4), 867-893.

Saviano, M., Polese, F., Caputo, F., & Walletzký, L. (2016). A T-shaped model for rethinking higher education programs. In *Proceedings of the Toulon-Verona Conference "Excellence in Services", Huelva, Spain* (pp. 5-6).

Squires, J. E., Estabrooks, C. A., Newburn-Cook, C. V., & Gierl, M. (2011). Validation of the conceptual research utilization scale: an application of the standards for educational and psychological testing in healthcare. *BMC health services research*, *11*(1), 1-14.

Stanley, J., & Williamson, T. (2017). Skill. *Noûs*, *51*(4), 713-726.

Stephenson, J. (1998). The concept of capability and its importance in higher education. *Capability and quality in higher education*, 1-13.

Tavis, A. (2008), Leading the talent development life cycle, *People & Strategy,* Vol. 31 No. 1, p. 7.

Tropman, E. J., & Johnson, H. R. (1992). *Committee management in human services: Running effective meetings, committees, and boards*. Wadsworth Publishing Company.

Van Der Vegt, G. S., & Bunderson, J. S. (2005). Learning and performance in multidisciplinary teams: The importance of collective team identification. *Academy of management Journal*, *48*(3), 532-547.

Wiernik, B. M., & Kostal, J. W. (2019). Protean and boundaryless career orientations: A critical review and meta-analysis. *Journal of counseling psychology*, *66*(3), 280.

The role of Intellectual Property Rights in Enhancing Regional Development

Yee Yee Sein* and Viktor Prokop
Science and Research Centre, Faculty of Economics and Administration, University of Pardubice, Pardubice, Czech Republic
yeeyee.sein@student.upce.cz
viktor.prokop@upce.cz
https://orcid.org/0000-0002-9349-4243
https://orcid.org/0000-0001-6313-395X
*Corresponding author

Abstract: Intellectual property rights (IPRs) are recognized as a growth enhancing factor for the economy. IPRs can influence the growth process through the domestic and external sectors of an economy. Therefore, researchers are increasingly interested in the role of IPR protection in the economic growth of countries. In OECD countries, most industries rely on innovation with innovative technology, hence, the role of IPR is important in stimulating the diffusion of knowledge to foster innovation that contributes to the regional development. Based on the above-mentioned, the research aims to analyze the role of IPR protection in enhancing regional development in OECD countries. The study uses the latest data set from the OECD and World Bank. We found that IPRs have a positive and significant effect on regional economic growth in OECD countries. FDI is also highly significant effect on regional economic growth. The result of this study provides interesting results that will support policy makers in considering improving intellectual property rights of inventors when formulating policies for national and regional development.

Keywords: Intellectual Property Rights (IPRs), Patents, Regional Development, Economic Growth, FDI

1. Introduction

The economies of the world are open and classified as knowledge-based, and the development of a country or region is focused on the undertaking of innovation activities. Simultaneously, it is necessary to protect the inventor's invention or creativity. Therefore, Intellectual Property Rights (IPR) has become an important policy issue of regional development in most countries. There has been a lot of arguments among policy makers and academics on the issue of whether IPR stimulates economic growth and regional development (Gould & Gruben, 1997; Falvey et al., 2006). Especially since innovation is the engine of growth, IPR might be the booster of long-term growth of economies. This argument is widely accepted both theoretically and empirically. However, the connection between regional economic growth and IPR is still unclear in a closed economy (Gould & Gruben, 1997; Horii & Iwaisako, 2007; Furukawa, 2007).

In addition, over the decades, the evolution of IPR has invariably resulted in a shift in nations' perspectives on cultural and societal development (Adam, 2011). The role of IPR has become important in fostering scientific and technological capacity improvement, encouraging innovation, as well as in enhancing the level of growth in developing countries mostly (Barro & Sala-i-Martin, 2004; Laik, 2005; Zhylinska et al., 2020). However, academics (Bielig, 2015; Neves et al., 2021) have asked whether IPR is responsible for triggering innovation and, as a result, economic growth. Economists have paid close attention to the extent IPRs stimulates innovation and economic growth. The theoretical literature on the subject has grown significantly and empirical studies have been conducted to assess the effects of IPR on innovation and economic growth.

For example, Papageorgiadis & Sharma (2016) investigated the relationship between IPR and innovation using a panel of 48 countries between 1998 and 2011 and found that IPRs enhance economic growth. In another study Sweet & Maggio (2015) assesses the impact of rigorous IPR systems on innovation through an index of economic complexity of 94 countries from 1965 to 2005 and observed a positive impact on economic growth. On the other hand, Sattar & Mahmood, (2011) analysed the impact of IPR on economic growth using Ginarte and Park index of IPR in high, middle- and low-income countries during the period of 1975-2005 and concluded that IPR adversely affects economic growth. Yang, Huang & Lin (2014) analysed the role of IPRs protection on stimulating innovations in 42 countries by using panel threshold analysis and observed that IPR has no significant effect on economic growth in non-high-income countries. Neves et al. (2021) explored the relationship between IPR, innovation, and growth in developed and developing countries. Neves et al. (2021) showed that the impact of

IPR on economic growth varies with the level of economic development. The authors observed that the relationship is positive for developed countries but negative in developing countries. It is clear at this point that empirical evidence cited in the literature on the relationship between IPR and economic growth is not clear.

Therefore, the aim of this study is to attempt to fill this research gap, by investigating the role of intellectual property right in enhancing regional development in OECD countries and how intellectual property right affects regional growth in these countries. OECD countries are highly industrialised, relying on innovation which requires knowledge protection systems such as IPR to encourage innovation activities as a channel to promote regional development. It has therefore become imperative to investigate IPR and its effect on regional development in the context of OECD countries.

The paper is organized as follows. The second section provides theoretical background. The third section explains the data and methodology. The fourth section describes the empirical results, and the discussion of the result is described in the fifth section. Conclusions and limitations are offered in the sixth section.

2. Theoretical Background

IPR protection has long been an essential component of economic development in developed and developing countries (Sattar & Mahmood, 2011). IPR has been acknowledged as part of the infrastructure that supports investments in research and development (R&D), which leads to innovation and resulting economic growth (Bilbao-Osorio & Rodríguez-Pose, 2004; Guloglu & Tekin, 2012). In addition, IPRs have, in turn, become the basis and motivation for technological progress and new knowledge. The formation and deployment of new knowledge, innovations, and social welfare have led to the establishment of a structured IPR regime that encourages innovative and creative activities through incentive structures and exclusive copyrights for creators (Adams, 2011; Haydaroğlu, 2015).

The IPR regimes vary between developed and developing countries and the IPR regime protects all categories of intellectual property through strong mechanisms and has a well-structured management to create a situation that accommodates substantial R&D investments in developed countries (Neves et al. ,2021). The main idea is to encourage innovative and creative activities to stimulate economic growth (Falvey et al., 2006a). In developing countries, imitation is the main source of technological development; lower IPR protection is the best way to encourage more financially viable internal activities and to ensure long-term economic growth (Falvey et al., 2006b).

IPR protection plays a key role in countries' economic growth. Nevertheless, it also has drawbacks because the incentive requirements are determined by market power, and the welfare gain is frequently jeopardized (Gilbert & Shapiro, 1990; Maurer & Scotchmer, 2002). To spread technical knowledge to imitators, the scope and duration of IPR protection should be limited to lead society to more innovative economic development and prosperity (Towse & Holzhauer, 2002). IPR protection may also jeopardize the dissemination of new knowledge, innovation, and growth because the spread of innovative ideas is hampered by monopoly effects (Henry & Stiglitz, 2010). In addition, the creation and diffusion of knowledge is often considered a major source of technological progress (Prokop et al., 2021). Knowledge is an important mechanism underlying endogenous economic growth (Grossman & Helpman, 1991; Vollebergh & Kemfert, 2005).

In addition to international trade, foreign direct investment (FDI) was considered as an important source of knowledge dissemination for a long time before the introduction of R&D-driven growth models (Romer, 1990; Kayani et al., 2021). A country's growth is closely related to its use of the knowledge embodied in FDI, as well as the formation of physical and human capital (Romer, 1990). FDI can facilitate the process of diffusion of knowledge not only directly through supplier training, but also indirectly through labour mobility (Mallick & Zdražil, 2018) and imitation (Furukawa, 2007).

FDI is perceived as a significant driver of economic growth because it improves technology, trade expansion, job opportunities, and global market integration (Osano & Koine, 2016). Growth in FDI leads to an increase in capital stock, which in turn leads to economic development in developing countries (Zang & Baimbridge, 2014; Maune, 2019). New growth theories focus on the importance of FDI on economic growth by financing new investment and technology transfer (Osano & Koine, 2016). The literature shows a positive effect of FDI on economic growth (Agrawal, 2015; Zekarias, 2016). Similarly, another study conducted by Sukar, Ahmed & Hassan (2011) observed

a marginal contribution of FDI to growth. According to Arabi & Abdalla (2013) the effect of FDI on economic growth depended on the level of human capital. Furthermore, strand empirical studies proposed the importance of trade openness in economic growth (Shahbaz et al., 2011; Mishra et al., 2019). Trade openness can increase economic growth by enhancing the scale of spillover (Romer, 1990; Stejskal et al., 2018).

Scholars have investigated the impact of IPRs on regional economic growth. Park & Ginarte (1997) examined the effect of IPRs on growth in a cross-section of countries for the period 1960–1990 by using a quantitative index of IPRs. They found that IPRs have an indirect impact on economic development by encouraging the accumulation of factor inputs such as R&D and physical capital. In particular, the positive impact of IPRs on the overall volume of R&D capital has limited the analysis of a general measure of property rights. Schneider (2005) observed the role of high-technology trade, IPRs and FDI using a unique panel data set of 47 developed and developing countries from 1970 to 1990 in determining a country's rate of innovation and economic growth. In their findings, IPRs have a greater effect on local innovation in developed countries and have a negative impact on innovation in developing countries. This means most of the innovation in developing countries is imitation or adaption. Kim et al. (2012) analysed the role of patents and utility models in innovation and economic growth by using a panel dataset of over 70 countries. They found that patent protection is an important determinant of innovation, and patentable innovations contribute to economic growth in developed countries, but not in developing countries. Another scholar, Adams (2009), who focused on developing countries, found that strengthening IPRs has a negative effect on economic growth. Hudson & Minea (2013) used a panel smooth threshold regressions model to perform the estimation of IPR level on innovation by using a dataset of 62 developed and developing countries. They concluded that IPR exerts a complex effect on innovation and that the relationship is a U-shaped curve. Moreover, Hu & Png (2013) concluded that stronger patent rights were associated with faster growth in more patent-intensive industries, and the effect is greater in higher income countries. Likewise, Zhang et al. (2015) and Mrad (2017) found a positive and stronger IPR effect on innovation and economic growth.

In the light of the above, the main aim of the paper is to analyse the role of IPRs in enhancing regional development in OECD countries.

3. Data and Methodology

The data for the paper is collected from the OECD and World Bank database. Annual data on GDP growth, patent count, number of researchers, FDI, export and imports, GDP, gross domestic expenditure on R&D and population with tertiary education is sourced from the OECD data base and World Bank. The data spans from 2005 to 2018. This is a country level data on twenty-two OECD countries (Austria, Canada, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Latvia, Mexico, Netherlands, Poland, Portugal, Slovak Republic Turkey, United Kingdom, and United States).

We used annual percentage growth rate of GDP as a dependent variable which is taken from the World Bank, Patent applications as an independent variable from OECD database. The other variables are foreign direct investment inflow, number of researchers, trade openness and R&D expenditure. Population with tertiary education is used as a proxy for human capital.

Table 1: Variable Descriptions

Variables	Description	References
GDP growth	GDP growth	Falvey et al. (2006)
Patents	Number of patents	Kim et al. (2012)
Researchers	Number of Researchers	Izushi and Huggins (2004)
FDI	Foreign Direct Investment	Schneider (2005)
Openness	Trade openness	Schneider (2005)
GERD	Gross domestic expenditure on R&D	Gumus & Celikay (2015)
Tertiary (human capital)	Population with tertiary education	Murthy and Chien (1997)

In the paper, quantitative research method was employed. the quantitative method tries to find to get precise and consistent measurements that permit a statistical analysis (Queirós, 2017). According to Sukamolson (2007), quantitative research is a social research that employs empirical methods and empirical statements. In the analysis, at first panel regression models used to estimate the impact of IPR on Regional development. The panel regression technique is helpful in examining the effect of IPR variations on growth. However, after analysis,

based on the result, we made the decision to use quantile regression analysis to see the changes of significant effect on each quantile period (Lee et al., 2013). From Figure 1 where the scatter plot is presented, one can observe that the data has outliers. This is an indication that fitting a regression line to capture the average relationship between patent and growth cannot be completely captured. This is an agreement with Mosteller & Tukey (1977) who argue that regression line which captures average relationship is not ideal for highly dispersed data. In consonance with Coad & Roq (2006) who argue that dispersed data is the best fitted by quantile regression. The study fitted the data using quantile regression estimation technique.

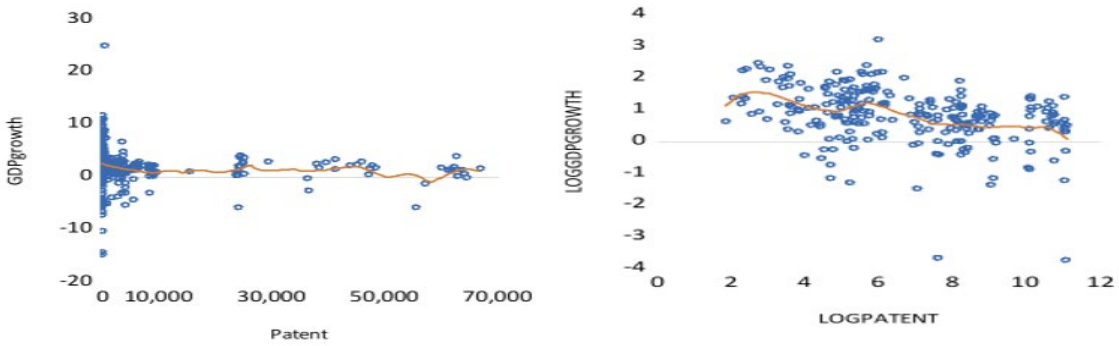


Figure 1: Scatter Plot

4. Experimental Results

Table 2 presents a panel regression analysis of the effect of IPR on GDP growth. The control variables in the regression model includes number of researchers, foreign direct investment, trade openness, R&D expenditure, and population with tertiary education. In the first model, the analysis describes that two-year lag patents regressed on LOGGDPGROWTH indicated as a positive and significant level at 1%. The regressor LOGFDI is positive and significant at 10%, and LOGRESEARCHER is positive and significant at 1%. Surprisingly, LOGOPENNESS and LOGGERD are negative and significant levels at 10%. However, two-year lag LOGTERTIARY indicated as an insignificant result in the first model. Moreover, the R-squared suggested that 23% of the GDPGROWTH is explained by the regression model. The intercept is significant at 10% level, but it has a negative sign.

The second model represented in Table 2 showed that the two-year lag patents are positive and significant at 5%. However, the LOGFDI in this model is not significant. LOGRESEARCHER contributes to the positive and highest significant level. At the same time, LOGOPENNESS is significant at 1%. LOGGERD is the highest significant level, but it does have a negative sign. In this model, the control variables, country, and period are significant however there is no significant sign in LOGTERTIARY. Furthermore, R-squared describes the 50 % of the regression model, but the intercept is not significant.

Table 2: Panel regression analysis

Variable	Model 1	Model 2
PATENT (-2)	1.02E-05 (0.0840) *	0.000100 (0.0338) **
LOGFDI	0.556107 (0.0000) ***	-0.269892 (0.5014)
LOGRESEARCHER	0.378559 (0.0694) *	1.598287 (0.0084) ***
LOGOPENNESS	-0.392709 (0.0379) **	2.215867 (0.1190) *
LOGGERD	-0.714230 (0.0004) ***	-1.287835 (0.0196) **
LOGTERTIARY (-2)	-0.143691 (0.4094)	0.832042 (0.2756)
C	-1.556386 (0.0232) **	-3.084301 (0.2826)
Country fixed effect	yes	Yes

Variable	Model 1	Model 2
Period fixed effect	yes	Yes
R-squared	0.232004	0.504000
Adjusted R-squared	0.208373	0.392098
F-statistic	9.817935	4.503924
Prob(F-statistic)	0.000000	0.000000
Mean dependent var	0.748762	0.748762
S.D. dependent var	0.884219	0.884219
Durbin-Watson stat	1.760097	2.132922

*** significant at p<0.01; ** significant at p<0.05; * significant at p<0.10. Legend : () – Pvalue

Table 3 shows the quantile regression analysis for the six quantile periods. Two-year lag PATENT is positive and significant level at 1% in Q4 and 10% in Q5 period, however there is no significant in other periods. Surprisingly, LOGFDI is positive and significant in all quantile periods with a level of 10%. LOGRESEARCHER is also a positive and significant level at 1% in Q3, 5% in Q5 and 10% in Q4 and Q6. Moreover, LOGOPENNESS provides a significant result in Q1, Q2, Q3, and Q6, but has a negative sign. Similarly, LOGGERD has a negative and significant level of 1% in Q2, 10% in Q3, Q4, Q5, and Q6. The two-year lag LOGTERTIARY contributes negative and significant in Q4, Q5 and Q6. The intercept is negative and significant in only Q1 and Q2, but it has no significant result in other quantiles.

Table 3: Quantile regression analysis

Variable	Q1 (0.1)	Q2 (0.25)	Q3 (medi)	Q4(0.75)	Q5(0.8)	Q6(0.9)
PATENT (-2)	1.60E-05 (0.1995)	9.90E-06 (0.3167)	7.11E-06 (0.3166)	8.07E-06 (0.1449)*	1.06E-05 (0.0407)***	6.78E-06 (0.2624)
LOGFDI	0.815674 (0.0001)***	0.639086 (0.0002)***	0.323371 (0.0122)***	0.325633 (0.0090)***	0.371018 (0.0022)***	0.397940 (0.0244)**
LOGRESEARCHER	0.205860 (0.6239)	0.340676 (0.2182)	0.375889 (0.0829)*	0.570965 (0.0081)***	0.508311 (0.0237)**	0.719456 (0.0045)***
LOGOPENNESS	-0.712680 (0.0510)**	-0.465679 (0.0957)*	-0.340034 (0.0966)*	-0.174809 (0.3413)	-0.066233 (0.7009)	-0.348160 (0.1348)*
LOGGERD	-0.675882 (0.1933)	-0.561809 (0.0927)*	-0.676293 (0.0058)***	-0.817568 (0.0003)***	-0.763426 (0.0008)***	-0.857010 (0.0018)***
LOGTERTIARY(-2)	0.118130 (0.7272)	-0.046186 (0.8652)	-0.125624 (0.5278)	-0.379611 (0.0340)**	-0.451996 (0.0170)***	-0.484741 (0.0289)**
C	-4.223444 (0.0001)***	-2.589385 (0.0069)***	-0.619699 (0.3761)	0.374647 (0.5532)	0.664231 (0.3023)	0.415647 (0.6662)
R-squared	0.173382	0.119133	0.087556	0.146108	0.161370	0.177504
Adjusted R-squared	0.147947	0.092030	0.059481	0.119835	0.135566	0.152197
Mean dependent var	0.748762	0.748762	0.748762	0.748762	0.748762	0.748762
S.D. dependent var	0.884219	0.884219	0.884219	0.884219	0.884219	0.884219

*** significant at p<0.01; ** significant at p<0.05; * significant at p<0.10. Legend : () - Pvalue

5. Discussion

The results of the data analysis in Table 2 represented that there is a strong significant and positive relationship between IPR and GDP growth. This result was confirmed by a study of (Hu & Png, 2013) who used panel data from up to 54 manufacturing industries in up to 72 countries to argue that stronger IPR is related to faster economic growth. Moreover, this effect is stronger in patent intensive industries and higher income countries. This is because stronger IPR could increase the returns to innovation. Higher returns could stimulate more R&D activities and higher productivity growth, which can lead to regional development. In addition, our study is also consistent with Neves et al. (2021), who found that IPR has a positive effect on growth. In that our study is also in line with Kashcheeva (2013) and Kim et al. (2012), who reported a positive and significant effect of IPR protection on growth using a measure of IPR in country-level analysis. It is clear that a stronger level of IPRs leads to a higher level of economic growth.

However, our results challenge the findings of previous studies which have been identified as a negative effect on economic growth (Maskus, 2000; Adams, 2009). At first, gains and losses are determined by the competitive market, as well as by the effectiveness of the market rules. As a result, the nature of IPR is likely to vary across

countries based on their economic and political institutions, as well as their ability to engage in and distribute R&D (La Croix & Konan, 2006). In the quantile analysis, not all periods have significant IPRs for the data.

In our analysis, trade openness is significant and negatively related to growth. This finding is consistent with the finding of Hye & Lau (2015), who found that trade openness negatively impacts economic growth eventually. In fact, trade openness can increase the flow of technological knowledge through human capital. If the domestic human capital system is unable to effectively absorb the innovative knowledge generated by trade openness (Rivera-Batiz & Rivera-Batiz, 2018), it can have a negative impact on growth in this case. FDI is significant and is positively related to growth. This is confirmed by a study (Agrawal, 2015). Meanwhile, human capital is negative and has a significant relationship with growth. Our finding is against the finding of Ogundari & Awokuse (2018), who found that human capital has positive effects on economic growth. Researchers also contribute a positive impact on regional economic growth; however, R&D expenditures have a negative and significant impact on growth.

6. Conclusion

The main aim of this paper is to analyse the role of IPR on regional development. We started by focusing on the importance of IPR on regional economic growth. We performed the regression analysis. First, we employed panel regression analysis to see the total effects. Our research showed that the two-year lag patent is positive and significant on growth in panel regression analysis. FDI, number of researchers, trade openness, and R&D expenditure are also significant. However, we did not find any significant effect of human capital on growth. Also, we doubted that the effect can change based on the period. Therefore, we used quantile regression analysis as a second step. We found that IPR does not have a significant effect in all quantile period. We firmly confirmed that it is due to the level of economic development in each period and the funding for R&D activities to undertake innovation (Prokop & Stejskal, 2019; Sein & Prokop, 2021). Additionally, we could see the variation of the effect of other variables.

The policy implication is that the role of IPR is important for regional economic growth. Therefore, it is necessary to support technological development to undertake more R&D activities for innovation because innovation and IPR are complementary in nature (Schneider, 2005). Once innovation is higher, it will certainly contribute to the regional development. Another fact is that IPRs which enhance regional growth depend on the extent to the trade openness (Gould & Gruben, 1997). Therefore, trade policy should be well structured, updated, had more transparency to achieve a desired impact on technological development, which leads to innovation and higher economic growth in a region. There is a limitation on this study. Only one input variable is applied to evaluate the effect on regional economic development. To conclude, more input variables can be added, and a different analysis method can be used in the future.

Acknowledgement

This work was supported by the Student Grant Competition of University of Pardubice SGS_2022_016.

References

Adams, S. (2011). IPR, innovation, and economic growth in Sub-Saharan Africa. *Journal of Third World Studies*, *28*(1), 231-243.

Agrawal, G. (2015). Foreign direct investment and economic growth in BRICS economies: A panel data analysis. *Journal of Economics, Business and Management*, *3*(4), 421-424.

Bilbao-Osorio, B., & Rodríguez-Pose, A. (2004). From R&D to innovation and economic growth in the EU. *Growth and Change*, *35*(4), 434-455.

Bielig, A. (2015). Intellectual property and economic development in Germany: empirical evidence for 1999–2009. *European journal of Law and Economics*, *39*(3), 607-622.

Falvey, R., Foster, N., & Greenaway, D. (2006a). Intellectual property rights and economic growth. *Review of development Economics*, *10*(4), 700-719.

Falvey, R. E., Foster, N., & Memedovic, O. (2006b). The role of intellectual property rights in technology transfer and economic growth: theory and evidence. Geneva: UNIDO.

Furukawa, Y. (2007). The protection of intellectual property rights and endogenous growth: Is stronger always better? *Journal of Economic Dynamics and Control*, *31*(11), 3644-3670.

Fu, X. (2012). Foreign direct investment and managerial knowledge spillovers through the diffusion of management practices. *Journal of Management Studies*, *49*(5), 970-999.

Grossman, G. M., & Helpman, E. (1991). Trade, knowledge spillovers, and growth. *European economic review*, *35*(2-3), 517-526.

Gould, D. M., & Gruben, W. C. (1997). The role of intellectual property rights in economic growth. In *Dynamics of globalization and development* (pp. 209-241). Springer, Boston, MA.

Gumus, E., & Celikay, F. (2015). R&D expenditure and economic growth: new empirical evidence. *Margin: The Journal of Applied Economic Research*, *9*(3), 205-217.

Guloglu, B., & Tekin, R. B. (2012). A panel causality analysis of the relationship among research and development, innovation, and economic growth in high-income OECD countries. *Eurasian Economic Review*, *2*(1), 32-47.

Haydaroğlu, C. (2015). The relationship between property rights and economic growth: an analysis of OECD and EU countries. *DANUBE: Law, Economics and Social Issues Review*, *6*(4), 217-239.

Henry, C., & Stiglitz, J. E. (2010). Intellectual property, dissemination of innovation and sustainable development. *Global Policy*, *1*(3), 237-251.

Horii, R., & Iwaisako, T. (2007). Economic growth with imperfect protection of intellectual property rights. *Journal of Economics*, *90*(1), 45-85.

Hudson, J., & Minea, A. (2013). Innovation, intellectual property rights, and economic development: a unified empirical investigation. *World Development*, *46*, 66-78.

Hu, A. G., & Png, I. P. (2013). Patent rights and economic growth: Evidence from cross-country panels of manufacturing industries. *Oxford Economic Papers*, *65*(3), 675-698.

Hye, Q. M. A., & Lau, W. Y. (2015). Trade openness and economic growth: empirical evidence from India. *Journal of Business Economics and Management*, *16*(1), 188-205.

Innovation, O. E. C. D. (2007). Growth: Rationale for an innovation strategy. *Luxembourg: Statistical Office of the European Communities*.

Kayani, F. N., Al-Ammary, O. M., & Sadiq, M. (2021). Inward FDI and Economic Growth Nexus: A Case of Emerging Brazil from Latin America. *Scientific Papers of the University of Pardubice. Series D. Faculty of Economics and Administration*, *29*(3).

Koenker, R., & Hallock, K. F. (2001). Quantile regression. *Journal of economic perspectives*, *15*(4), 143-156.

Kim, Y. K., Lee, K., Park, W. G., & Choo, K. (2012). Appropriate intellectual property protection and economic growth in countries at different levels of development. *Research policy*, *41*(2), 358-375.

Laik, K. (2005). Role of intellectual property in economic growth. *Journal of Intellectual Property Rights, Vol 10*, pp 465-473.

Lee, K., Baek, H. J., & Cho, C. (2013). Analysis of changes in extreme temperatures using quantile regression. *Asia-Pacific Journal of Atmospheric Sciences*, *49*(3), 313-323.

Mallick, J., & Zdražil, P. (2018). FDI and regional income disparity in the Czech Republic. *Scientific Papers of the University of Pardubice. Series D, Faculty of Economics & Administration*, *25*(43).

Maskus, K. E. (2000). Intellectual property rights and economic development. *Case W. Res. J. Int'l L.*, *32*, 471.

Maurer, S. M., & Scotchmer, S. (2002). The independent invention defence in intellectual property. *Economica*, *69*(276), 535-547.

Maune, A. (2019). Trade in services-economic growth nexus: an analysis of the growth impact of trade in services in SADC countries. *Journal of Economics and Behavioral Studies*, *11*(2 (J)), 58-78.

Mishra, V., Sharma, S. S., & Smyth, R. (2010). Is economic development in the Pacific island countries export led or import led? *Pacific economic bulletin*, *25*(1), 46-63.

Mrad, F. (2017). The effects of intellectual property rights protection in the technology transfer context on economic growth: the case of developing countries. *Journal of Innovation Economics Management*, *23*(2), 33-57.

Neves, P. C., Afonso, O., Silva, D., & Sochirca, E. (2021). The link between intellectual property rights, innovation, and growth: A meta-analysis. *Economic Modelling*, *97*, 196-209.

Ogundari, K., & Awokuse, T. (2018). Human capital contribution to economic growth in Sub-Saharan Africa: does health status matter more than education? *Economic Analysis and Policy*, *58*, 131-140.

Osano, H. M., & Koine, P. W. (2016). Role of foreign direct investment on technology transfer and economic growth in Kenya: a case of the energy sector. *Journal of Innovation and Entrepreneurship*, *5*(1), 1-25.

Park, W. G., & Ginarte, J. C. (1997). Intellectual property rights and economic growth. *Contemporary Economic Policy*, *15*(3), 51-61.

Papageorgiadis, N., & Sharma, A. (2016). Intellectual property rights and innovation: A panel analysis. *Economics Letters*, *141*, 70-72.

Prokop, V., & Stejskal, J. (2019). Different influence of cooperation and public funding on innovation activities within German industries. *Journal of Business Economics and Management, volume 20, issue: 2*.

Prokop, V., Hajek, P., & Stejskal, J. (2021). Configuration paths to efficient national innovation ecosystems. *Technological Forecasting and Social Change*, *168*, 120787.

Queirós, A., Faria, D., & Almeida, F. (2017). Strengths and limitations of qualitative and quantitative research methods. European journal of education studies.

Rivera-Batiz, F. L., & Rivera-Batiz, L. A. (2018). The economics of technological progress and endogenous growth in open economies. *World Scientific Book Chapters*, 105-138.

Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, *98*(5, Part 2), S71-S102.

Sattar, A., & Mahmood, T. (2011). Intellectual property rights and Economic growth: Evidence from high, middle, and low income countries. Pakistan economic and social review, 163-186.

Sukar, A., Ahmed, S., & Hassan, S. (2007). The effects of foreign direct investment on economic growth: The case of Sub-Sahara Africa. *Southwestern Economic Review*, *34*, 61-73.

Schneider, P. H. (2005). International trade, economic growth, and intellectual property rights: A panel data study of developed and developing countries. *Journal of Development Economics*, *78*(2), 529-547.

Shahbaz, M., Azim, P., & Ahmad, K. (2011). Exports-led growth hypothesis in Pakistan: further evidence. *Asian Economic and Financial Review*, *1*(3), 182-197.

Stejskal, J., Hájek, P., & Prokop, V. (2018). Collaboration and innovation models in information and communication creative industries–the case of Germany. *Journal of Information and Communication Technology, volume 17, issue: 2*.

Sein, Y. Y., & Prokop, V. (2021). Mediating Role of Firm R&D in Creating Product and Process Innovation: Empirical Evidence from Norway. *Economies*, *9*(2), 56.

Sweet, C. M., & Maggio, D. S. E. (2015). Do stronger intellectual property rights increase innovation? *World Development*, *66*, 665-677.

Sukamolson, S. (2007). Fundamentals of quantitative research. *Language Institute Chulalongkorn University*, *1*(3), 1-20.

Vollebergh, H. R., & Kemfert, C. (2005). The role of technological change for a sustainable development. *Ecological Economics*, *54*(2-3), 133-147.

Yang, C. H., Huang, Y. J., & Lin, H. Y. (2014). Do stronger intellectual property rights induce more innovations? A cross-country Analysis. *Hitotsubashi Journal of Economics*, 167-188.

Zang, W., & Baimbridge, M. J. (2014). Foreign Direct Investment and economic growth in OECD countries.

Zekarias, S. M. (2016). The impact of foreign direct investment (FDI) on economic growth in Eastern Africa: Evidence from panel data analysis. *Applied Economics and Finance*, *3*(1), 145-160.

Zhylinska, O., Bazhenova, O., Zatonatska, T., Dluhopolskyi, O. V., Bedianashvili, G., & Chornodid, I. (2020). Innovation processes and economic growth in the context of European integration. *Scientific Papers of the University of Pardubice. Series D. Faculty of Economics and Administration*, *28*(3).

Analysis of the Potential for Resilience of Integrated Oil & Gas Operations in Brazil

Denilson Sell[1,2,3], Heron Trierveiler[2], José Todesco[2,3], Aran Morales[3], Paulo Selig[2,3], Eduardo Giugliani[4] and Jane Lúcia dos Santos[4]
[1]ESAG, Universidade do Estado de Santa Catarina, Florianópolis, Brazil
[2]PPEGC, Universidade Federal de Santa Catarina, Florianópolis, Brazil
[3]Instituto Stela, Florianópolis, Brazil
[4]TECNOPUC, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil
denilson@stela.org.br
heronjt@gmail.com
tite@stela.org.br
aran@stela.org.br
pauloselig@gmail.com
giugliani@pucrs.br
jane.santos@pucrs.br

Abstract: Resilience is presented in literature as the capacity of a system to disarm, adapt and recover from unexpected events. Despite the increase of interest of industries and academia in the subject, there are a lack of models that describes the elements that condition and determines resilient performance. This article presents a knowledge model that characterizes intangibles which determine resilient responses and is a central piece in a data science strategy supporting monitoring and analysis of potential for resilience in high-risk industries. Through an interdisciplinary approach, this model was established using an integrative review of the literature and the contribution of experts from several areas. The potential for resilience is represented by a set of leading indicators that allows continuous monitoring of both static characteristics of complex operations and dynamic resource mobilization in the face of unexpected events. Knowledge engineering and data science techniques are applied to treat data from various sources. The established approach addresses several elements that are not traditionally explored in safety management systems, including those related to knowledge that determine resilient responses, as well as factors related to human, structural and relational capital that condition resilient performance. Results of the application of the model are presented, including how the analytical model supports the definition of knowledge management and safety investment strategies in oil and gas companies in Brazil. The approach supports the prioritization of actions and investments to promote safety and enable strategies to learn from accidents and positive conditions that make operations safer despite unpredictability in daily operational routine.

Keywords: Resilience Engineering; Human factors; Knowledge Management; Safety Management

1. Introduction

Complexity and instability are characteristic of socio-technical systems where responses to unexpected events, as well as the decision on the investments needed to promote safety, are critical challenges to operational safety management (Bergström et al., 2015; Hollnagel, 2014; McManus, 2008; Patriarca et al., 2017; Patriarca & Bergström, 2017).

Widespread approaches to operational safety applied to organizations are based on lagging indicators, implementation of detailed and rigid procedures and justification of accidents as behavioral deviations. The complexity of socio-technical systems determined by social, environmental and accelerated technological development makes these approaches not the most appropriate nowadays (Dekker, 2006; Lay et al., 2015). In this context, scientific and practical assumptions based on Resilience Engineering (RE) and Human Factors (HF) are alternatives for the design and evaluation of complex systems (Dekker et al., 2008; Hollnagel et al., 2006; Hollnagel, 2010, 2014; Nemeth & Hollnagel, 2014; Patriarca et al., 2018; Woods, 2009).

In industries such as oil and gas (O&G), where occasional accidents are critical for potential human, environmental, and economic damage, RE is being studied as an alternative approach to traditional safety management strategies. RE considers the analysis of HF (i.e., the interactive relationship amongst humans, works, and artifacts) from design to the operation of the system, considering not only the absence of negative aspects, but also the presence of positive ones (Hollnagel, 2014; Nemeth & Hollnagel, 2014).

The literature presents prominent works focusing on the analysis of potential for resilience (Nemeth; Hollnagel, 2014). However, most of them do not provide a roadmap for analyzing HF and their relationship to the potential for resilience in complex sociotechnical systems. Thus, the challenges that motivate this research are to identify (i) how to qualify HF and knowledge resources that condition resilient responses and (ii) how to establish leading indicators (Hollnagel, 2010; Patriarca et al., 2017) that allow continuous monitoring of these factors, promote learning and better target investments in operational safety management.

This work presents an alternative model that transcends monitoring approaches based on lagging indicators to evaluate factors that condition resilient performance, combining knowledge management, HF, RE and operational safety management.

2. Potential for resilience analysis

In several industries, accidents and incidents, beyond unintended or individual phenomena, result from social and organizational factors (Hovden et al., 2018). In complex operations, there is no way to predict everything that can happen. In the perspective of safety management, Hollnagel (2010) defines resilience as "the intrinsic ability of a system or organization to adjust its functioning before, during or after changes and disturbances, so that it can sustain the necessary operations under expected and unexpected conditions". According to Park et al. (2012), resilience is not a static property of the system but an emerging property resulting from a process of detection, anticipation, learning and adaptation to risk. This view significantly implies the adaptive management of complex systems and this stems from the importance of defining and evaluating resilience of operations in complex systems. Thus, it is critical to identify ways to qualify HF's that determine resilient responses and to analyse their condition of improving safety. Also, it is critical to establish methods to measure resilience and promote continuous learning to improve the potential for resilience of organizations (Stephenson, 2010). It is also critical to consider how knowledge could be managed to improve potential for resilience (Fraga; Varvakis; Sell, 2018; Sell et. al., 2021).

There are models that deal with the measurement of resilience in organizations (Bahmra, Dani and Burnard; 2011, Lengnick-Hall et. al.; 2011, Stephenson; 2010, Alonso and Bressan; 2015), however, in these studies, knowledge is not considered as a critical organizational resource. Knowledge used by employees in their daily adaptations is often not recognized or documented (Rasmussen & Svedung, 2000), making it difficult to improve resilience (Rankin et al., 2014).

The Framework for Analysis of Resilient Responses (Sell et al.; 2021) gives the basis of this work. Its objective is to support comprehensive analyses by shedding light on several HF from the perspectives of the individual, work and organization, as proposed by Edwards (1988) and Hawkins (2017), but exploring knowledge as a key factor amongst other HF usual in Oil & Gas integrated operations. Resilience is a topic of interest to different areas, but internal and external factors make it particularly interesting for the O&G industry[1]. At operational level, complexity and risk inherent in oil production and external factors, like fluctuation cycles in the price of raw materials and derivatives and social pressures in favor of replacing fossil fuels with renewable ones, raise concerns about organizational resilience (Bento et al., 2021).

Based on this framework, we analyzed models of indicators that could allow the monitoring of resilience potential in continuous flow.

2.1 Indicators adherent to Resilience Engineering

Indicators are a useful tool for inferring changes that can reflect on the safety of organizations. Performance indicators are most applied to traditional safety management, especially so-called *lagging indicators*, as they are objective, and quantifiable. They, however, measure results, things and events that have already occurred (e.g. incidents and accidents) and raise questions, because the retrospective bias may not indicate the real safety of the organization (Dekker, 2004; Grecco et al., 2014).

[1] Brazil is the largest oil producer in South America and the eighth largest in the world. The sector represents about 10% of Brazil's GDP and the country is in a leading position for the exploration and production of offshore oil in pre-salt province. International Energy Agency (IEA) estimates that in 2040, Brazil will produce about 50% of the world's offshore oil (International Trade Administration, 2021).

Grecco et al. (2014) advocate for indicators that could confirm long-term effects and not only immediate changes in dynamic environments. They suggest leading indicators focused on HF, good working practices and determinants of resilience in the anticipation of vulnerabilities. The big challenge is to identify measurable organizational factors that influence resilience and safety. For this, the elements of safety culture proposed by Reason (1997), Wreathall (1999; 2006) and Grecco et al. (2014) are a good starting point.

Reason (1997) addresses principles for understanding the causes of accidents, detailing elements that underpin later work (e.g., Wreathall, 1999; 2006):

1. **Management Commitment**: senior management infuses in the organization a sense of significance and value of human performance, both in words and actions.
2. **Learning culture**: learning should be obtained not only by the occasion of incidents and accidents, but also by regular activities.
3. **Flexibility**: organization's ability to adapt to new or complex problems in a way that maximizes its ability to solve problems without disrupting overall functionality.
4. **Awareness**: what is happening in relation to the quality of human performance and the current state of the system's defenses.
5. **Just culture**: supports the reporting of problems in the organization without being condescending to culpable behaviors.
6. **Readiness**: organizational technical competence necessary to achieve safety objectives.

Grecco et al. (2014) proposed a fuzzy logic-based model to assess safety culture using indicators capable of predicting changes in an organization's safety performance. In the work, Grecco et al. (2014) proposed a set of assertions that describe how a fictitious company referencing safety culture would address the typology of Reason (1990, 1997). Their model is indicated for managers to monitor and evaluate safety culture in organizational processes. It can be applied in any safety-critical organization[2], such as civil aviation and mining, with adjustments to indicators and metrics according to their characteristics (Grecco et al., 2014).

3. Methodology and research strategy

The indicators and analytical tools presented in this article were developed as elements of the framework described in Sell et al. (2021) applying *Design Science Research* (DSR) method (Peffers et al., 2006). Needs and objectives of the solution were identified applying organizational context modeling techniques proposed by CommonKADS (Schreiber et al., 1999). Seven companies in the O&G sector, including contractors and chartered workers, participated sharing information about their performance, statements from managers and data on safety management.

Regarding the development of the model of representation and analysis of HF, an exploratory literature review was developed, through which it was possible to identify studies in different industries (*e.g.,* IOGP[3], ERA[4], ARGONNE[5] and IAEA[6]). The first version of the model was established based on these studies and then evaluated by O&G professionals and specialists in areas such as sociology, social work, RE and knowledge management. As a result, it was designed a new version of the model.

The indicators guided collection, treatment and analysis of data obtained from the companies participating in the study. In the next section, we detail how the model was structured.

4. Resilient Performance Analysis Model

The framework proposed by Sell et al. (2021) is composed by:

- a knowledge model describing HF that condition the potential for resilience;

[2] Safety-critical organizations are those that operate in areas that involve significant risks to the safety of the environment or society. Safety is a prerequisite for its very existence. Uncertainties, complexity and contradictory requirements are inherent to safety-critical organizations (S. W. A. Dekker & Woods, 2010; Oedewald & Reiman, 2007; Reiman et al., 2015; Weick & Sutcliffe, 1999).

3 **https://www.iogp.org/**

4 **https://www.era.europa.eu/**

5 **https://www.anl.gov/**

6 **https://www.iaea.org/**

- information systems to handle and analyse different data sources;
- knowledge systems to support the prioritization of actions to improve the potential for resilience.

The framework's knowledge model is composed by 136 factors, organized into first-order constructs (Individual, Work, and Organization). Figure 1 presents an overview of the factors, highlighting through the "Knowledge repertoire for adaptation" factor how they are described and associated with information sources to populate the model.

The framework knowledge model integrates the factors associated to the individual level (*i.e.,* workers' competencies; psychological, physiological, and social conditions); to work (e.g. workload, internal conditions, procedures, and technologies); and to organizational aspects (e.g. policies related to people's, knowledge management and safety management). Knowledge is explored through the perspectives of individuals (*i.e.,* the stock of workers' knowledge and their repertory to deal with unforeseen events), work (*i.e.* knowledge required for work and information dissemination for safe work), as well as in the organizational perspective (*e.g.* policies for people management, organizational learning and knowledge management). The main factors are broken down into up to four levels of associated factors to provide an operational description to support their observation in the work environment.

In the next sections, we describe how we established leading indicators to support the evaluation of factors represented in the knowledge model.

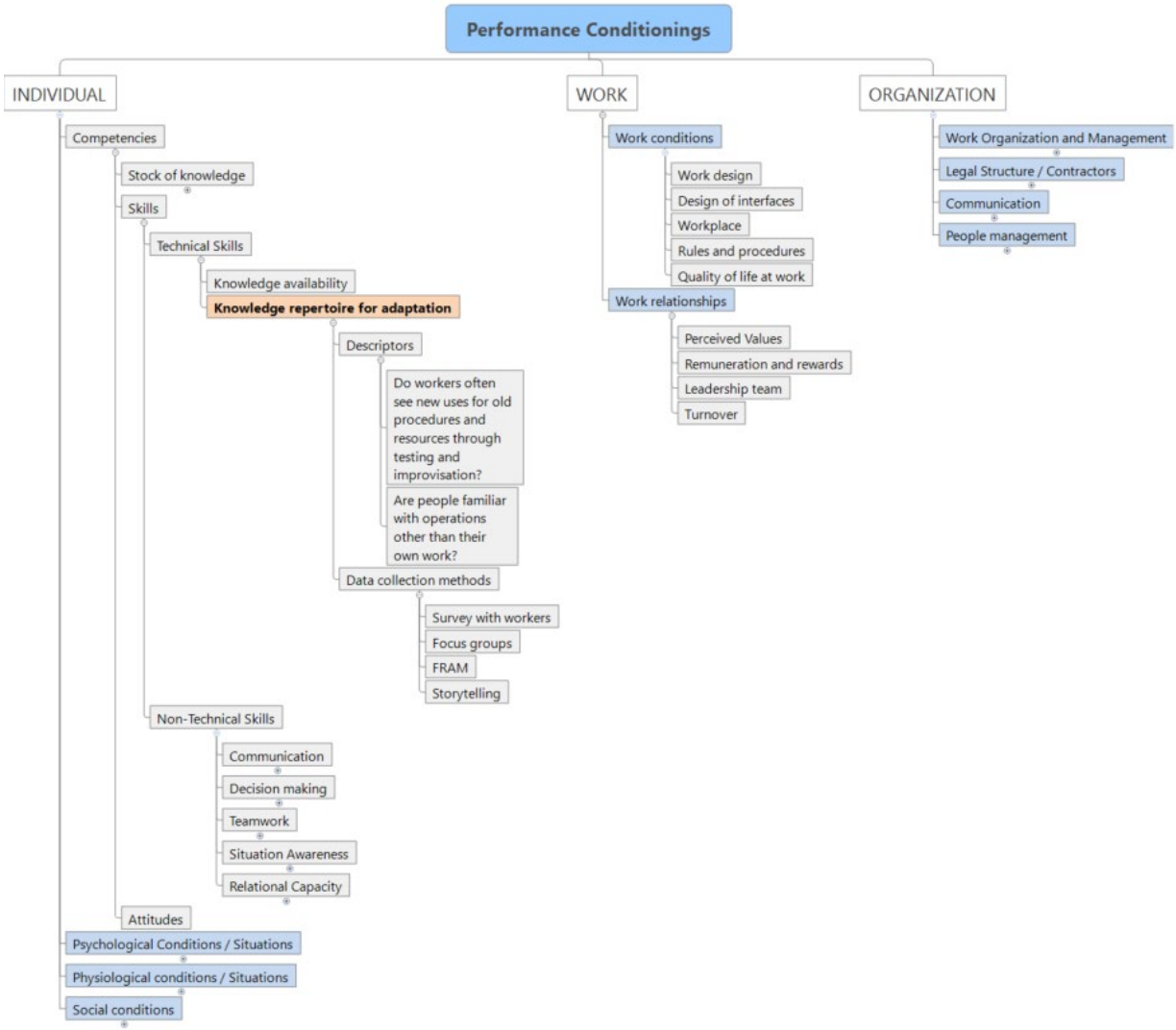


Figure 1: Overview of framework factors

Source: from authors

4.1 Strategy for structuring leading indicators

Our proposal for leading indicators were structured based on the Reason (1997) six attributes of safety culture and in the conceptual model of the framework described in Sell et. al. (2021). The indicator model was structured based on the following steps: (i) selection of a structure of indicators; (ii) adherence analysis of the indicators to factors that condition resilient performance; and (iii) review of the structure of indicators with the support of experts. Such steps are described in the following sections.

4.1.1 Selection of indicators

Grecco et al. (2014) suggest that the selection of indicators considers what needs to be monitored and not the ways in which monitoring can be done. Otherwise, the selection can be biased considering only what is possible or convenient to measure, not meeting the purposes of monitoring. In this sense, in the present work, we designed the instruments referencing models of safety culture indicators adherent to the principles of RE that were already applied in complex sociotechnical systems.

The model of Grecco et al. (2014) was selected as the basis for the present work due to its adherence to factors of our framework (Sell et. al., 2021). That model consists of 43 leading indicators grouped into 6 safety culture attributes, as described in the Table 1, aimed to assess the safety culture using safety performance indicators.

Table 1: Leading indicators grouped by safety culture attributes

Attributes	Leading indicators
Management Commitment	1.1 Human resources
	1.2 Material resources
	1.3 Commitment to safety
	1.4 Safety policies
	1.5 Procedure management
	1.6 Training programs
	1.7 Selection of competencies
Organizational learning	2.1 Dissemination of information
	2.2 Information flow
	2.3 Work management
	2.4 Current working practices
	2.5 Local adaptations
	2.6 Content of the documentation
	2.7 Documentation availability
	2.8 Accident analysis
	2.9 Investigation of incidents and accidents
Organizational flexibility	3.1 Ability to control the unexpected
	3.2 Ability for flexibility
	3.3 Professional recognition
	3.4 Limits for safe work
	3.5 Reports of adaptations
	3.6 Incorporation of adaptations
Situational awareness	4.1 Problem communication
	4.2 Information security
	4.3 Communication mechanisms
	4.4 Teamwork
	4.5 Workload
	4.6 Interpersonal relationships
	4.7 People's tasks and skills
	4.8 Awareness of limits
	4.9 Preventive maintenance
	4.10 Proactive actions
Just culture	5.1 Reports of deviations/concerns
	5.2 Understanding errors
	5.3 Perception of errors
	5.4 Non-punitive actions
	5.5 Peer reviews
Emergency preparedness	6.1 Emergency preparedness plan
	6.2 Risk identification
	6.3 Safety equipment
	6.4 Alarm system

Attributes	Leading indicators
	6.5 Proactive procedures 6.6 On-site emergency training

Source: adapted from Grecco et al. (2014)

Grecco et al. (2014) suggest the attribution of an assertion for each attribute to guide the responses of the target audience and quantify the responses through metrics. To quantify the answers, a 5-point Likert scale was adopted, with "Strongly disagree" equivalent to one point and "Strongly agree" equivalent to five points. Table 2 presents an example of a metric attributed to the "Organizational Learning" attribute.

Table 2: Safety culture metrics

Attribute	Indicator	Metric
2 Organizational Learning	2.11 Success as a source of learn	Factors that ensure the success and safety of daily work are observed as a source of learning.

Source: adapted from Grecco et al. (2014)

4.1.2 Adherence analysis of indicators to the factors of the model

To achieve the main objective of this study, we evaluated the degree of adherence of the selected leading indicators to the factors that condition resilient performance. Beforehand it was known that complete adherence would not be achieved, as the factors are related to constructs that go beyond the safety culture, including, for example, leadership, communication and non-technical skills.

Table 3 presents an extract from the adherence analysis, where indicators 3.5 and 4.3 of the model by Grecco et al. (2014) were confronted with the 'Communication' factor, part of the Individual dimension of the framework.

Table 3: Example of adherence analysis between the indicators and the framework

Framework for Analysis of Resilient Performance (Sell et al., 2021)		**Leading indicators (Grecco et al., 2014)**	
Dimension > Factor > Associated Factors	**Description**	**Indicator**	**Metric**
Individual > Non-Technical > Skills	Workers: 1. voluntarily share information; 2. keeps others informed about progress and changes in work; 3. give appropriate feedback on time; 4. have adequate capacity to communicate with clarity and objectivity; 5. devote adequate time and attention to new information and confirm their understanding.	3.5 Report of adaptations 4.3 Communication mechanisms	3.5 Local adaptations of tasks are communicated by people. 4.3 To what extent communication mechanisms are available.

Source: from authors

When comparing the 43 safety culture indicators to the content of the framework, adherence was identified with 6 of its 10 factors, as described in Table 4. Workshops were than held with experts to review the mapping between the framework factors and the indicators proposed by Grecco et. al. (2014), as well as to prospect indicators for the factors not contemplated in the mapping, as described in the next section.

Table 4: Result of the analysis of adherence of the indicators with the framework

INDIVIDUAL		**WORK**		**ORGANIZATION**	
Factors	**Indicators**	**Factors**	**Indicators**	**Factors**	**Indicators**
Competence / Repertoire	20	Working conditions	24	Management and organization of work	18
Physiological conditions	-	Working relationships	3	Formal legal structure	-

INDIVIDUAL		WORK		ORGANIZATION	
Factors	**Indicators**	**Factors**	**Indicators**	**Factors**	**Indicators**
Social conditions	-			Communication	3
Psychological conditions	-			People management	4

Source: from authors.

4.1.3 Review of indicators by experts

The last step of the method was to review the indicators by academic and professional experts working in O&G companies. The experts evaluated the content, relevance, and plausibility of the indicators.

At the end of this stage, the structure of indicators was reviewed based on the observations. A new version of the model was obtained, consisting of 48 indicators according to the reality of the O&G sector, where it is intended to expand the studies by the periodic application of surveys.

4.1.4 Application of knowledge systems

In order to analyze the structure and level of contribution of the indicators to operational safety management, a survey was structured and applied with teams from O&G companies. The questions were formulated to address the level of agreement of the teams with statements on the level of development of each leading indicators' metrics associated with their work environment.

A knowledge system was established to enable the analysis of the factors that condition resilient performance through the proposed leading indicators. The calculation method was adapted from the critical infrastructure resilience index, RMI (Petit et al., 2013). The final index of the second-order construct Resilience Performance Conditionings is based on the aggregation of equally weighted first-order constructs or attributes of resilient organizations (*i.e.,* Senior Management Commitment, Organizational learning, Organizational flexibility, Situational awareness, Just culture and Emergency preparedness).

Indicators are presented through a set of dashboards, which contain summaries of the qualitative analyses carried out for each factor. Figure 2 depicts the first screen of the knowledge system. An estimated score for each of the model first and second-order constructs is presented (data illustrated were anonymized and manipulated to respect the confidentiality of the information collected in the study). Users can drill down to obtain more detailed information and access specific dashboards with highlights associated with each factor.

The data collected through the survey and by other means were (*e.g.,* interviews, observation, document analysis) synthesized around the factors of the model. Through the analysis of the data, working groups were formed by the themes *Leadership*, *Just Culture*, *Operational Safety Events* and *Self Care*. The aim of these working groups is to deep the data analysis around each theme as well as develop action plans. In this sense, the model's indicators helped to guide the interventions in the companies, as well as to enable the future analysis of the results and impacts of the action plans developed, favouring learning and strengthening the potential for resilience.

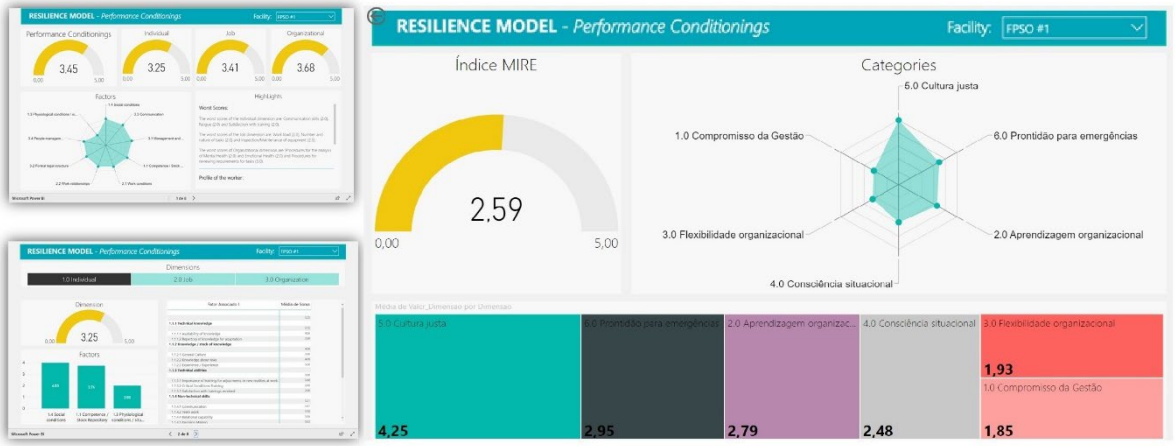


Figure 2: Partial illustration of the knowledge system

Source: from authors

5. Discussions and conclusions

In this paper, we presented a model that guides continuous analysis of the elements that condition resilient performance and described its application in the analysis of companies that operate in the O&G sector in Brazil. The model applies leading indicators to enable a holistic view of the conditions related to safety culture found in high-risk companies and to support an interdisciplinary analysis of the issues to be addressed to strengthen safety.

The analysis model offers a proactive tool which provides a basis for action without waiting for events, addressing strengths and weaknesses of safety culture attributes and HF that condition resilient performance. Through a systemic approach, exploring a wide range of factors that condition resilient performance, knowledge systems reveal the latent factors that contribute to the occurrence of safety events and the status of safety culture attributes. Several aspects related to knowledge are explored among the factors presented in the knowledge model. The indicators guide knowledge management interventions to address individual gaps or risks regarding knowledge determinant for critical tasks, as well as the analysis of policies and strategies for the enhancement of organizational learning and safety.

This study in the O&G industry in South America showed that the model offers interesting perspectives for resilience improvement. In fact, the leading indicators allowed the identification of potential issues in the Just Culture category, regarding items such as the distinction between acceptable and unavoidable errors, errors such as learning sources and fair treatment of subordinates. These issues are among those that are inherent to a punitive culture still very present in this industry and its implications can be correlated with other findings associated to communication and learning. These findings should be investigated more deeply in other companies in O&G industry.

The proposed analysis model may also be used to compare resilience potential with a given ideal pattern, but do not indicate potential improvements in safety management strategy. However, as described in related studies, this weakness could be addressed by a mobilization of experts to set up new measures and targets to be pursued.

The approach adopted to propose the indicators combining the steps developed by Grecco et al. (2014) with conceptual model, as outlined in the framework described in Sell et al. (2021), proved to be viable and adherent to the needs of the companies involved in the study. The framework is supporting the analysis of the effectiveness of investments in safety and reveal the potential risks not prioritized by current plans, contributing to the promotion of organizational learning. Considering that the model was applied in 7 organizations, it should be applied in more organizations to analyze its replicability in other contexts.

Future studies should further explore: a) the identification of additional information sources and data gathering strategies; b) the improvement of knowledge systems to automate the framework application; c) the continuous application of the framework to estimate how interventions affects resilience potential.

Acknowledgements

This study was carried out with the support of the National Agency for Oil, Natural Gas, and Biofuels, Brazil (ANP), through resources from the R, D&I Clauses - Regulation n. 03/2015 (processes: 2016/00187-1 and 2019/00105-3). This study was also financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) Finance Code 001.

References

Alonso, A. D. and Bressan, A. (2015) 'Resilience in the context of Italian micro and small wineries: an empirical study', International Journal of Wine Business Research, 27(1), pp. 40–60. doi: 10.1108/IJWBR-08-2014-0035.

Bento, F., Garotti, L., & Mercado, M. P. (2021). Organizational resilience in the oil and gas industry: A scoping review. Safety Science, 133, 105036. https://doi.org/10.1016/j.ssci.2020.105036

Bergström, J., van Winsen, R., & Henriqson, E. (2015). On the rationale of resilience in the domain of safety: A literature review. Reliability Engineering & System Safety, 141, 131–141. https://doi.org/10.1016/j.ress.2015.03.008

Cox, S.; Jones, B.; Rycraft, H. (2004) Behavioural approaches to safety management within UK reactor plants. Safety Science, v. 42, n. 9, p. 825–839.

Dekker, S. (2004). Ten Questions About Human Error: A New View of Human Factors and System Safety. CRC Press.

Dekker, S. (2006). Resilience Engineering: Chronicling the Emergence of Confused Consensus. In Resilience Engineering: Concepts and Precepts (pp. 77–97). CRC Press.

Dekker, S., Hollnagel, E., Woods, D., & Cook, R. (2008). Resilience Engineering: New directions for measuring and maintaining safety in complex systems. 67.

Dekker, S. W. A., & Woods, D. D. (2010). The High Reliability Organization Perspective. In Human Factors in Aviation (pp. 123–143). Elsevier. https://doi.org/10.1016/B978-0-12-374518-7.00005-5

Edwards, E. (1988) 'Introductory Overview', in Wiener, E. L. and Nagel, D. C. (eds) Human Factors in Aviation. San Diego: Academic Press (Cognition and Perception), pp. 3–25. doi: 10.1016/B978-0-08-057090-7.50007-2.

Fraga, B.; Varvakis, G.; Sell, D. (2018) Framework for analyzing critical knowledge related to the potential of organizational resilience. IFKAD Proceedings. In: 13TH EDITION OF THE INTERNATIONAL FORUM ON KNOWLEDGE ASSET DYNAMICS - IFKAD. Delft, Netherlands.

Grecco, C. H., Vidal, M. C. R., Cosenza, C. A. N., dos Santos, I. J. A. L., & de Carvalho, P. V. R. (2014). Safety culture assessment: A fuzzy model for improving safety performance in a radioactive installation. Progress in Nuclear Energy, 70, 71–83. https://doi.org/10.1016/j.pnucene.2013.08.001

Hawkins, F. H. (2017) Human Factors in Flight. 2nd edn. New York, USA: Routledge.

Hollnagel, E. (2010). How Resilient Is Your Organisation? An Introduction to the Resilience Analysis Grid (RAG). http://www.ipac.ca/documents/RAG%20discussion_APR05.pdf

Hollnagel, E. (2014). Safety-I and Safety-II. CRC Press.

Hollnagel, E., Woods, D. D., & Leveson, N. (Eds.). (2006). Resilience engineering: Concepts and precepts. Ashgate.

Hovden, J. et al. (2008) 'The safety representative under pressure. A study of occupational health and safety management in the Norwegian oil and gas industry', Safety Science, 46(3), pp. 493–509. doi: 10.1016/j.ssci.2007.06.018.

Hulme, A. et al. (2019) 'Accident analysis in practice: A review of Human Factors Analysis and Classification System (HFACS) applications in the peer reviewed academic literature', Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 63(1), pp. 1849–1853. doi: 10.1177/1071181319631086.

International Trade Administration. (2021). Energy Resource Guide: Brazil—Oil and Gas. U.S. Department of Commerce. https://www.trade.gov/energy-resource-guide-brazil-oil-and-gas

Lay, E., Branlat, M., & Woods, Z. (2015). A practitioner's experiences operationalizing Resilience Engineering. Reliability Engineering & System Safety, 141, 63–73. https://doi.org/10.1016/j.ress.2015.03.015

Lengnick-Hall, C. A., Beck, T. E. and Lengnick-Hall, M. L. (2011) 'Developing a capacity for organizational resilience through strategic human resource management', Human Resource Management Review, 21(3), pp. 243–255. doi: 10.1016/j.hrmr.2010.07.001.

McManus, S. (2008). Organisational Resilience in New Zealand [Doctor of Philosophy in Civil Engineering]. University of Canterbury.

Nemeth, C. P., & Hollnagel, E. (2014). Resilience Engineering in Practice (Vol. 2). Ashgate Publishing Limited.

Oedewald, P., & Reiman. (2007). Special characteristics of safety critical organizations. Work psychological perspective. Espoo 2007. VTT Publications 633.

Park, J. et al. (2012) Integrating Risk and Resilience Approaches to Catastrophe Management in Engineering Systems. Risk analysis : an official publication of the Society for Risk Analysis, v. 33.

Patriarca, R., & Bergström, J. (2017). Modelling complexity in everyday operations: Functional resonance in maritime mooring at quay. Cognition, Technology & Work, 19. https://doi.org/10.1007/s10111-017-0426-2

Patriarca, R., Bergström, J., Di Gravio, G., & Costantino, F. (2018). Resilience engineering: Current status of the research and future challenges. Safety Science, 102, 79–100. https://doi.org/10.1016/j.ssci.2017.10.005

Patriarca, R., Di Gravio, G., Costantino, F., Falegnami, A., & Bilotta, F. (2017). An Analytic Framework to Assess Organizational Resilience. Safety and Health at Work, 9(3), 265–276. https://doi.org/10.1016/j.shaw.2017.10.005

Peffers, K., Tuunanen, T., Gengler, C. E., Rossi, M., & Hui, W. (2006). The Design Science Research Process: A Model for Producing and Presenting Information Systems Research. DESRIST 2006 Proceedings, 84–106.

Petit, F. D. P. et al. (2013) Resilience Measurement Index: An Indicator of Critical Infrastructure Resilience. ANL/DIS-13-01, 1087819, p. ANL/DIS-13-01, 1087819. doi: 10.2172/1087819.

Rankin, A., Lundberg, J., Woltjer, R., Rollenhagen, C., & Hollnagel, E. (2014). Resilience in Everyday Operations: A Framework for Analyzing Adaptations in High-Risk Work. Journal of Cognitive Engineering and Decision Making, 8(1), 78–97. https://doi.org/10.1177/1555343413498753

Rasmussen & Svedung. (2000). Proactive risk management in a dynamic society. Swedish Rescue Services A.

Reason, J. T. (1990). Human error. Cambridge University Press.

Reason, J. T. (1997). Managing the risks of organizational accidents. Ashgate.

Reiman, T., Rollenhagen, C., Pietikäinen, E., & Heikkilä, J. (2015). Principles of adaptive management in complex safety–critical organizations. Safety Science, 71, 80–92. https://doi.org/10.1016/j.ssci.2014.07.021

Schreiber, G., Akkermans, H., & Anjewierden, A. (Eds.). (1999). Knowledge engineering and management: The CommonKADS methodology. MIT Press.

Sell, D. et al. (2021) Framework for the Analysis of Resilient Performance Conditionings in Integrated Operations of the Oil and Gas Industry. In: MATOS, F.; SELIG, P.; HENRIQSON, E. (Eds.). . Resilience in Digital Age: Global Challenges in Organizations and Society. 1. ed. Cham, Switzerland: Springer International Publishing. p. 56–81.

Stephenson, A. (2010) Benchmarking the Resilience of Organizations. Doctor of Philosophy in the Civil and Natural Resources Engineering Department. University of Canterbury.

Theophilus, S. C. et al. (2017) 'Human factors analysis and classification system for the oil and gas industry (HFACS-OGI)', Reliability Engineering & System Safety, 167, pp. 168–176. doi: 10.1016/j.ress.2017.05.036.

Umoh, G. I.; Amah, E. (2014) Management Development and Organizational Resilience. A Case Study Of Some Selected Manufacturing Firms In Rivers State. Nigera. IOSR Journal of Business and Management, v. 16, p. 07–16.

Weick, K., & Sutcliffe, D. (1999). Organizing for high reliability: Processes of collective mindfulness. In B. Staw & R. Sutton (Eds.), Research in Organizational Behavior (1st ed., Vol. 21, pp. 81–123). JAI Press. http://wendynorris.com/wp-content/uploads/2018/08/Weick-et-al-2008-Organizing-for-High-Reliability-Processes-of-Collective-Mindfulness.pdf.pdf

Woods, D. D. (2009). Escaping failures of foresight. Safety Science, 47(4), 498–501. https://doi.org/10.1016/j.ssci.2008.07.030

Wreathall, J. (1999). Guidelines for Leading Indicators of Human Performance: Preliminary Guidance for Use of Workplace and Analytical Indicators of Human Performance (TR-107315; p. 152). EPRI.

Wreathall, J., & Connelly, E. (1992). Using Performance Indicators to Evaluate Training Effectiveness: Lessons Learned. Performance Improvement Quarterly, 5(3), 35–43.

Wreathall, P. J., Fragola, J., Appignani, P., Burhle, G., & Shen, Y. (1990). The Development and Evaluation of Programmatic Performance Indicators Associated with Maintenance at Nuclear Power Plants (NRC FIN L1183; p. 136). Office of Nuclear Regulatory Research.

Wreathall, J. (2006) Properties of Resilient Organizations: An Initial View. In: Resilience Engineering. 1. ed. Boca Raton, USA: CRC Press. p. 275–286.

Semiotic Inception, Attitude Altering, and Behavioral Expression: Understanding the Foundation of Organizational Knowledge Construction

Chulatep Senivongse[1] and Alex Bennet[2]
[1]Institute for Knowledge and Innovation - South-East Asia
[2]Mountain Quest Institute and IKI-SEA
Chulatep.S@bu.ac.th
Alex@mountainquestinstitute.com

Abstract: This study explores the theory of semiotics and how it is processed in the cognitive space of a person (a complex adaptive system) with a focus on an individual's response to persuasive arousal, how behavior is altered, and how habits are formulated. The study involves reviewing on the theory of semiotics, attitude altering, and behavior enactment. An SIAB framework is constructed from the combination of multiple fields of knowledge domains. The proof of the framework construction validity is verified by systematic literature review and meta-analysis techniques on the past marketing semiotic research. The framework can explain how humans incept the sign, how the sign influences attitudes, and how behavior is expressed. The SIAB framework can be the foundation to explain how individual knowledge is constructed, which can support many future studies.

Keywords: Semiotics; Attitude Altering; Elaboration Likelihood Model; Behavioral Control and Expression; SIAB Framework

1. Introduction

Semiotic analysis is a process related to interpreting the notions of signs and developing understanding and expression (Kuzu, 2016; Louhema *et al.*, 2019). It stands for something iconically, indexically, or symbolically to convey the meaning that may include abstract, theoretical, non-observable, or non-existent objects and properties (Queiroz and El-Hani, 2006; He and Shao, 2018). Semiotic theories developed along two grounds of two significant theorists; one is a Swiss linguist Ferdinand de Saussure and the American theorist Charles Sanders Peirce (He and Shao, 2018). Saussure's theory focused on the linguistic sign composed of a two-sided concept called a signified and a sound-image named a signifier (Wells, 1947; Richter, 1998). Saussure is based on verbal meaning and association between the signifier and signified.

Peirce looks at semiotics as a process of visual communication with cognitive interpretation with social and cultural influences presuming lexical, verbal, and lingual understanding (Moriarty, 2002). Peirce's approach is straightforward in terms of the three types of signs: iconic, indexical, and symbolic, where an icon refers to an object which denotes the character its own, and the index refers to an object that represents the value of being itself, and a symbol refers to an object that indicates the thing that obeys by some code of conducted or governed by law (He and Shao, 2018).

The semiotic theory has been used in the neuromarketing field to induce sales by altering consumer behavioral patterns and studying human behavior in daily life situations (Cherubino *et al.*, 2019). The application of semiotics theory raises how a sign impacts a person's preference and response.

Human is a complex adaptive system (CAS). Complex systems consist of many interrelated parts that may or may not have nonlinear relationships, feedback loops, and dynamic uncertainties that are difficult to understand and predict. Complex systems can create global emergent properties from their elements and interactions. Yet, those characteristics cannot be easily traced back to the connections because of the nonlinearity and unpredictability of the features and relationships (Bennet and Bennet, 2013). These emergent properties make the whole system very different from the sum of its parts. Co-evolving through both responsive and proactive adaptation to its environment, a CAS has partially ordered systems that evolve while operating at some level of perpetual disequilibrium, which contributes to their unpredictable behavior.

For semiotics to affect human behavior, further exploration is required to understand the mechanism of how humans interpret the inception of a sign that leads to the expression of action.

This research explores the theory of semiotics and how it is processed in the cognitive space of a person with a specific focus on an individual's response to persuasive arousal, how behavior can be changed, and how habits are developed. A model is constructed from the literature review to identify how the semiotic analysis system and behavior change procedural system works. The completed model combines the inception of arousal information, the altering process of attitude, and the determination of how to express the behavior. The elaboration Likelihood model explains how attitude altering happens. The matrix analysis of behavioral resolution for expression identifies the expression of behavior in responding to the arousal.

2. Literature Review

The literature review provides related theories on semiotics, how information is cognitively processed, and how the responding behaviors are expressed.

2.1 Peircean semiotic triadic framework

Peircean Semiotic Triadic framework starts with the sign. The sign is the notion that symbolizes the object. A sign can be in the form of iconic, indexicality, or symbolic. These forms of signs are called the "Representamen." The sign refers to something it represents, called an "Object." Peirce called the representation of the sign with the real-world object the "Interpretant." The interaction between the three functions forms the process of meaning or "Semiosis" (Chandler, 2017). The Peircean model is a triadic relation in which the sign acts as the mediator between the object of the word and the concept in mind. Semiosis is the process of representation. The process involves the sign representing an object to the mind. In other words, representamen represents an object, having the interpretant as the mediating representation.

The sign must represent the meaning. Otherwise, it is not a sign. However, to pertain to the meaning, the sign must be translated into another sign until the meaning is fully developed. Therefore, semiosis can spawn with another semiosis, representing the original sign to make meaningful interpretants. This recursive property led to a hermeneutic cycle of communication language construct (Chandler, 2017) and called this chain of semiotic interpretation a "syntagmatic relations" (Louhema *et al.*, 2019).

Saussure's theory mentioned that the sign has a dyadic relation of signifier and signified (Yakin and Totu, 2014), while in Peircean theory, the signifier part is called representamen. The signified part is the referent of the object. Still, the representation of meaning cannot happen without the interpretant part. In other words, representamen is the physical or material form that explicitly exists and can be distinguished by human senses. At the same time, the interpretant is the abstract form that happens in the cognitive space of the human mind (Yakin and Totu, 2014).

In comparison, the dynamic interpretant process is the process that realizes the meaning of the sign to the interpreter. Bradley (2016) identifies the differences between Icon, Index, and Symbol. An Icon has a real connection between signifier and signified. For example, a photograph of the dark cloud, an icon, has an image object (the cloud) that resembles the signifier and the representative part that defines the meaning of that image object (about to rain). An Index has both the signifier and signified part, where a signifier cannot exist without the signified. For example, an image object of a floppy disk, which is classified as an index, on a word processing application represents the meaning of how to save the file. A Symbol does not have any connections between signifier and signified. For example, a school emblem is a symbol that has no meaning to anyone except the students from that school. The meaning of a symbol must be learned to understand what it represents.

However, according to Keeler and Kloesel (1997), a theory must have a relationship between two separated items. The traditional Saussure's dichotomous theory of signifier and signified lacks a defined relationship between the two entities. Saussure's concept cannot explain the meaning of thought and communication when reading a sign and cannot explain the uniqueness of the sign's meaning. Thus, Saussure's theory can only be understood as a theory of language. The Peircean semiotics concept focuses on visual communication. Consequently, the interpretant process is more visible than the verbal inference (Moriarty, 2002). This process makes Peircean semiotics theory a theory of "knowing" rather than a theory of language.

2.2 Semiotics and Multimodality Stimulus

Sign in Semiotics interrelates with other signs to form semiotic systems (Louhema *et al.*, 2019). The human universal semiotic system uses language, gesture, and depiction as the medium for expression (Zlatev, 2019). Language appears in the form of speech, writing, and signing. Gesture appears in the form of visual presentation

of the body. The depiction is the material produced as the visual medium for communication. Semiotic analysis has been widely used in the Sensory marketing (Lwin *et al.*, 2016). Multimodality has been exploited to fully captivate the essence of marketing communication using metaphoric referent Fields(Forceville, 2017). Metaphoric referent requires two common principles: the communicator (source) and the communicatees (target). First, the metaphoric subjects must have shared understanding and experiences between the two sides, and second, the comparative properties of the two subjects are not reversible (Forceville, 2017).

The Semiotic theory focuses on studying the sign system and interpreting the meaning to reach the referral object in nature. However, it does not explain how the sign system impacts human attitude and how behaviors are enacted. Therefore, a deeper exploration of how humans behave needs to be examined.

2.3 Behavioral Change and Cognitive Process

Human behavioral change relies heavily on the cognitive mechanism (Bandura, Adam and Beyer, 1977), the mind, and emotions and feelings. According to social learning theory, behavioral changes are caused by affective attitudinal changes (Rokeach, 1966; Mason, 2001), with the strength of an attitude characterized by its persistence and resistance to change as well as an ability to predict behavior (Petty *et al.*, 2003). Attitude—which includes our evaluation of feelings or a predisposition to a class of stimuli—has three components: cognitive (beliefs and knowledge), affective (emotions and feelings), and behavior (Rosenberg *et al.*, 1960).

A significant cause of attitude change comes from persuasion (Petty and Wegener, 1998), which induces changes in opinions, beliefs, and attitudes but is not always consistent. “Thinking” is mainly unconscious, and “the unconscious can influence our thoughts and emotions without our awareness” (Bennet, Bennet and Turner, 2015, p. 112). Persuasion in a heavily saturated misinformation and disinformation environment has conscious and unconscious effects. The term “persuasion” alludes to conscious intent and some level of awareness on the part of the addressee.

Petty and Wegener (1998) described the process of attitude changes using the Elaboration Likelihood Model (ELM). The ELM is a theory responsible for processing the persuasion information and producing the attitudes' low or high level of mental effort. The person who possesses a high level of object-relevant information will likely elaborate on the knowledge and reach the reasoning attitude well-articulated and bolstered extensively by supporting information. This elaboration is called the "Central Route." On the other hand, the person who possesses a low level of object-relevant details will be unlikely to utilize knowledge and base their reasoning on emotion. Personal preference is called the "Peripheral Route." Low effort processes change attitudes weaker than those changed by high effort (Petty, Cacioppo and Schumann, 1983).

For a high effort process to influence attitude change, a person must be motivated to think. To have the ability to think, the person must have the necessary resources and opportunity to engage in the thinking process (Petty and Brinol, 2010). In this process, the person is either exposed to the same type of information that person is accustomed to or has general knowledge about the topic with issue-relevant information.

The information integration process starts when the information is combined to form attitudes in responding to an individual's thoughts on a persuasive response. According to Petty, Wheeler, and Tormala (2003), three aspects of cognitive responses are essential. First, the *content* of thoughts is the extent of persuasion that is likely to be adequate to be motivated. Second, the *number* of thoughts is the number of persuasive communications to affect how many people are encouraged. Third, the *confidence* of thought is the confidence or doubt the people have in the validity of the persuasion.

If information comes from an expert, the information is considered to have a significant impact on biased attitude responses. Therefore, expertise is regarded as a highly influential factor. Furthermore, information from experts affects the attitudes without much thinking. Hence, an expert suggestion can bias the thought process (Eagly and Chaiken, 1993).

The attitude developed with knowledge and persuasion that follows the central route will strongly impact that person's behaviors (Cacioppo *et al.*, 1994). The peripheral route is followed if a person is not keen to explore the deeper detailed information. Since the ELM model depends on the amount of based information, the size of the ELM can vary if a person pays attention to the perceived information. The attitude on the peripheral route can transfer to the central route. Therefore, the ELM is a continuum model.

There are five distinct characteristics of dual attitude theory. First, explicit and implicit attitudes co-exist in the memory (Wilson, Lindsey, & Schooler, 2000). Second, the implicit attitude is activated unconsciously, while the explicit attitude requires more capacity and motivation for the retrieval (Wilson, Lindsey and Schooler, 2000; Petty *et al.*, 2003). Third, the implicit attitude response is an uncontrollable and unspontaneous (Serenko and Turel, 2019). Fourth, the explicit can be changed effortlessly, while the implicit requires higher efforts (Wilson, Lindsey and Schooler, 2000). Lastly, Changes can be done only to the explicit attitude, and the changed attitude will later become an implicit attitude (Petty *et al.*, 2003).

When expressing behavioral expression, the manifested behavior can be categorized into four types (Wilson, Lindsey and Schooler, 2000); Trueself, Over-thinker, Disguise, and Autonomous. Figure 1 represents the behavioral expression matrix.

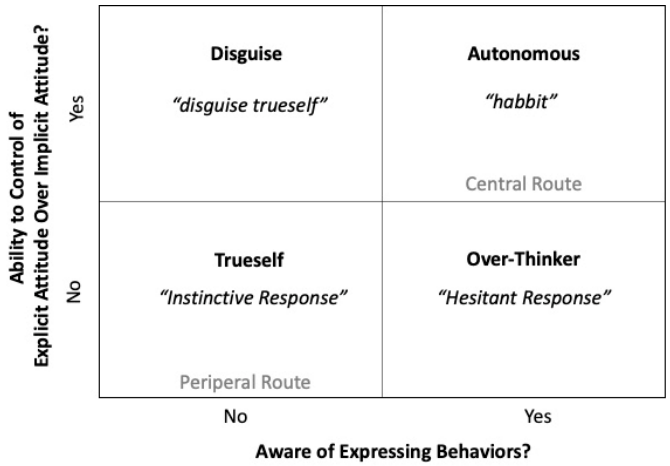


Figure 1: Behavioral Determination and Consideration Expression Matrix

"Trueself" is when a person's implicit and explicit attitudes are separately developed. The person is unaware that they have both perspectives, which work in disassociation from each other. In this mode, the person shows their true feelings when aroused by the information. As explained by the ELM continuum model, this will be along the path of the peripheral route, and the impact will be temporary.

"Over-thinker" is when a person is fully aware of the implicit attitude and will control the expression by overriding it with a different perspective. At the same time, the person may become unaware and express the unwanted attitude unintentionally. Once recalled, he will try to conceal his behavior and express the opposite. In this mode, the person will spend time thinking about how to react when aroused by the received information. When unaware, the person may respond instinctively, then later try to conceal and show the behavior as what he wants others to see.

"Disguise" is when a person can control an implicit attitude. Still, curiosity overrules the feeling to disguise the inner instinct and let the motivation activate the cognitive capacity of implicit attitude. We can also call this anxiety-provoking mode since it can be dangerous when hiding the true feeling and may express as the opposite. An example in this quadrant is an LGBT person trying to conceal their identity but is still very interested in learning about the cultures or stories of other LGBTs.

"Autonomous" is when the explicit attitude automatically overwrites the implicit attitude. This mode happens unconsciously, just like the "habitual" process. An example of this mode is when a person repetitively engages in message elaboration comprehensibility cognitively, which the changed attitude and altered behavior may have impacted. According to the ELM continuum model, this will be along the path of the central route with biased information and knowledge for permanent implicit attitude change and behavioral impact.

2.4 Research Question and Research Framework

Semiotic theory alone cannot clarify the mechanism of how a sign can impact human behavioral expression. Psychological theories of EMT and the dyadic decision-making model indicate the internal processes of the human cognitive system of how attitude can be amended and impact behavior. Multiple-domain theories must

be combined to explain the inception of semiotic information and how a human has processed it to have the behavioral expression as required. The novelty of this study is the construction of the Semiotic Inception, Attitude Altering, and Behavior Expression (SIAB) framework, as appears in figure 4. The terms and the descriptions of each milestone phase are shown in table 1.

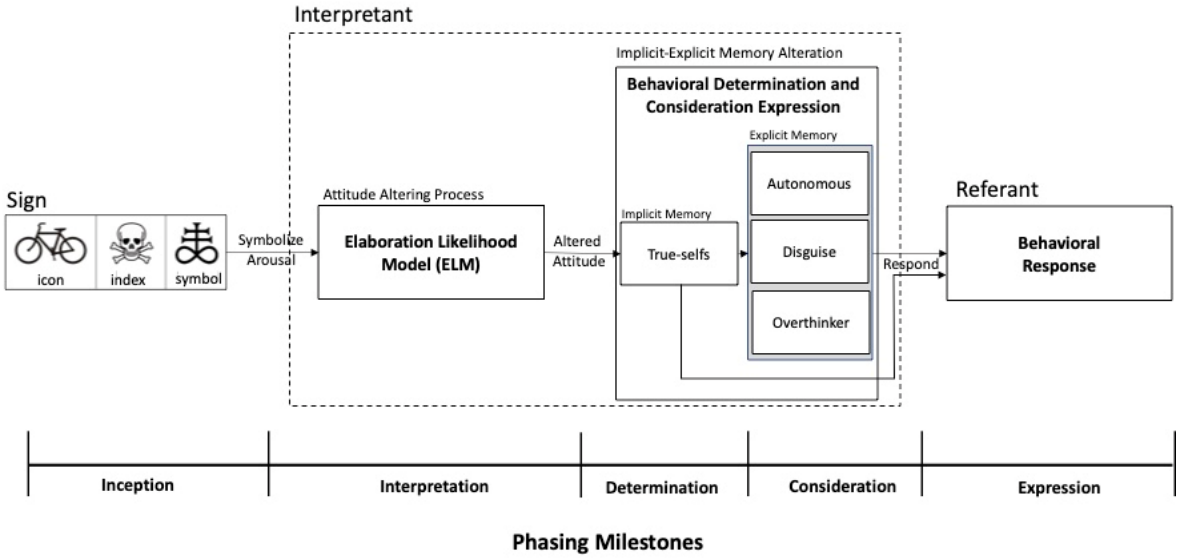


Figure 2: Semiotic Inception Attitude Altering and Behavior Expression (SIAB) Model

Table 1: Thematic Categorizations of Reviewed Journals

Theme	Description
Inception	In-coming of semiotic arousal information
Interpretation	Interpret the meaning in association with the Sign
Determination	Elaborate Likelihood Model (ELM) on Attitude Altering
Expression-True self	React with a direct un-altered response
Expression-Suppressive	React with disguised behavior
Expression-Overthinker	React with direct behavior, then cover up with disguised behavior
Expression-Autonomous	React with habitual behavior
Others	Semiotic research is conducted in other areas outside interest
Irrelevant	This research has nothing to do with the semiotic study

This leads to the following Research Questions (RQ):

RQ: How does the SIAB model, which constitutes a semiotic theory, the ELM continuum theory, and behavioral matrix, fit to explain how humans process the incoming information and express the behavior and in which manner?

3. Epistemological Approach and Research Methodology

3.1 Epistemological Nature of Semiotic Study

Putting the semiotic process into context requires dialectic relations with persons' cultures, exposures, mindsets, social relations, and the material worlds they are engaged in (Fairclough, Jessop and Sayer, 2002). It means semiosis—the process of the semiotic analysis (Queiroz and El-Hani, 2006)—cannot be reduced without reference to relating meaning and interpretation of the context, event, and time. It can only be explained through how we understand the concept.

Semiosis is a dynamic social activity that requires curios investigators to observe and identify three distinctive forms of stratifications (Queiroz and El-Hani, 2006). These stratifications emerge in nature in the 'real' structure (Bhaskar and Hartwig, 2016). The 'actual' structure refers to what happens when these powers and liabilities are activated and change through each event, and the 'empirical' form emerges from experiences that influence behavior (Fairclough, Jessop and Sayer, 2002). This epistemological stance is “Critical Realism”.

3.2 Research Method

A way to prove the constructed model and its validity are by reviewing past research studies. A Systematic Literature Review is an informative approach, using the Academic Research Database for the reviewing of research papers within the area of "Semiotic Analysis" and "Marketing Semiotics," plus some manual downloads on "Visual Advertisement" and "Semiotics." The EPSCO Database is used with predefined conditions: the article must be peer-reviewed, printed in English, and have publication dates between 2000 and 2021.

Qualitative analysis is applied to extract data from the reviewed articles, and thematic analysis is used to classify research directions. Themes follow the key phasing milestone of the constructed model (see table 1.)

4. Systematic Literature Review Along the Path of SIAB Framework

The total number of journals found in the database was 829, but the total downloadable was 124. After screening for relevancy, the number came down to 83, and after deducting the duplications, the final to explore came down to 80 papers. This number is the number of journals to analyze.

The top 5 most common analytic areas in table 2 are advertising, semiotics, marketing, psychology, metaphor, and consumer behavior from the author-supplied keywords. This evidence confirms that most research clusters around people's response when seeing the advertising sign and responding to the hidden message.

This notion confirms that most research on marketing semiotics focuses on the impact of customer behaviors for marketing purposes or attitude impact and marketing strategy. However, when conducting the bibliometric analysis based on the relationships of authors and co-authors, we found that all research was done irrelevantly. As shown in figure 3, the bibliometric network graph confirms the incoordination of research directions.

Table 2: Research Journal Related Keywords

Authors Supplied Keywords	Frequency
advertising	26
semiotics	19
marketing	17
psychology	16
metaphor	8
consumer behavior	6
consumer attitude	6
social semiotics	4
marketing strategy	4
cognition	4
consumer attitude research	3
advertising campaign	3
olfactory perception	3
advertising & psychology	2
figure of speech	2

From the review of eighty journals, thirty-two used a quantitative research approach, seven used quantitative analysis, and three used mixed methods. In addition, five used an experimental approach, and one used a systematic literature review and bibliometric analysis approach. However, twenty-six authors wrote articles that were lightly related to semiotics.

All articles were then thematized according to the phasing milestones of the SIAB model. Figure 4 shows the results based on the checkpoints of the SIAB model. Thirty journals follow the path of the SIAB model, while nine explore only the feature of attitude alteration. Twenty-seven stops at testing the concept of semiotics theory. Four explore the sense of humans. The remaining four do not follow the SIAB track but lead into some other areas. Finally, six were irrelevant to the interest of this study.

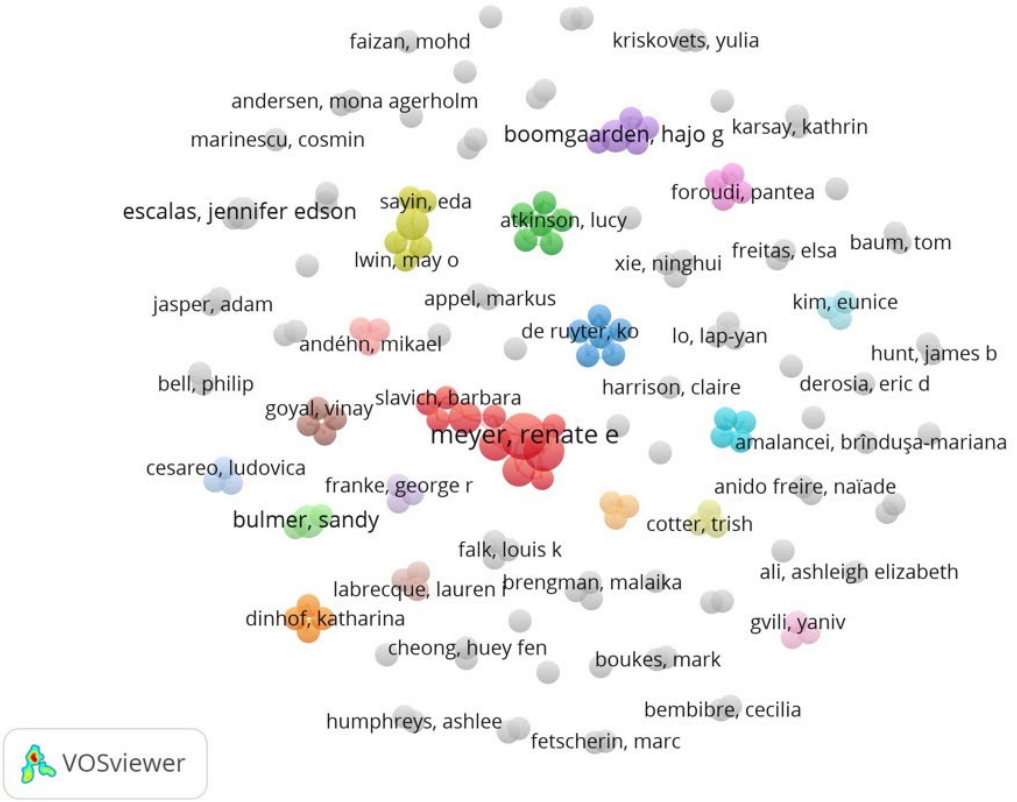


Figure 3: Bibliometric Analysis of Research Journal on Semiotic Analysis by Authors and Co-Authors

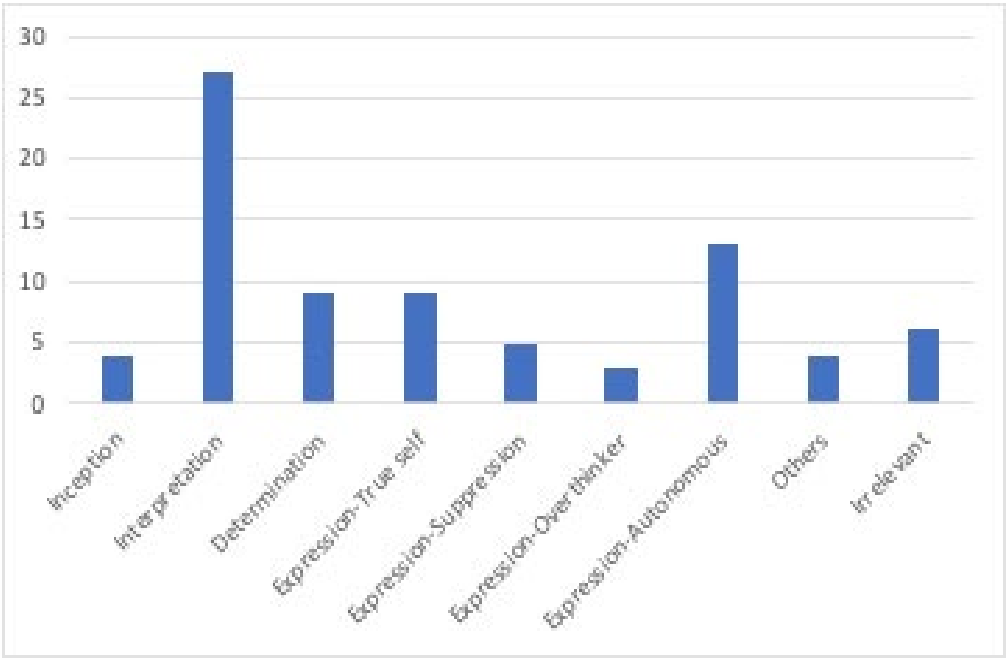


Figure 4: SIAB Milestone Phase Analytic

Most of the research, especially in marketing, focuses on interpretation. These articles emphasize the physical object of the sign (signifier) and its interpretant (signified).

Of the journals that follow the SIAB model, Figure 5 categorizes research on the EMT continuum model. Forty-three percent (43%) relate to the development of *Autonomous* habits. Only ten percent (10%) relate to the *Over-*

thinker type, and seventeen (17%) refer to the *Suppression* type. Thirty percent (30%) of them focus on the automatic response of humans when aroused by the sign.

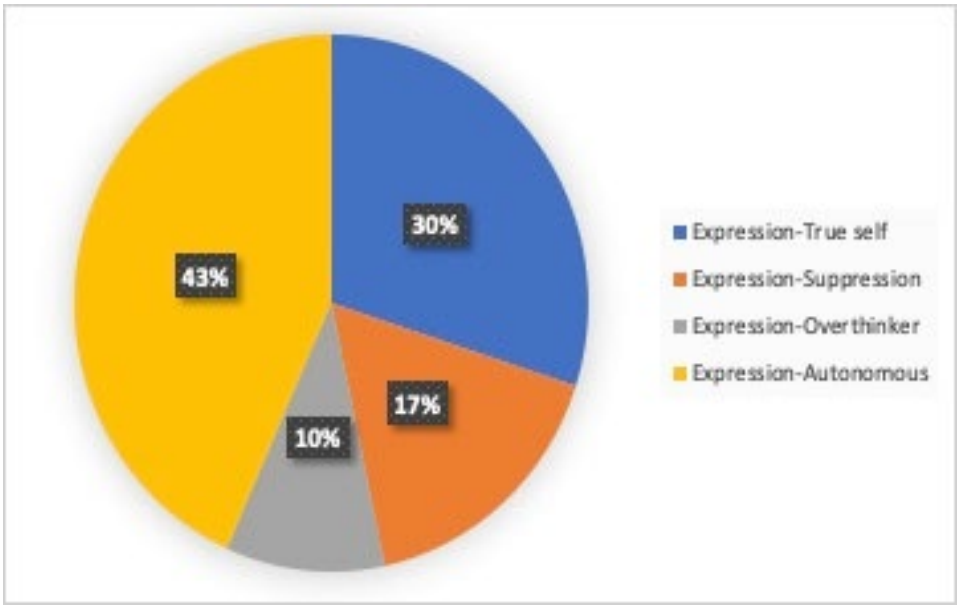


Figure 5: Responding Behaviors

5. Discussion, Limitations, Conclusion, and Future Research Directions

SIAB simplifies the cognitive process into a simple Input-Process-Output scheme. Semiotic is the input, ELM is the process, and Behavioral Expression is the output. This finding leads to many implications which are to discuss.

5.1 Discussion

The alignment of compositional theories matches the consumer step-wise behavioral change process of Awareness, Understanding, Believing, Feeling Good, Ownership, and Empowerment (Bennet *et al.*, 2020) that finally leads to Action. Semiotics initiate awareness to draw a person's attention. To understand and believe, information must go down the "central route," which will impact the attitudes. Feel-good, ownership, and empowerment lie in the expression control matrix before a person can decide how to act.

In answering RQ, the SIAB framework fits with the ELM continuum theory, altering attitude change and resulting in behavioral change as reflected in the dyadic attitude expression matrix. Thus, the SIAB model is fit to answer the phenomenon of how a sign is observed, and arousal information triggers the attitude change and results in the expression of behavior.

"Cognitive," in the crossed-knowledge domains, can be referred to as "the study of thought, learning, and mental organization, which draws on aspects of psychology, linguistics, philosophy, and computer modeling" (Cognitive Learning Science, 2022). When combined with "Semiotics," "Cognitive Semiotics" becomes the theory that studies a phenomenology of "anything" that presents to the mind and effectively acts to the world (Paolucci, 2015). Bringing meaning to the world represents actions through behaviors, habits, and sense-making, which is the foundation of the epistemological approach to knowledge organization in many branches of the theory (Thellefsen and Thellefsen, 2004). Thus, it is not a surprise because semiotics can be a theoretical study that represents a phenomenon in many research disciplines.

The construction of organizational knowledge requires the process of knowledge transfer at the individual level (Chai-Arayalert and Nakata, 2013). The individual knowledge becomes the organizational knowledge with the advent of organizational processes and routines (Lewin, Massini and Peeters, 2011; Senivongse, Mariano and Bennet, 2014). Knowledge transfer inevitably involves the "sign" system on the artifact that represents knowledge. Hence, SIAB is seen as the fundamental foundation of organizational knowledge construction.

5.2 Limitations

The initial focus of this study is on the semiotic representation and interpretation based on Marketing. However, when exploring deeper into the context of the process of interpreting semiotic information in the cognitive system, regarding the consciousness of feeling, image, conception, or other representations that phenomenologically comes to the mind, semiotics is more than a matter of marketing issues. It delves into the reflection on signs, meaning, and the world through action and sense-making (Paolucci, 2015). According to Eco (1979), the study of semiotics can be bounded by the three boundary thresholds-the political, the natural, and the epistemological. The political threshold is about the theoretical limits that each discipline may have its point of concern, raising theories or descriptions around its problem, and conducting an empirical study based on the relevant phenomena. Semiotics in marketing is no exception.

5.3 Future Research Directions

One possibility for future research needs a change in the decision expression matrix. A new focus area can be on problem-solving in different situations. This prospective study requires the combination of semiotic theory and the change of behavioral expression matrix to the Snowden's (2000) Cynefin model of problem-solving, where problems are recognized as simple, complicated, complex, and havoc systems. In a simple system, the responsiveness when recognizing the sign can be in a reflexive mode. That is, it can be instantaneous from the subconscious mind. In the complex system, the response requires syntactic structure, semantic understanding, and even pragmatic representation for successful transfer. However, in Complex systems, the transfer occurs in unconditionally unpredictable situations. The response from the recipient varies depending on the result as the input from the source of the transfer knowledge. Human is a complex system. Studies in how individual knowledge is constructed along the SIAB process and transferred can be explored.

The study of semiotics and sense-making is another challenge. Sense-making is conceived as a form of cognition, from the basic to the complex ones (Paolucci, 2015). Sense-making is tied to the non-representational meaning and habits. Sense-making relates to the mind and is connected to problem-solving capability when combined with cognitive skills. The area of SIAB and sense-making is worth exploring in more detail.

Another potential relates to the lying theory, which is regarded as one of the immense disciplines in semiotic processing in the cognitive space (Paolucci, 2015). When a person is supplied with biased information, unpleasant behavior may manifest. Changing behavior by reversely providing unbiased information is called the "Cognitive Dissonance" (Festinger, 1962). It is not easy to reduce dissonance or change the behavior. The process of dissonance is not in the scope of this study.

Another possibility is to interpret the semiotic in an artifact under the type of knowledge aspect. An Artifact is an object which is made up of two distinctive parts; ostensive (structure) and performative (interpretant) (Lewin, Massini, & Peeters, 2011; Mariano & Al-Arrayed, 2017). The ostensive part is the codification of explicit knowledge, while the performative element requires tacit knowledge to understand its underlying meaning (Senivongse and Bennet, 2019). An artifact can be used as a knowledge transfer aid in communication across syntactic, semantic, and pragmatic boundaries (Corsaro, 2018; Senivongse *et al.*, 2020). Semiotic understanding of signs and theory provides a better experience of knowledge representation in the knowledge organization (Friedman and Thellefsen, 2011). Research on how artifacts withhold the knowledge of events and time with the semiotic concept benefits how knowledge is constructed, embedded, transferred, and reconstructed.

5.4 Conclusion

This study has empirically shown that the SIAB model clearly explains how the semiotic process works in the cognitive domain. Specifically, it shows how attitudes are altered through the EMT continuum model and how behaviors and habits are formed with the behavioral determination and control matrix. Cognitive semiotics is the knowledge organization method for many disciplines. For the idea that starts from a "sign," with representation to the mind, and turns into actions and the formation of habits and behaviors, this becomes knowledge and provides knowledge organization in the form of structure (syntax), understanding (semantics), and doing/performing (pragmatics). However, based on semiotics, the interpretation and reconstruction of the knowledge is an interdisciplinary and individual capability.

"Attitude" comes mainly from the unconscious and is highly reflective of previous preconceptions and biases, often developed as sub-personalities. Caprara and Cervone (2000) defined a psychological complex system as a unity and continuity in terms of past, present, and future, both as perceived by the individual and as the

individual is perceived by others. Core to this definition is the term "psychological complex system," recognizing the personality as a complex system of structures and processes that emerge from multiple subsystems, specifically involving interdependencies between the person and the environment. Of course, since the human is a complex adaptive system (CAS), we recognize that the development of neurological structures is dependent on both genetic programming and personal experience (Kolb, Gibb and Robinson, 1988). As part of that structure, sub-personalities are "patterns of feelings, thoughts, behaviors, perceptions, postures, and ways of moving which tend to coalesce in response to various recurring situations in life" (Brown, 2013),. "A semi-permanent and semi-autonomous region of the personality capable of acting as a person" (Rowan, 2006, p. 8). In other words, there are (instant) automatic responses that have been programmed into our unconscious through repeated experiential engagements. These "responses" are triggered by unconscious patterns developed over time. On the marketing aspect, the "purchase" may not be a result of "persuasion" as much as an internal trigger based on past experiences. Semiotics is such a rich field of study.

References

Bandura, A., Adam, N. E. and Beyer, J. (1977) 'Cognitive Process mediating Behavioral Change', *Journal of Personality of Social Psychology*, 35(3), pp. 125–139.

Bennet, A. *et al.* (2020) *The Profundity and Bifurcation of Change Part I: Laying the Groundwork*, *Moutain Quest Institute*. MQI Press.

Bennet, A. and Bennet, D. (2013) *Decision-Making in The New Reality Complexity, Knowledge, and Knowing*, *MQI Press*. Frost, WA: MQI Press.

Bennet, D., Bennet, A. and Turner, R. (2015) *Expanding the self: The intelligent complex adaptive learning system*, *A New Theory of Adult Learning*. Frost, WV: MQI Press.

Bhaskar, R. and Hartwig, M. (2016) *Enlightened common sense: The philosophy of critical realism*. Routledge.

Bradley, S. (2016) 'Icon, Index, and Symbol—Three Categories of Signs', *Vanseo Design*, 5(April 5, 2016).

Brown, L. J. (2013) *Intersubjective Processes and the Unconscious: An Integration of Freudian, Kleinian, and Bionian Perspectives*, *The Psychoanalytic Quarterly*.

Cacioppo, J. T. *et al.* (1994) 'Attitude change', *Encyclopedia of Human Behavior*. Academic Press San Diego, CA, 1(36), pp. 261–270.

Caprara, G. V. and Cervone, D. (2000) *Personality: Determinants, dynamics, and potentials*. Cambridge University Press.

Chai-Arayalert, S. and Nakata, K. (2013) 'Semiotic approach to a practice-oriented knowledge transfer', *ICISO 2013 - Proceedings of the 14th International Conference on Informatics and Semiotics in Organisations, IFIP WG8.1 Working Conference*, pp. 56–61.

Chandler, D. (2017) *Semiotics: the basics*. 3rd edn, *Angewandte Chemie International Edition, 6(11), 951–952.* 3rd edn. Routledge.

Cherubino, P. *et al.* (2019) 'Consumer behaviour through the eyes of neurophysiological measures: State-of-the-art and future trends', *Computational Intelligence and Neuroscience*, 2019.

Cognitive Learning Science (2022) *Cognitive Science for Better Learning*, *Cedar Interactive.*

Corsaro, D. (2018) 'Crossing the boundary between physical and digital: the role of boundary objects', *IMP Journal*, 12(2), pp. 216–236.

Eagly, A. H. and Chaiken, S. (1993) *The psychology of attitudes*. Harcourt brace Jovanovich college publishers.

Eco, U. (1979) *A Theory of Semiotics*. First Edit, *International Philosophical Quarterly*. First Edit. Indiana University Press.

Fairclough, N., Jessop, B. and Sayer, A. (2002) 'Critical Realism and Semiosis', *Alethia*. Taylor & Francis, 5(1), pp. 2–10.

Festinger, L. (1962) 'Cognitive dissonance', *Scientific America*, 207(4), pp. 93–106.

Forceville, C. (2017) 'Visual and Multimodal Metaphor in Advertising: Cultural Perspectives', *Styles of Communication*, 9(No 2), pp. 26–41.

Friedman, A. and Thellefsen, M. (2011) 'Concept theory and semiotics in knowledge organization', *Journal of Documentation*, 67(4), pp. 644–674.

He, J. and Shao, B. (2018) 'Examining the dynamic effects of social network advertising: A semiotic perspective', *Telematics and Informatics*, 35(2), pp. 504–516.

Keeler, M. and Kloesel, C. (1997) 'Communication , Semiotic Continuity , and the Margins of the Peircean Text by', *Margins of the Text*, David Gree, pp. 1–53.

Kolb, B., Gibb, R. and Robinson, T. E. (1988) 'Brain plasticity and behavior', *Annual review of psychology*, 49(1), pp. 43–64.

Kuzu, T. S. (2016) 'The Impact of a Semiotic Analysis Theory-Based Writing Activity on Students' Writing Skills', *Eurasian Journal of Educational Research*, 16(63), pp. 34–54.

Lewin, A. Y., Massini, S. and Peeters, C. (2011) 'Microfoundations of Internal and External Absorptive Capacity Routines', *Organization Science*, 22(1), pp. 81–98.

Louhema, K. *et al.* (2019) 'Translating from monosemiotic to polysemiotic narratives: A study of Finnish speech and gestures', *Sign Systems Studies*, 47(3–4), pp. 480–525.

Lwin, M. O. *et al.* (2016) 'Odor Semantics and Visual Cues: What We Smell Impacts Where We Look, What We Remember, and What We Want to Buy', *Journal of Behavioral Decision Making*, 29(2–3), pp. 336–350.

Mariano, S. and Al-Arrayed, S. (2017) 'Combinations of absorptive capacity metaroutines: The role of organizational disruptions and time constraints', *European Management Journal*. Elsevier Ltd, 36(2), pp. 171–182.
Mason, L. (2001) 'The process of change through persuasion: A commentary', *International Journal of Educational Research*, 35(7–8), pp. 715–729.
Moriarty, S. E. (2002) 'The Symbiotics of Semiotics and Visual Communication', *Journal of Visual Literacy*, 22(1), pp. 19–28.
Paolucci, C. (2015) *Cognitive semiotics, Integrating Signs, Minds, Meaning and Cognition*, *International Handbook of Semiotics*. Springer.
Petty, R. E. *et al.* (2003) *Persuasion and Attitude Change*, *Handbook of psychology: Personality and social psychology*.
Petty, R. E. and Brinol, P. (2010) 'Attitude structure and change: Implications for implicit measures.', *Handbook of implicit social cognition: Measurement, theory, and applications*. The Guilford Press, pp. 335–352.
Petty, R. E., Cacioppo, J. T. and Schumann, D. (1983) 'Central and Peripheral Routes to Advertising Effectiveness-The Moderating Role of Involvement', *The Journal of Consumer Research*, 10, pp. 135–146.
Petty, R. E. and Wegener, D. T. (1998) 'Attitude change: Multiple roles for persuasion variables', *Annual review of psychology*, 48(1), pp. 1–78.
Queiroz, J. and El-Hani, C. N. (2006) 'Semiosis as an Emergent Process', *Transaction of the Charles S. Peirce Society*, 42(1), pp. 78–116.
Richter, D. H. (1998) 'Nature of the Linguistic Sign', *The Critical Tradition: Classic Texts and Contem- porary Trends*, Ed. Boston, pp. 832–835.
Rokeach, M. (1966) 'Attitude Change and Behavioral Change.', *Public Opinion Quarterly*. Oxford University Press, 30(4, winter), pp. 529–550.
Rosenberg, M. J. *et al.* (1960) 'Attitude organization and change: An analysis of consistency among attitude components', *Yales studies in attitude and communication*. Yale Univer. Press, III.
Rowan, J. (2006) 'Subpersonalities and the transpersonal', *Self & Society*. Taylor & Francis, 33(6).
Senivongse, C. *et al.* (2020) 'Absorptive capacity efficacy in SMEs : evidence from multiple case studies in the information technology industry', *Knowledge Management Research & Practice*. Taylor & Francis, 00(00), pp. 1–14.
Senivongse, C. and Bennet, A. (2019) 'Clarifying absorptive capacity and dynamic capabilities dilemma in high dynamic market IT SMEs', *VINE Journal of Information and Knowledge Management Systems*, 49(3), pp. 372–396.
Senivongse, C., Mariano, S. and Bennet, A. (2014) 'Internal processes of absorptive capacity: A systematic literature review and future research directions', in *ICICKM 2015*. Sonning Common, England: ACPI Publiching, Inc., pp. 1–12.
Serenko, A. and Turel, O. (2019) 'A dual-attitude model of system use: The effect of explicit and implicit attitudes', *Information and Management*. Elsevier, 56(5), pp. 657–668.
Snowden, D. (2000) 'Cynefin, a sense of time and place: an ecological approach to sense making and learning in formal and informal communities'. Citeseer.
Thellefsen, T. L. and Thellefsen, M. M. (2004) 'Pragmatic semiotics and knowledge organization', *Knowledge Organization*, 31(3), pp. 177–187.
Wells, R. S. (1947) 'De Saussure's System of Linguistics', *WORD*, 3(1–2), pp. 1–31.
Wilson, T. D., Lindsey, S. and Schooler, T. Y. (2000) 'A Model of Dual Attitudes', *Psychological review*, 107(1), pp. 101–126.
Yakin, H. S. M. and Totu, A. (2014) 'The Semiotic Perspectives of Peirce and Saussure: A Brief Comparative Study', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 155(October), pp. 4–8.
Zlatev, J. (2019) 'Mimesis theory, learning, and polysemiotic communication', in *Encyclopedia of educational philosophy and theory*. Springer.

Knowledge Sharing Enablers and Barriers: Insights From a Socio-Environmental Project

Natália Silvério, Edilene dos Anjos Cavalcanti, Mariângela Poleza and Gregório Varvakis
Department of Knowledge Engineering and Management, Federal University of Santa Catarina, Florianópolis, Brazil
natalia.silverio@posgrad.ufsc.br
edilene.anjos@posgrad.ufsc.br
mapoleza@outlook.com
g.varvakis@ufsc.br

Abstract: Knowledge is recognized as an organizational asset in projects, as it reduces failures, improves competencies, and saves resources. Knowledge sharing (KS), specifically, brings value to projects. However, it is poorly investigated in project management literature, as generally previous works have focused on IT and civil construction projects. The literature has described some factors which foster or inhibit KS, nevertheless, there is little consensus about KS enablers and barriers in the project's contexts. Therefore, this paper investigates KS enablers and barriers in a socio-environmental project. It adopted Action Research as the strategy of investigation. Observations and semi-structured interviews were used for data collection, as well as field notes. The thematic analysis method was used for data analysis. The results highlight the participants' systemic thinking, which can explain why the feeling of dependence and perceived personal benefits were assumed as KS enablers. Also, the team's collaborative and empathetic behavior and the participants' openness to dialogue influenced positively the intention to share knowledge. The project's horizontal organizational structure and the availability of virtual and physical spaces facilitated the knowledge flow. Most of the interviewees were professors which possibly influenced their KS behavior. The social restrictions imposed by COVID-19 were a KS barrier. In addition, the team size, lack of time, and the multidisciplinary character of the project likely hindered KS. Surprisingly, the lack of previous social ties was not a significant KS barrier. In summary, our results confirmed previous results regarding KS enablers, and we found systemic thinking as a KS enabler. As a KS barrier, we highlighted the lack of time, suggesting it is common in projects due to their limited timeline. These findings add to the KS literature, mainly to analyze an organizational context that is unsatisfactorily investigated. Furthermore, this study helps managers to identify KS enablers and barriers aimed at adopting appropriate organizational interventions to increase KS. Moreover, this research has shown evidence from a multidisciplinary project from the socio-environmental field which needs to integrate several professionals' knowledge to provide substantial conclusions regarding the social, cultural, and natural aspects they were analyzing.

Keywords: Knowledge Sharing, Enablers, Barriers, Project, Socio-Environmental, Multidisciplinary Project.

1. Introduction

Knowledge is recognized as an organizational asset in projects, as it is essential to reduce failures, improve competencies, and save resources (Gasik 2011, Moraes, Silva and Oliveira 2020). In the literature, interest in studying the contribution of knowledge in projects has increased (Karagoz, Whiteside and Korthaus 2020), mainly because projects or programs represent 40% of economic activities (Cuevas, Bodega and Torres-Lima 2021). Projects are carried out according to a defined schedule and resources aimed at creating a unique product, service, or result (PMI 2017).

Knowledge sharing (KS) allows knowledge to be made available to people (Ipe 2003). KS brings value to projects, however, it is poorly investigated in project management literature, as generally previous works have focused on Information Technology (IT) and civil construction projects (Favoretto and Carvalho 2021, Gomes, Oliveira and Chaves 2018, Latif et al. 2020). Furthermore, KS is not sufficiently explored in the public sector (Jorgensen et al. 2020).

The literature has described some factors which foster KS, like trust (Amayah 2013) and perceived benefits (Henttonen, Kianto and Ritala 2016). On the other hand, barriers also have been identified, such as lack of time, individual factors, and team size (Santos, Soares and Carvalho 2012, Shinoda, Maximiniano and Sbragia 2015, Smith 2006). Although scholars have researched KS enablers and barriers, there is little consensus on projects context (Karagoz, Whiteside and Korthaus 2020). Therefore, this paper aims to investigate KS enablers and barriers in a socio-environmental project. The literature highlights the relevance of this study, which is a significant theoretical and empirical contribution to the advancement of studies on knowledge sharing in socio-

environmental projects and multidisciplinary teams. In addition, it is research focused on public service, where there is also a need for scientific advances.

2. Literature Review

The literature emphasizes three main aspects concerning the concept of projects: time, budget, and scope, which are clearly defined. Projects are temporary organizations and generally short-term oriented. The scope includes specific objectives which are achieved through complex and interrelated tasks performed by individuals from different areas of knowledge (Hanish et al. 2009, Lindner and Wald 2011, Prabhakar 2008, Reich 2007). It results in new products, processes, or services development. Therefore, projects are unique, so it hinders the creation and development of organizational routines (Lindner and Wald 2011).

Factors to the project's success include leadership style (Padalkar and Gopinath 2016), clear and realistic objectives, timeframe, and budget (Fortune and White 2005, Frinsdorf, Zuo and Xia 2014). Furthermore, management based on knowledge allows projects to achieve their results successfully due it reducing failures and increasing the team's productivity, learning, creativity, performance, and innovation capacity (Kinder 2020, Moraes, Silva and Oliveira 2020, Navimipour and Charband 2016).

2.1 Knowledge sharing

Knowledge sharing is a key process of knowledge management in terms of individual and organizational learning. This process refers to the exchange of information to solve problems, develop new ideas, or implement procedures (Riege 2005, Wang and Noe 2010). It is also defined as the "exchange of task-related information, advice and expertise to help others and to collaborate with others to carry out daily tasks" (Ahmad and Karim 2019, p. 208). An effective knowledge-sharing process reduces costs, accelerates product development, and improves innovation and performance. Therefore, it increases the competitive advantage of organizations (Ahmad and Karim 2019), and impacts project success (Polyaninova 2011). In projects, KS otimizes the use of resources and avoids reworking (Gomes, Oliveira and Chaves 2018, Pauli and Sell 2019). So, KS is considered a critical success factor (Navimipour and Charband 2016, Zhang and He 2016).

Furthermore, KS is a complex process due to individual, organizational and contextual factors that influence it. Thus, there are barriers that inhibit this process and facilitators promote sharing (Ahmad and Karim 2019).

2.1.1 Enablers

KS enablers play a key role in the knowledge management process. They motivate group members to share their knowledge and experiences, allowing organizational knowledge to grow (Yeh, Lai and Ho 2006). Some of the factors that facilitate KS include rewards, organizational structure, organizational culture (Lee et al. 2020), leadership, trust, and pleasure in helping others (Ali 2019, Lin 2007, Singh et al. 2021).

Rewards, for example, can range from monetary incentives, such as salary increases and bonuses, to non-monetary rewards like promotions and job security (Lee et al. 2002, Lin 2007). Organizational culture can provide a context for employees to obtain, create and share knowledge during their functional tasks (Azeem et al. 2021).

In projects, social ties, feeling of dependence, and perceived personal benefits facilitate KS. Social ties, defined as the close relationship between colleagues, are able to increase the willingness to share knowledge (Navimipour and Charband 2016, Zhang and He 2016). Regarding the feeling of dependence, these authors mention that project team members share knowledge when they feel dependent on other people's results. Zhang and He (2016) found evidence that the perception of personal benefits motivated the sharing of tacit knowledge in the investigated project.

2.1.2 Barriers

Barriers to KS are factors that difficult the share of knowledge between colleagues. Riege (2005) states that identifying and recognizing barriers to KS is fundamental to the success of knowledge management strategies. At the individual level, barriers are often related to lack of time, lack of communication skills, overemphasis on job status, and lack of trust (Riege 2005, Santos, Soares and Carvalho 2012). At the organizational level, barriers are usually associated with economic viability, lack of infrastructure and resources, accessibility of formal and informal spaces, and team size (Karagoz, Whiteside and Korthaus 2020, Riege 2005, Santos, Soares and Carvalho 2012).

Shinoda, Maximiniano, and Sbragia (2015) and Pauli and Sell (2019) state the lack of time as a barrier to KS in projects. Karagoz, Whiteside, and Korthaus (2020) considered the department size as a KS barrier due to a large number of members. Furthermore, the authors mentioned that the geographically dispersed team also inhibited KS.

3. Methods

A qualitative research approach was adopted using Action Research as the strategy of investigation. The research was conducted based on four steps: identify the problem, plan the solution, implement the solution, and evaluate the solution (Creswell 2014, Sampieri, Collado and Lucio 2013). The context investigated referred to a socio-environmental project which aimed to conduct a diagnosis to create a protected area.

The project belonged to the Federal University of Santa Catarina. It was composed of a multidisciplinary team from the socio-environmental area. The team included professors, researchers, and students working in the areas of environmental education and governance, fauna, flora, geology, hydrology, and socio-anthropology, for instance. Observations and semi-structured interviews were used for data collection, as well as field notes, which took place between September 2019 and April 2020.

Specifically, we conducted interviews based on pre-set questions with eight project leaders (professors and researchers), including the general coordinator. Those participants were selected due to their role in the project. We recorded all interviews and transcribed them for data analysis according to the thematic analysis method. The inductive approach was used for data coding and subsequently clustering into categories with similar meanings (Braun and Clarke 2006, Creswell 2014). In the end, we reviewed all transcription sorts for report writing.

4. Results

The role of KS was emphasized by all interviewees, especially on how it could help them to analyze and discuss data collected by teams they led. This highlights their systemic thinking because they recognized a link between the different project's research fields and allowed them to be collaborative and empathetic, as well as open to dialogue. In their opinion, KS could help them to understand better the land where data was collected and give insights into data analysis. It can explain why it was identified a feeling of dependence and personal benefits to sharing knowledge between different research fields. In other words, they saw benefits to sharing knowledge because they depended on the results provided by their colleagues to analyze data.

Concerning personal characteristics, the higher educational level was another KS enabler. All informants had a master's degree level, and six of them had a doctoral level, which likely facilitated KS.

Regarding organizational aspects, it was observed that the project had a horizontal organizational structure, which eased the team in sharing knowledge, regardless of their project's role. According to one informant, the horizontal structure allowed an open dialogue between professors, undergraduate, and postgraduate students, something which was not common in other projects he had participated in.

Lastly, they mentioned virtual spaces as tools to share knowledge, especially WhatsApp which facilitated team interaction due to its agility and facility to use. The participants on the whole agreed that the project's WhatsApp group was an important virtual space to be updated about the project results. As an example of WhatsApp Group's benefit, respondents commented about new insect species identified by a team member, which was an important discovery regarding the natural land analyzed.

Other tools revealed were e-mails and the repository. E-mails were used mainly by the project manager to schedule meetings and events with the team, and for team members to send files, for instance. Google Drive, the principal project's data and information repository, stood out as a tool to search for documents from different areas of the study. Moreover, they mentioned that it stored important documents provided by the project's management, such as guidelines for trips to the field site, and allowed them to work online with their colleagues.

Comparing the three tools above mentioned, the WhatsApp Group was recognized as the best one to interact virtually. Therefore, it was an important tool to promote KS within the project, especially due to the team members were geographically dispersed.

Although participants acknowledged the WhatsApp role, they said they preferred face-to-face meetings to share knowledge. Thus, they cited meeting rooms and the natural space where they collect field data as physical spaces to share knowledge. Including, one interviewee stated that trips to the field site were opportunities to strengthen ties between team members.

The specialists performed their activities geographically dispersed and separately according to their research field due to the multidisciplinary character of the project. Notably, one professor mentioned that multidisciplinary teams, in general, have difficulties interacting in projects because members focus on their specific field of research, and just spend their time achieving results in this concern. Moreover, some interviewees thought that their results could not be interesting or useful to others, therefore, they did not share knowledge with their colleagues from different fields.

Another interviewee argued that the project's final report should be integrated, which required KS between all members, independently of which field they were from. Even though they recognized the importance to share knowledge, the lack of time hindered them from sharing knowledge as often as they would like. In addition, the team members had never worked together on previous projects. So, they did not have prior social ties, which was considered a KS barrier.

As mentioned before, the informants appreciated trips to the field site to share knowledge, which were forbidden due to COVID-19 social restrictions. Thus, the restrictions hindered KS in those physical spaces, and as a consequence, virtual spaces assumed the main role to enable it, despite the difficulty to schedule meetings with the whole team due to the high number of members. So, the team size was considered an aspect that hindered KS.

Overall, these results indicate that personal and organizational aspects drove nine factors to enable KS, whereas five barriers hindered it, which are presented in Figure 1. The next section, therefore, moves on to discuss the results according to the literature.

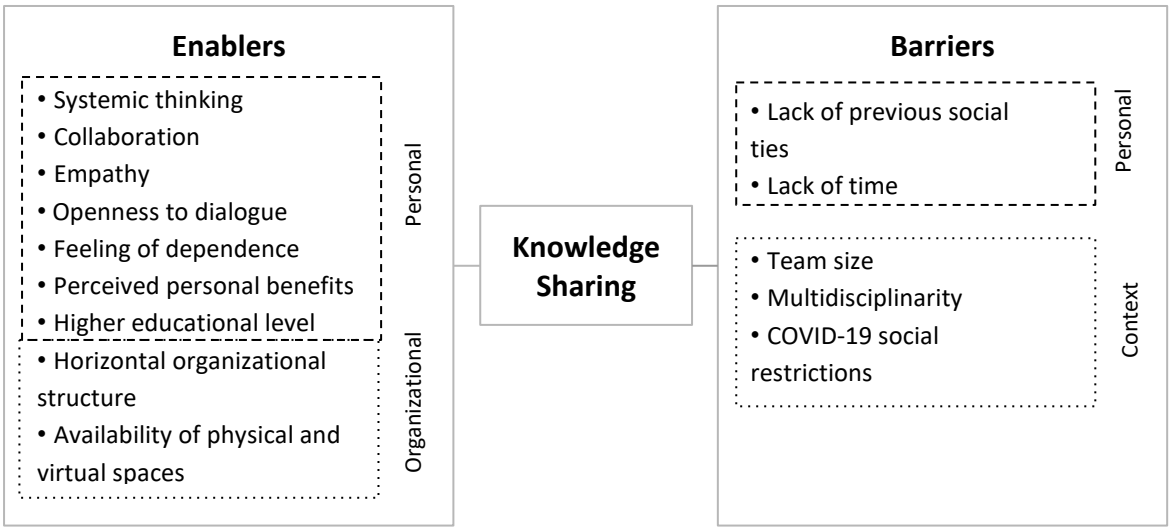


Figure 1: Overview of knowledge sharing enablers and barriers identified.

5. Discussion

Aiming to widen the understanding of KS in temporary organizations, this paper investigated KS enablers and barriers in a socio-environmental project. The results evidenced nine enablers factors to KS classified according to personal and organizational aspects. On the other hand, five barriers regarding personal aspects and the context analyzed were identified, which hindered KS within the project.

The first personal KS enabler was systemic thinking. Although each interviewee focused on their specific field, they recognized a link with others. Systemic thinking allowed them to analyze specific parts of their studies and their relationship with other parts, which is common in the socio-environmental field (Seiffert and Loch 2004). Therefore, this thinking facilitated KS within the project because they depended on results provided by other fields. Systemic thinking has not been recognized as a KS enabler, however, Rana, Crowe, and Usoro (2013) described it as a factor to build trust between employees, which helps organizations to improve KS in workplaces.

The feeling of dependence and perceived personal benefits were also considered KS enablers. Due to their systemic thinking, they saw benefits in sharing knowledge with colleagues, as mentioned above, so doing it supported the data analysis, otherwise, it could limit their studies' conclusions. This outcome is contrary to Amayah (2013) who found that the increasement in personal benefits decreased willingness to share knowledge. On the other hand, the perception of benefits was one motivator for sharing tacit knowledge in integrated project teams (Zhang and He 2016), and it has increased the likelihood of knowledge-sharing (Henttonen, Kianto and Ritala 2016). Moreover, team members share knowledge if they feel dependent on other participants (Navimipour and Charband 2016).

The results evidenced the team's collaborative and empathetic behavior, which influences positively the intention to share knowledge (Goswami and Agrawal 2019, Von Krogh 1998) and accord with the findings obtained by Rios-Ballesteros and Fuerst (2021). The authors have demonstrated that empathy facilitates people's willingness to share knowledge, even if they worked in geographically dispersed teams. So, they also understood empathetic behavior as a KS enabler. Regarding collaborative behavior, Wróbel (2007) believes that is difficult to promote KS when the collaborative culture is weak. Thus, he suggested building strong interpersonal relations between employees to overcome the lack of collaboration.

Another participants' personal characteristic which facilitated the share of knowledge was openness to dialogue, which is consistent with Karagoz, Whiteside, and Korthaus (2020). Specifically, they assumed an open culture promotes open communication, which enables KS, as also presumed by Shinoda, Maximiniano, and Sbragia (2015).

All of the interviewees had a high level of education, which possibly influenced their KS behavior. This is in line with Henttonen, Kianto, and Ritala (2016) and Karagoz, Whiteside, and Korthaus (2020) findings. The previous one demonstrated that employees with a higher educational level are more likely to share knowledge, and Karagoz, Whiteside, and Korthaus (2020) verified the level of education was not a barrier to KS. These results refute the previous finding from Riege (2005), who classified the education level as a KS barrier. In our case, KS occurred independently of the participants' educational level. Professors, for instance, shared knowledge with undergraduate and postgraduate students and consultants.

It may also be connected with the project's horizontal organizational structure, an organizational aspect that facilitates KS. Generally, knowledge flows easier in less hierarchical organizations (North and Scharle 2020).

Virtual and physical spaces also were considered KS enablers, in line with (Dorow, Fraga and Rados 2018). Virtual spaces, in particularity, assumed an important role due to COVID-19 social restrictions and the geographically dispersed team characteristic. In our case, the WhatsApp group was the main virtual space mentioned by participants, in contrast to e-mails and the repository. This can be explained due to instant messaging allows people to send text messages, audio, and images in a fast and dynamic way, as highlighted by Mallmann, Maçada, and Oliveira (2018). So, this can be the reason why participants preferred the WhatsApp group to update about field data and share knowledge between members.

Despite technology having been strategic for KS (Dorow, Fraga and Rados 2018), mainly to teams geographically dispersed (Mallmann, Maçada and Oliveira 2018), the informants had a preference for physical spaces to share knowledge due to their information richness. However, the social restrictions imposed by COVID-19 prevented them from using physical spaces, thus, it was a KS barrier. A similar result was observed by Bolisani et al. (2020) who investigated the effects of enforced working from home condition caused by the spread of COVID-19 on KS. They noted that the share of knowledge between employees was more difficult due to its enforced condition and substitutes for face-to-face interactions are hard to implement due to the relational essence of human work.

Considering the temporary nature of projects, the lack of time also was confirmed by our results as a KS barrier, in accordance with Shinoda, Maximiniano, and Sbragia (2015), Pauli and Sell (2019), Karagoz, Whiteside, and Korthaus (2020). Therefore, it seems common not only in the context of the projects but also in other organizations (Riege 2005).

In addition, the team size and the multidisciplinary character of the project likely hinder KS for some reasons: a) difficulty to organize meetings with the entire team; b) specialists performed their activities separately according to their field, which probably hinders KS between different groups, and c) lack of collective understanding of some results reported by groups, which can hide KS due to lack of common language (Holloway 2009).

Regarding the team size, our results support evidence from Karagoz, Whiteside, and Korthaus (2020), who considered the department size as a KS barrier due to a large number of people. Indeed, they worked dispersed, so it took considerable time and effort to establish a professional network with colleagues in different departments. As a result, it inhibited KS.

Despite the most of the interviewees have never worked together previously on the project, the lack of previous social ties was not a significant KS barrier as acknowledged by Bakker et al. (2006). Bakker et al. (2006) believe that teams composed of members who have been working together longer are more likely to share knowledge than those teams that are younger. It is closely related to trust, which is generally addressed by literature (Amayah 2013) and fundamental to motivating people to share knowledge (Ipe 2003).

In general, the multidisciplinary character can explain why they prioritized their time to work on their specific field of research. Also, it can be the reason why most of the team members had never worked together on previous projects. So, they did not have prior social ties, which was considered a KS barrier, mainly during the beginning of the project execution.

6. Conclusion

In summary, our results evidenced nine KS enablers, which were classified according to personal and organizational aspects. Most enablers confirm findings from previous studies, such as perceived personal benefits (Zhang and He 2016), collaborative and empathetic behavior (Goswami and Agrawal 2019, Von Krogh 1998), horizontal organizational structure (North and Scharle 2020), and availability of virtual and physical spaces (Dorow, Fraga and Rados 2018). We identified systemic thinking as a KS enabler, which has not been widely discussed by literature. This thought stimulated the interviewees to share knowledge due to the dependence they had on results from different fields.

Regarding KS barriers, we identified five barriers concerning personal aspects and the context analyzed. We highlighted the lack of time as a barrier, which supports previous findings from Shinoda, Maximiniano, and Sbragia (2015), and Karagoz, Whiteside, and Korthaus (2020).

Exploring the KS enablers and barriers helps managers to adopt appropriate organizational interventions to increase KS (Goswami and Agrawal 2019). Thus, it is possible to strengthen the positive factors and weaken the negative ones (Amayah 2013). These findings add to the KS literature mainly to analyze a multidisciplinary project from the socio-environmental field, an organizational context that is unsatisfactorily investigated. This type of project integrates different professionals' knowledge to provide significant solutions regarding the social, cultural, and natural aspects they analyze. Considering that this study focused on the leaders of the project, future research may interview participants who do not have a strategic role. Also, it can explore if systemic thinking is a KS enabler in other contexts or is particular to specific socio-environmental projects.

Acknowledgements

It will be added after the review process.

References

Ahmad, F. and Karim, M. (2019) “Impacts of knowledge sharing: a review and directions for future research”, Journal of Workplace Learning, Vol. 31, No. 3, pp 207-230.

Amayah, A. T. (2013) “Determinants of knowledge sharing in a public sector organization”, Journal of knowledge management, Vol. 17, No. 3, pp 454-471.

Azeem, M., et al. (2021) "Expanding competitive advantage through organizational culture, knowledge sharing and organizational innovation", Technology in Society, Vol. 66, p 1-10.

Bakker, M., et al. (2006) "Is trust really social capital? Knowledge sharing in product development projects", The Learning Organization, Vol. 13, No. 6, pp 594–605.

Bolisani, E., et al. (2020) "Working from home during COVID-19 pandemic: Lessons learned and issues", Management & Marketing, Challenges for the Knowledge Society, Vol. 15, No. 1, pp 458-476.

Braun, V. and Clarke, V. (2006) "Using thematic analysis in psychology", Qualitative Research in Psychology, Vol. 3, No. 2, pp 77–101.

Creswell, J. W. (2014) *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*, No. 4, Lincoln: Pearson.

Cuevas, R., Bodea, C-N., and Torres-Lima., P. (2021) *Research on Project, Programme and Portfolio Management: Integrating Sustainability into Project Management*, Switzerland, Springer Nature.

Dorow, P. F., Fraga, B.F. and Rados, G. J. V. (2018) "Ambientes determinantes ao compartilhamento do conhecimento em organizações de radiologia e diagnóstico por imagem: um estudo de múltiplos casos", Perspectivas em Gestão & Conhecimento, Vol. 8, No. 2, pp 22-42.

Favoretto, C. and Carvalho, M. M. de. (2021) "An analysis of the relationship between knowledge management and project performance: literature review and conceptual framework", Gestão & Produção, Vol. 28, No. 1., pp 1-21.

Fortune, J. and White, D. (2006) "Framing of project critical success factors by a systems model", International Journal of Project Management, Vol. 24, No. 1, pp 53-65.

Frinsdorf, O., Zuo, J. and Xia, B. (2014) "Critical factors for project efficiency in a defence environment", International Journal of Project Management, Vol. 32, No. 5, pp 803-814.

Gasik, S. (2011) "A Model of Project Knowledge Management", Project Management Journal, Vol. 42, No. 3, pp 23–44.

Gomes, F., Oliveira, M. and Chaves, M. S. (2018) "An analysis of the relationship between knowledge sharing and the project management process groups, Knowledge and Process Management", Vol. 25, No. 3, pp 168–179.

Goswami, A.K. and Agrawal, R.K. (2020) "Building intellectual structure of knowledge sharing", VINE Journal of Information and Knowledge Management Systems, Vol. 50, No. 1, pp 136-162.

Hanish, B. et al. (2009) "Knowledge management in project environments, Journal of knowledge management", Vol. 13, No. 4, pp 148-160.

Henttonen, K., Kianto, A. and Ritala, P. (2016) "Knowledge sharing and individual work performance: an empirical study of a public sector organisation", Journal of Knowledge Management, Vol. 20, No. 4, pp 749-768.

Holloway, J. (2009) "Performance management from multiple perspectives: taking stock", International Journal of Productivity and Performance Management, Vol. 58, No. 4, pp 391-399.

Ipe, M. (2003) "Knowledge sharing in organizations: A conceptual framework", Human Resource Development Review, Vol. 2, No. 4, pp 337-359.

Jorgensen, R., et al. (2021) "Improving public sector knowledge sharing through communities of practice", VINE Journal of Information and Knowledge Management Systems, Vol. 51, No. 2, pp 318-332.

Karagoz, Y., Whiteside, N. and Korthaus, A. (2020) "Context matters: enablers and barriers to knowledge sharing in Australian public sector ICT projects", Journal of Knowledge Management, Vol. 24, No. 8, pp 1921-1941.

Kinder, N. (2020) "Connect the people and the knowledge will flow–My recipe for building strong, knowledge sharing communities of peers", Business Information Review, Vol. 37, No. 4, pp 176-181.

Latif, K. F., et al. (2020) "Impact of entrepreneurial leadership on project success: mediating role of knowledge management processes", Leadership & Organization Development Journal, Vol. 41, No. 2, pp 237-256.

Lee, Y. et al. (2020) "Demystifying the differences in the impact of training and incentives on employee performance: mediating roles of trust and knowledge sharing", Journal of Knowledge Management, Vol. 24, No. 8, pp. 1987-2006.

Lin, H. (2007) "Knowledge sharing and firm innovation capability: an empirical study", International Journal of Manpower, Vol. 28, No. 3/4, pp 315-332.

Lindner, F. and Wald, A. (2011) "Success factors of knowledge management in temporary organizations, International" Journal of Project Management, Vol. 29, No. 7, pp 877–888.

Mallmann, G., Maçada A. C. G., and Oliveira, M. (2018) "The influence of shadow IT usage on knowledge sharing: An exploratory study with IT users", Business Information Review, Vol. 35, No. 1, pp 17-28.

Moraes, A. T., Silva, L., F., and Oliveira, P. S. G. (2020) "Systematization of absorptive capacity microprocesses for knowledge identification in project management", Journal of Knowledge Management, Vol. 24, No. 9, pp 2195-2216

Navimipour, N. J. and Charband, Y. (2016) "Knowledge sharing mechanisms and techniques in project teams: Literature review, classification, and current trends", Computers in Human Behavior, Vol. 62, pp 730-742.

North, K. and Scharle, A. (2020) *European Network of Public Employment Services: Practitioner Toolkit of Knowledge Management*, No. 1, Luxembourg, Publications Office of the European Union.

Padalkar, M. and Gopinath, S. (2016) "Six decades of project management research: Thematic trends and future opportunities", International Journal of Project Management, Vol. 34, No.7, pp 1305-1321.

Pauli, C. and Sell, D. (2019) "Gestão do conhecimento em escritórios de gerenciamento de projetos: diagnóstico e definição de estratégias para um instituto de pesquisa privado", Revista de Gestão e Projetos, Vol. 10, No. 3, pp 47-63.

PMI (2017) *Um guia do conhecimento em gerenciamento de projetos (Guia PMBOK)*, Project Management Institute Inc., No. 6, Pensilvânia, Project Management Institute.

Polyaninova, T. (2011) “Knowledge management in a project environment: organisational CT and project influences”, Vine, Vol. 41, No. 3.
Prabhakar, G. P. (2008) “Projects and Their Management: A Literature Review”, International Journal of Business and Management, Vol. 3, No. 8, pp 3-9.
Rana, S., Crowe, M. and Usoro, A. (2013) Factors for Knowledge Sharing Behaviour to Develop Trust in Professional Organisations Environment, In: 14th European Conference on Knowledge Management. Academic Conferences and Publishing Limited (ACPIL), pp 914-919.
Reich, B. H. (2007) “Managing knowledge and learning in IT projects: A conceptual framework and guidelines for practice”, Project Management Journal, Vol. 38, No. 2, pp 5-17.
Riege, A. (2005) “Three-dozen knowledge-sharing barriers managers must consider, Journal of Knowledge Management”, Vol. 9, No. 3, pp 18-35.
Rios-Ballesteros, N. and Fuerst, S. (2021) “Exploring the enablers and microfoundations of international knowledge transfer”, Journal of Knowledge Management, Vol.ahead-of-print, No. ahead-of-print.
Sampieri, R. H., Collado, C. F. and Lucio, P. B. (2013) *Metodologia de Pesquisa*, No. 5, Penso Editora, Porto Alegre.
Santos, V. R., Soares, A. L. and Carvalho, J. A. (2012) “Knowledge Sharing Barriers in Complex Research and Development Projects: an Exploratory Study on the Perceptions of Project Managers”, Knowledge and Process Management, Vol. 19, No. 1, pp 27-38.
Seiffert, M. E. B. and Loch, C. (2004) “Systemic thinking in environmental management: support for sustainable development”, Journal of Cleaner Production, Vol. 13, No. 12, pp 1197-1202.
Shinoda, A. C. M., Maximiano, A. C. A., and Sbragia, R. (2015) “Gestão do conhecimento em organizações orientadas para projetos”, Gestão e Projetos: GeP, Vol. 6, No. 1, pp 95-110.
Singh, S., et al. (2021) “Top management knowledge value, knowledge sharing practices, open innovation and organizational performance”, Journal of Business Research, Vol. 128, pp 788-798.
Wang, S. and Noe, R. (2010) “Knowledge sharing: A review and directions for future research”, Human Resource Management Review, Vol. 20, No. 2, pp 115-131.
Wróbel, P. (2007) Knowledge Management Challenge for Polish Universities, In: 8th European Conference on Knowledge Management. Academic Conferences and Publishing Limited (ACPIL), pp 1114-1117.
Yeh, Y., Lai, S. and Ho, C. (2006) “Knowledge management enablers: a case study”, Industrial Management &amp, Data Systems, Vol. 106, No. 6, pp 793-810.
Zhang, L. and He, J. (2016) “Critical factors affecting tacit-knowledge sharing within the integrated project team”, Journal of Management in Engineering, Vol. 32, No. 2, pp 1-10.

Knowledge-Based Management Challenges in the Asset Life Cycle

Viivi Siuko, Jussi Myllärniemi and Pasi Hellsten
Tampere University, Finland
viivi.siuko@tuni.fi
jussi.myllarniemi@tuni.fi
pasi.hellsten@tuni.fi

Abstract: This study examines knowledge-based management challenges at different stages of the asset life cycle in project networks. The case network is the infrastructure construction sector, which includes organizations in design, construction and maintenance. This sector forms an interesting case as there are multiple problems related to knowledge-based management. By comparing the maturity levels of the different stages of the asset life cycle, we aim to identify the major challenges in knowledge-based management in asset life cycles within the infrastructure sector. A maturity survey on knowledge-based management was distributed to 22 organizations, generating 68 respondents. The respondents worked in infrastructure sector organizations at different stages of the asset life cycle, including design, construction and maintenance. The findings of the survey were compared, so as to present relevant issues at each stage, and analysed with a framework suggested for the maturity model. There is little research on knowledge-based management relating to the asset life cycle. Therefore, this study creates new knowledge in this area and enhances understanding of how issues of knowledge-based management differ in the stages of the life cycle as a manifestation of knowledge management. Organizations in the infrastructure sector gain valuable information on the issues that need to be fixed so as to gain more value from digitalization. This research is part of the ProDigial research programme whose practical contribution will be a manual on knowledge-based management for asset-managing organizations.

Keywords: Knowledge-based management, maturity model, asset life cycle

1. Introduction

In recent decades, there has been marginal productivity development in the infrastructure construction sector, which includes building public structures such as roads and bridges. Vaismaa et al. (2020) scrutinized productivity in the asset life cycle of the infrastructure construction sector and found that there were knowledge-based management (KBM) related challenges and bottlenecks affecting productivity and digitalization therein. In other words, fixing KBM-related challenges may advance digitalization and increase the productivity of the infrastructure construction sector. As Myllärniemi et al. (2019) put it, organizations can advance digitalization by refining data or information to knowledge so as to improve their decision-making capabilities and productivity. Digitalization involves dealing with organizational data and information resources with dedicated tools and techniques (Hellsten and Paunu, 2020). However, KBM-related challenges have received very little research attention in the infrastructure sector, especially in relation to the asset life cycle.

The infrastructure sector is fragmented, complex and project-based. The life cycle of assets in the project environment is complex as multiple organizations need to cooperate in the context of co-dependent lifecycle stages: design, construction and maintenance. In addition, the asset life cycle can be decades long, for example, that of a bridge. These characteristics imply asset lifecycle-related challenges in the sector in terms of capturing and reusing valuable knowledge gathered during projects. According to Vaismaa et al. (2020), sector operators are 'siloed', that is, they may have little fluent communications with their 'neighbours' or co-operators. Similarly, the information on which the decision-making is based may be false or may change, and organizations often have unused knowledge. Based on the findings of Vaismaa et al. (2020), KBM plays a significant role in increasing productivity in the field. Similarly, Lawson et al. (2009) found that KBM in projects with multiple actors, as in the infrastructure construction sector, can decrease asset lifecycle costs.

Based on Vaismaa et al. (2020), information and its correct handling are two of the main components of productivity in the infrastructure construction sector. The sector is eager to utilize the solutions that digitalization provides, for example, the Internet of things, big data, artificial intelligence and building information modelling (BIM). In particular, BIM is widely used in building and infrastructure projects (Chong et al., 2016). However, it implies weaknesses in relation to KBM, such as erroneous or missing information (Nývlt and Prûsková, 2017). There are multiple challenges regarding knowledge management and KBM, as manifested in the infrastructure construction sector, that need to be addressed before digitalization can deliver value.

In this study, we sought to identify the major KBM challenges relating to the asset life cycle in the infrastructure construction sector. Our research questions are as follows:

1. Which KBM challenges relating to the asset life cycle in the infrastructure construction sector can be identified?
2. Do the stages of the life cycle have distinctive challenges that hinder KBM in relation to the asset life cycle?

We conducted a maturity survey of KBM in the infrastructure construction sector, which included the various stages of the asset life cycle, to understand the current state of KBM relating to the asset life cycle in the sector. The survey focused on KBM practices undertaken during infrastructure projects, and the study context was the Finnish infrastructure construction sector. It should be noted that customer organizations in the infrastructure construction sector in Finland are always public. Therefore, this study takes place in the intersection of the public sector and private companies. However, the cooperation dynamics between private and public actors are not discussed.

As a practical contribution, organizations in infrastructure construction will gain valuable knowledge on the KBM-related challenges they will need to overcome to advance digitalization. The theoretical contribution involves creating new knowledge on how KBM challenges vary in each stage of the asset life cycle as there is a dearth of research on KBM relating to the asset life cycle.

In the next section, we illuminate the existing research and theoretical presumptions concerning KBM and the asset life cycle in the infrastructure construction sector. Section three presents the methodology of the study and data collection. Section four presents the findings, while section five discusses the results in the context of the existing research. Section six concludes the research.

2. Related research

2.1 Knowledge-based management

Digitalization has been responsible for changing operational landscapes (Reis et al., 2019). It involves the creation and execution of 'changes associated with the application of digital technology in all aspects of human society' (Stolterman and Fors, 2004, p. 23). This generally covers a range of organizational activities. The changes and trends involved affect the whole organization from the individual level (i.e. how personal communication is conducted) to the operational level (i.e. how the organization functions communicate) (Bloomberg, 2018). Thus, it becomes a question of angle and viewpoint in terms of defining more closely what exactly is under scrutiny. Digitalization is connected to all business processes of an organization because it is only through this connection that the organization can draw high-quality information from activities and form information products from actual proceedings to lay foundations and bring value to decision-making. Digitalization most often deals with the operational data and information of organizations. It is a proven tool to improve organizational operations and in enabling knowledge management operations.

Knowledge management (KM) is an approach through which the various forms of knowledge content within an organization may be identified and taken into use (Nonaka and Toyama, 2007; Nonaka and Takeuchi, 1995). This use includes decision-making or planning at various operational levels and managing daily working routines. A central objective of this approach is to offer the right information or knowledge at the right time to those who need it for the purpose of decision-making. To accomplish this, the organization needs not only the appropriate technological infrastructure and necessary processes but also the right employee mindset, that is, the right combination of attitudes and skills to make things happen (Jääskeläinen et al., 2022). KM is an approach in which management considers both technological issues and human aspects when making decisions to promote organizational goal-setting (Girard and Girard, 2015). Conversely, KBM is a derivative of KM. In a way, the knowledge-based view of the firm is brought back into the conversation when one considers the role that knowledge plays in the organizational context and how it is best utilized (Grant, 1996). Knowledge content may be derived from both inside and outside the organization, thus underlining the holistic nature of KM. The main point in KBM is the very use of the knowledge assets that one has access to, giving even more significance to the way in which organizations need to recognize and acknowledge what knowledge is needed, relevant and obtainable. Similarly, organizations need to distinguish how knowledge needs to be effectively processed and shared within the organization and, where appropriate, with other stakeholders and how knowledge can be used in decision-making (Choo, 1996; Kaivo-oja et al., 2015; Thierauf, 2001).

Challenges in KBM include technical issues caused by unsuitable infrastructure, data quality, human issues such as reluctance to share knowledge and biases in thinking or even inefficiency issues in work processes (Väyrynen et al., 2017). In addition, the life cycle of assets in projects involving multiple organizations creates additional challenges for KBM: the various information systems might be misaligned, and employees might not share their knowledge outside their organization (Vuori et al., 2019). KM and the more pragmatic KBM have gained interest among researchers in projects involving multiple actors (Lancini, 2015; Agostini et al., 2020), similar to those in the infrastructure construction sector However, much of the existing research focuses on one area of KBM at a time, such as knowledge creation, knowledge sharing or knowledge acquisition. To a lesser extent, all stages, from identifying knowledge needs to knowledge utilization in the KBM process, have been depicted (Jääskeläinen et al., 2022). The KBM process can be divided into multiple sections: identifying information and knowledge needs, information acquiring, organizing and storing information, forming information products, sharing information and knowledge and using information in decision-making. The final stage is to make the necessary decisions and see them through in the organization, that is, knowledge use for organizational learning (Choo, 2002; Vitt et al., 2002).

There are ways in which to study KBM in an organization. One such tool is that of Jääskeläinen et al. (2022), which is based on the principles presented in Choo (2002). This tool makes it possible to scrutinize the state of KBM in an organization, after which development plans can be drawn as viewpoints are distinguished according to the breadth of the scrutiny.

2.2 Asset life cycle in the infrastructure construction sector

The life cycle of an asset in the infrastructure construction sector can be divided into various stages: design, construction and maintenance. In the design stage, the infrastructure is designed to the point where it can be constructed. Following the construction of the design, the structure is maintained, sometimes for decades. Figure 1 visualizes the asset life cycle and case project network. In each stage, private companies and customer organizations operate simultaneously in multiple projects while partnering with different organizations.

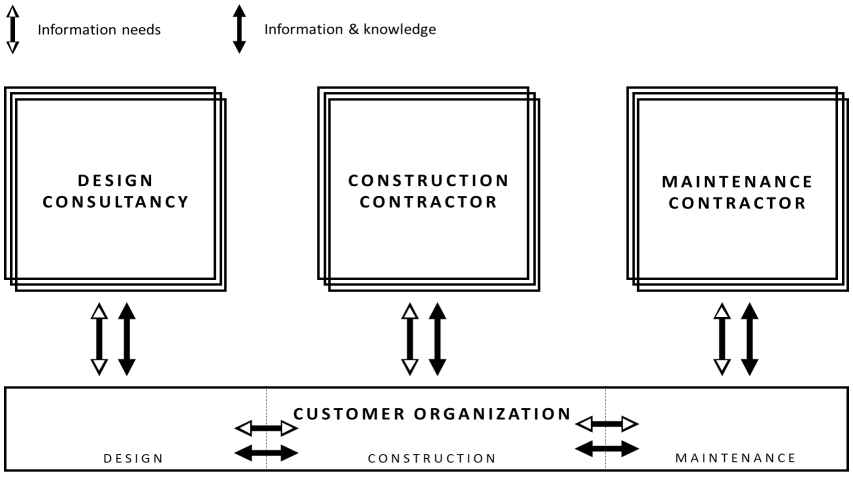


Figure 1: Asset life cycle and case project network

According to Muller et al. (2019), most tools used in design are unsatisfactory as they are not suitable or sufficiently flexible for rapid design processes; for example, it is difficult to share up-to-date information about simulations. KBM challenges, especially in terms of information sharing, are important as communication among actors and consistent reviews are essential for successful design (Zanni et al., 2014). Inadequate design documents create problems, especially if the construction does not update the design documents as 'built', as there might be costly maintenance effects if there is no information on what has been constructed (Muller et al., 2019). Love et al. (2014) pointed out that even a small change in a design decision can cause costly alterations in construction and maintenance stages. Construction efficiency can be improved by having information correspond with the physical infrastructure (Li and Cao, 2020). Chen and Lu (2019) maintained that information quality, quantity and accessibility are significant factors for successful KBM in construction. In addition, construction has faced difficulties in implementing practices and information sharing, which have hindered the development of KBM (Azhar, 2011).

Information is a critical factor in efficient and effective maintenance. However, it is laborious to acquire information for maintenance (Pärn et al., 2017). For the same reason, information is not always reliable as it might not be up to date (Lin et al., 2022). There can be a positive impact on lifecycle costs if the maintenance is done dynamically within the asset life cycle (Wong and Zhou, 2015), as a majority of the costs are formed in the stage of maintenance (Pärn et al., 2017). Xun et al. (2015) provided an example of unfunctional KBM and undynamic cooperation in the case of BIM, which is a digital representation of the physical characteristics of a built object (Volk et al., 2014). BIM can be used across the asset life cycle to improve simulation and analysis, collaborative working and information management (Liu et al., 2015). According to Xun et al. (2015), the BIM model from a previous stage is not delivered to the subsequent stage. Instead, a BIM is built for each stage. Since the infrastructure construction sector is fragmented and project-based, it makes KBM implementation difficult, a point made by Arayici and Aouad (2010) in the context of building construction. In addition, the complexity of the asset life cycle creates special documentation requirements (Wong and Zhou, 2015). Owen (2010) has stated that codified information and knowledge mainly exist within functions and other individual groups and are not shared sufficiently frequently with other partners. Currently, KBM is less than ideal in terms of the asset life cycle (Nývlt and Prúsková, 2017; Liu et al., 2009).

3. Methods

The research was conducted by distributing a survey to 22 organizations in the infrastructure construction sector in Finland. The organizational participants were companies and public customer organizational participants of the research program ProDigial. In total, we received 68 responses to this survey, which dealt with the various stages of the asset life cycle: design, construction and maintenance. The respondents were grouped according to these three stages, with each stage including respondents who reportedly worked therein. There were 18 respondents in design, 21 in construction and 12 in maintenance. The remainder of the respondents (17) reported having a more holistic view on the life cycle. Their responses were not included in this study as they will be discussed in further research.

The survey is based on a maturity model of information and knowledge management (Jääskeläinen et al., 2022). The survey questions were modified to better describe KBM instead of information and knowledge management. Except for the section on vision and strategy, which focused on the organizational level, the respondents were encouraged to consider common infrastructure construction projects instead of their own organization as a way to get them to think about cooperation in the asset life cycle.

In the survey, KBM was divided into eight sections: vision and strategy of an organization (A), governance and organization of a project (B), information needs in a project (C), information acquisition in a project (D), information organization and storage in a project (E), information products in a project (F), information and knowledge sharing in a project (G) and information usage in a project (H). Each of these sections included between five and ten statements on the development of practices. In addition, one statement addressed the satisfaction with the section. The respondents provided answers to these statements on a 5-point Likert scale: whether they strongly disagreed (1), somewhat disagreed (2), were neutral (3), somewhat agreed (4) or strongly agreed (5). They could also choose not to answer a statement. The responses were grouped into two categories – agree and disagree – because it is difficult to analyse the difference between strongly and somewhat agree or disagree and neutral as the intervals between these values could not be presumed as qual (Cohen et al., 2007). In addition, there were a few responses for strongly disagree or strongly agree, and it was assumed that grouping them would not have a notable impact on the results. After the grouping, the distribution of responses depicting agreement and disagreement was calculated as a percentage while leaving out the neutral responses. The percentages representing the satisfied and unsatisfied respondents were based on a single statement. The percentages for the responses agreeing with the development of each KBM section were based on five to ten statements each.

Jääskeläinen et al. (2022) proposed a framework for analysing maturity surveys, which was used in this study to analyse the results. The framework forms a 2 × 2 matrix, which included developed and undeveloped as well as dissatisfactory and satisfactory practices. As shown in figure 2, there were four levels of maturity: novice, facilitator, experimenter and advanced exploiter. Each KBM section was placed in this framework for each stage of the asset life cycle. Whether the KBM section included developed or undeveloped practices was determined from the distribution between the responses agreeing and disagreeing with the practices being developed: if more than 50% thought that practices were being developed, the section was placed on the experimenter or

advanced exploiter level. If more than 50% of the respondents were satisfied with a KBM section, it was placed on the advanced exploiter or facilitator level.

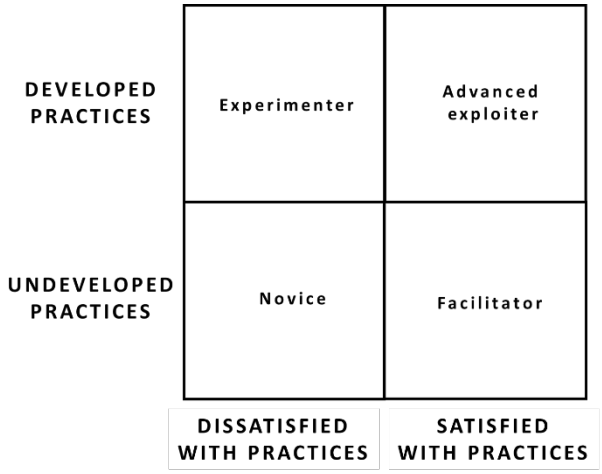


Figure 2: A framework for analysing the KBM maturity survey (Jääskeläinen et al., 2022)

The desired level is that of the advanced exploiter, where KBM practices are well-developed and meet the needs of the organization. Reaching the facilitator level is also positive because even if the practices are not quite developed, they are sufficient for the organization's needs. Being on the experimenter level implies that the practices are well developed, at least on the strategic level; however, either the practices do not satisfy the needs of the organization or they have not been successfully implemented. The novice level means that the organization's practices are in a primitive stage and that it should focus on developing these practices. (Jääskeläinen et al., 2022). In this study, instead of analysing each organization separately, each KBM section was placed separately in this framework, and the results were analysed based on the three stages of the asset life cycle.

4. Results

The results are presented in two tables. Table 1 presents the percentage of responses in agreement with the development of the KBM practices in the design, construction and maintenance stages. The percentages of respondents who were satisfied with each section of KBM are presented in table 2. Since the percentages in table 1 present the responses in agreement with the KBM practices being developed, a percentage that was less than 50% meant that there were more responses disagreeing with the KBM practices being developed. When the responses were equally distributed between the categories representing agreement and disagreement, the practices were interpreted as undeveloped because there was clearly a significant number of respondents who thought that the practices were not sufficiently developed.

Table 1: The percentage of responses in agreement with the development of the KBM practices

Sections of KBM	Design	Construction	Maintenance
A. Vision and strategy of an organization	80%	81%	79%
B. Governance and organization of a project	56%	49%	55%
C. Information needs in a project	66%	68%	77%
D. Information acquisition in a project	73%	69%	70%
E. Information organization and storage in a project	70%	54%	68%
F. Information products in a project	51%	50%	64%
G. Information and knowledge sharing in a project	60%	70%	70%
H. Information usage in a project	74%	78%	83%

The respondents in the design stage clearly agreed with the practices being developed in the sections of vision and strategy at the organizational level and information usage at the project level, with responses depicting agreement reaching at least three-quarters. The result regarding information products was quite controversial, showing that slightly more respondents considered the practices being developed. None of the KBM sections were clearly undeveloped in any of the stages of the asset life cycle; however, in construction, the sections covering governance and organization of projects and information products can be interpreted as having undeveloped practices. In construction, there was clear agreement regarding the development of vision and

strategy and information usage. The result was similar for maintenance, but there was also clear agreement regarding the development of practices pertaining to information needs. Overall, maintenance had the highest agreement percentages regarding the development of practices.

As mentioned earlier, each section on the survey included one statement on the respondents' satisfaction with the KBM section. The percentages of satisfied respondents are presented in table 2. A percentage of less than 50% indicated that more respondents were unsatisfied with the practices in the KBM section. In the case of responses being equally distributed between satisfied and unsatisfied respondents, the respondents were interpreted as unsatisfied.

Table 2: The percentage of respondents who were satisfied with the KBM practices

Sections of KBM	Design	Construction	Maintenance
A. Vision and strategy of an organization	50%	62%	60%
B. Governance and organization of a project	18%	42%	56%
C. Information needs in a project	46%	64%	45%
D. Information acquisition in a project	50%	64%	56%
E. Information organization and storage in a project	50%	50%	40%
F. Information products in a project	62%	57%	44%
G. Information and knowledge sharing in a project	50%	69%	44%
H. Information usage in a project	60%	69%	57%

The percentages representing satisfied respondents create interesting contrast to the seemingly developed practices. Whereas the percentages depicting agreement with the practices being developed mainly exceeded 50%, the percentages representing satisfied respondents were often 50% or less, indicating that the respondents were unsatisfied with the current state of these KBM practices. In addition, none of the stages had sections containing a remarkable number of satisfied respondents. In design, the respondents were notably unsatisfied with the governance and organization of projects. They were also unsatisfied with vision and strategy at the organizational level, information needs, information acquisition, information organization and storage and information and knowledge sharing. The satisfied respondents in construction represented a majority in most of the sections, with the only exceptions being the governance and organization of projects and information organization and storage. Of the three stages, construction seemed to have the most satisfied respondents. Maintenance had more unsatisfied respondents in the sections of information needs, information organization and storage, information products and information and knowledge sharing.

5. Discussion

The results were analysed using the framework presented in chapter 3. Clear differences – and interesting similarities – were found in the comparison of the design, construction and maintenance stages. They are shown in figure 3. For all stages of the life cycle, there were similarities in information usage (H) and information organization and storage (E), the first being at the advanced exploiter level and the latter at the experimenter level. The maturity levels of the KBM sections of construction and maintenance had in common organizational vision and strategy (A) and information acquisition (D), both of which were at the advanced exploiter level. Design and maintenance both had practices for identifying information needs (C) at the experimenter level. The KBM design sections were mostly at the experimenter level, except for creating and utilizing information products (F) and information usage (H), which were both at the advanced exploiter level. In maintenance, the KBM sections were equally distributed between the experimenter and advanced exploiter levels. Therefore, maintenance had a slightly better KBM situation than design. There was an interesting situation in construction. Most of the KBM sections were at the advanced exploiter level, but they had undeveloped practices relating to governance and organization of projects (B) and creating information products (F). However, the marginal development of creating information products did not seem to disrupt construction which seemed to fulfil its needs, at least to some degree, as this section reached the level facilitator. Information organization and storage (E) was on the experimenter level.

It should be noted, however, that in the KBM sections of design and maintenance at the advanced exploiter level, the percentages of satisfied respondents were between 56% and 62%, and therefore, there was still a significant number of unsatisfied respondents. Consequently, it could be argued that the overall KBM maturity level of design and maintenance remained at the experimenter level since at least half of the other sections were already considered to be at this level. Construction had slightly better satisfaction rates, reaching 69% in

two of the sections, and most of the KBM sections were at the advanced exploiter level. Even if construction reached the advanced exploiter level with unsignificant satisfaction, it can be argued that their KBM maturity was at a better level than that of design and maintenance.

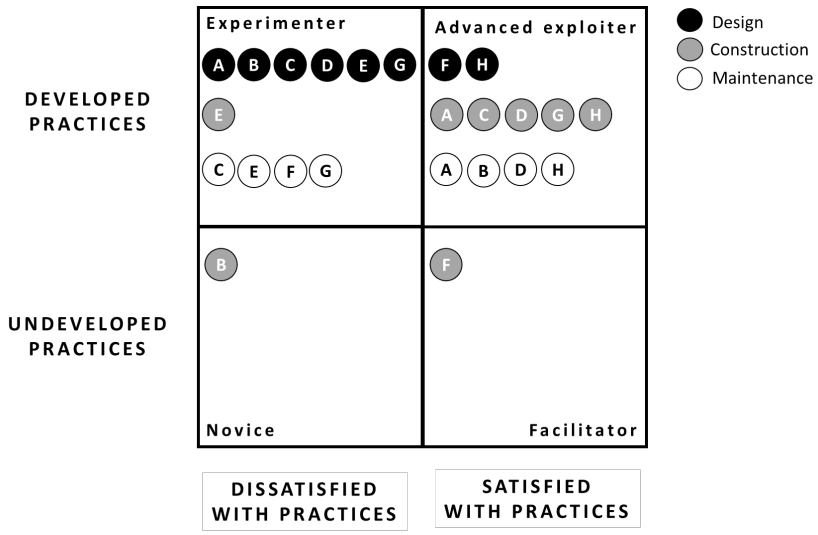


Figure 3: KBM in the different stages of the asset life cycle

Reaching the experimenter level indicates that the practices were not developed according to the needs of the employees or that the implementation of the practices was not successful (Jääskeläinen et al., 2022). As design is at the experimenter level, it seems that design has practices and tools to support their work but that the tools and practices do not meet their needs. This is well in line with the findings of Muller et al. (2019), who reported that while design has tools, they are not sufficiently suitable and flexible. Zanni et al. (2014) raised the importance of information sharing for successful design, and according to their results, information and knowledge-sharing practices (G) are unsatisfactory and need to be developed further. Another issue with design is the need to make changes to design decisions and the provision of inadequate design documents in the construction context (Love et al., 2014; Muller et al., 2019). These issues can be related to unsatisfactory information acquisition (D) or information needs identification (C) practices as it is difficult to make the right decisions with insufficient information. The results pertaining to maintenance contradict those in the literature. Pärn et al. (2017) noted the laboriousness in acquiring information in maintenance, but this was not clear in our results as information acquisition (D) reached the advanced exploiter level, although with only a 56% level of satisfaction. In addition, Lin et al. (2022) stated that information is not updated in maintenance, which suggests that information organization and storing practices (E) are not very developed. These results suggest, however, that the section was quite developed, with 68% agreement on development, despite being satisfactory to the employees.

According to Azhar (2011), construction has faced challenges in implementing practices. However, the current results suggest quite the opposite: construction was most successful in implementing practices compared to design and maintenance, with construction reaching the level of advanced exploiter in most of its KBM sections. According to Jääskeläinen et al. (2022), advanced exploiters have developed KBM practices, which are successfully implemented. However, construction did have its share of KBM challenges. The practices in the governance and organization of projects (B) were undeveloped and unsatisfactory. As information quality and accessibility are key factors for successful KBM in construction (Chen and Lu, 2019), the results suggest that construction has challenges relating to information quality and accessibility as the respondents were not satisfied with their information organization and storage practices (E). Construction can increase efficiency with tools such as BIM, in which information corresponds to physical infrastructure (Li and Cao, 2020), but erroneous or missing information is a significant factor in BIM-related problems (Nývlt and Prûsková, 2017). Therefore, it could help if construction increased efficiency to improve information organization and storage practices (E). None of the stages of the asset life cycle recorded satisfaction with information organization and storage practices (E). In addition, design and maintenance recorded challenges with acquiring (D) and sharing (G) information. These results indicate that the information systems between the organizations might have been misaligned, a common problem identified by Vuori et al. (2019) in projects involving multiple organizations. This

misalignment, according to Xun et al. (2015), can result in BIM models not being delivered from one stage to the next.

6. Conclusions

As the survey results show, there are difficulties in implementing KBM practices, especially in design and maintenance, and that the focus should be on these KBM challenges. However, as mentioned in chapter 2, the fragmented and project-based nature of the infrastructure construction sector makes the implementation difficult. Construction should improve information organization and storage as well as project organization. All stages in the asset life cycle would benefit from a better alignment of their information systems and more dynamic cooperation overall.

It should be noted that the organizations participating in the maturity survey took part in the ProDigial research programme, which focused on digitalization, KBM and the productivity leap. Therefore, organizations interested in participating in such research are not the least motivated in terms of digitalizing their operations. Since it is more likely to be the opposite, our results potentially show the maturity level of KBM in the most developed organizations in the Finnish infrastructure construction sector. In this case, the field consists of organizations, especially in maintenance, that could be benchmarked for developing other organizations at the same stage of the asset life cycle.

This research contributes new knowledge on KBM in the infrastructure construction sector and the asset life cycle. It provides insights on current KBM challenges in the stages of the life cycle. Organizations in the infrastructure sector will gain valuable information on which issues to fix in order to gain greater value from digitalization. The practical contribution of the study relates to the output of the ProDigial research programme as the corresponding research will be utilized to create a manual on KBM for asset-managing organizations. Furthermore, future research will take a closer look at the challenges in the infrastructure construction sector in an effort to seek solutions to these challenges. The details of the KBM challenges in relation to the asset life cycle should be further examined with a view to finding potential solutions.

References

Agostini, L., Nosella, A., Sarala, R., Spender, J.-C. and Webner, D. (2020) “Tracing the Evolution of the Literature on Knowledge Management in Inter-organizational Contexts: A Bibliometric Analysis”, *Journal of Knowledge Management*, Vol. 24, No. 2. pp. 463–490.

Arayici, Y. and Aouad, G. (2010) “Building Information Modelling (BIM) for Construction Lifecycle Management”, In: Doyle, S. G., ed. *Construction and Buildings: Design, Materials and Techniques*. New York: Nova Science Publishers, pp. 99–118.

Azhar, S. (2011) “Building Information Modelling (BIM): Trends, Benefits, Risks, and Challenges for the AEC Industry”, *Leadership and Management in Engineering*, Vol. 11, No. 3. pp. 174–187.

Bloomberg, J. (2018) “Digitization, Digitalization, and Digital Transformation: Confuse Them at Your Peril”, *Forbes*, April 29. www.forbes.com/sites/jasonbloomberg/2018/04/29/digitization-digitalization-and-digital-transformation-confuse-them-at-your-peril/?sh=3585d17c2f2c (Accessed: 09 March 2022).

Chen, K. and Lu, W. (2019) “Bridging BIM and Building (BBB) for Information Management in Construction: The Underlying Mechanism and Implementation”, *Engineering, Construction and Architectural Management*, Vol. 26, No. 7. pp. 1518–1532.

Chong, H.Y., Lopez, R., Wang, J., Wang, X. and Zhao, Z. (2016) “Comparative Analysis on the Adoption and Use of BIM in Road Infrastructure Projects”, *Journal of Management in Engineering*, Vol. 6

Choo, C.W. (1998) *The Knowing Organization: How Organizations Use Information to Construct Meaning, Create Knowledge, and Make Decisions*. New York: Oxford University Press.

Choo, C.W. (2002). *Information Management for the Intelligent Organization: The Art of Scanning the Environment*. Information Today, Inc.

Cohen, L., Manion, L. and Morrison K. (2007) *Research Methods in Education*, 6th ed. London: Routledge.

Girard, J.P. and Girard, J.L. (2015) “Defining Knowledge Management: Toward an Applied Compendium”, *Online Journal of Applied Knowledge Management*, Vol. 3, No. 1, pp. 1–20.

Grant, R.M., (1996). “Toward a Knowledge-based Theory of the Firm”, *Strategic Management Journal*, Vol. 17, 109–122.

Hellsten, P. and Pekkola, S. (2020) “Impacts of Digitalization: Many Agendas on Different Levels”, In: *Proceedings of the 53rd Hawaii International Conference on System Sciences (HICSS)*, January 7–10, 2020, Maui, Hawaii.

Jääskeläinen, A., Sillanpää, V., Helander, N., Leskelä, R.L., Haavisto, I., Laasonen, V. and Torkki, P. (2022) “Designing a Maturity Model for Analyzing Information and Knowledge Management in the Public Sector,” *VINE Journal of Information and Knowledge Management Systems*, Vol. 52, No. 1, pp. 120–140. doi:10.1108/VJIKMS-01-2020-0017.

Kaivo-oja, J., Virtanen, P., Jalonen, H. and Stenvall, J., (2015) "The Effects of Internet of Things and Big Data to Organizations and Their Knowledge Management Practices", *Knowledge Management in Organizations – Lecture Note in Business Information Processing*, Vol. 224, 495–513.

Lancini, A. (2015) "Evaluating Interorganizational Knowledge Management: The Concept of IKM Orientation", *The Electronic Journal of Knowledge Management*, Vol. 13, No. 2. pp. 117–129.

Li, Y.-W. and Cao, K. (2020) "Establishment and Application of Intelligent City Building Information Model Based in BP Neural Network Model", *Computer Communication*, Vol. 153. pp. 382–389.

Lin, Y.C., Hsu, Y.T. and Hu, S.T. (2022) "BIM Model Management for BIM-Based Facility Management in Buildings", *Advances in Civil Engineering*, Vol. 2022.

Liu, Z., Li, Y. and Lu, X. (2009) "Development of Integrated Information Technology in the Chinese Building Industry", *Proceedings of Shanghai International Conference on Technology of Architecture and Structure*, pp. 544–553.

Liu, Z., Osmani, M., Demian, P. and Baldwin, A. (2015) "A BIM-aided Construction Waste Minimization Framework", *Automation in Construction*, Vol. 59. pp. 1–23.

Love, P.E., Matthews, J. Simpson, I., Hill, A. and Olatunji, O.A. (2014) "A Benefits Realization Management Building Information Modelling Framework for Asset Owners", *Automation in Construction*, Vol. 37. pp. 1–10.

Moss, T. (1999) "Management Forecast: Optimizing the Use of Organizational and Individual Knowledge", *Journal of Nursing Administration*, Vol. 29, No. 1, pp. 57–62.

Muller, M.F., Esmanioto, F., Huber, N., Loures, E.R. and Canciglieri, O. (2019) "A Systematic Literature Review of Interoperability in the Green Building Information Modeling Lifecycle", *Journal of cleaner production,* Vol. 223. pp. 397–412.

Myllärniemi, J., Helander, N. and Pekkola, S. (2019) "Challenges in Developing Data-based Value Creation. In: *Proceedings of the 11th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management*. Vienna: Vienna SCITEPRESS –Science and Technology Publications, pp. 370–376.

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge Creating Company* Oxford: Oxford University Press.

Nonaka, I. and Toyama, R. (2007) "Strategic Management as Distributed Practical Wisdom (phronesis)", *Industrial and Corporate Change*, Vol. 16, No. 3, 371–394.

Nývlt, V. and Prûsková, K. (2017) "Building Information Management as a Tool for Managing Knowledge Throughout Whole Building Life Cycle", *IOP Conference Series: Materials Science and Engineering*, Vol. 256.

Owen, R. (2010) "Challenges for Integrated Design and Delivery Solutions", *Architectural Engineering and Design Management*, Vol. 6. pp. 232–240.

Pärn, E.A., Edwards, D.J. and Sing, M. C. P. (2017) "The Building Information Modelling Trajectory in Facilities Management: A Review", Automation in Construction. Vol. 75. pp. 45–55.

Reis, J., Amorim, M., Melão, N., Cohen, Y. and Rodrigues, M. (2020) "Digitalization: A Literature Review and Research Agenda". In: Anisic, Z., Lalic, B. and Gracanin, D. (eds) *Proceedings on 25th International Joint Conference on Industrial Engineering and Operations Management – IJCIEOM. IJCIEOM 2019*. Springer, Cham: Lecture Notes on Multidisciplinary Industrial Engineering. https://doi.org/10.1007/978-3-030-43616-2_47.

Thierauf, R.J. (2001) *Effective Business Intelligence Systems*. Greenwood Publishing Group.

Vaismaa, K., Laitinen, K., Örmä, M., Wallander, J., Koskinen, A., Junnonen, J.M. and Saari, A. (2020) Tiekartta infra-alan tuottavuuteen. Väyläviraston julkaisuja.

Väyrynen, H., Helander, N. and Vasell, T. (2017) "Knowledge Management for Open Innovation: Comparing Research Results between SMEs and Large Companies", *International Journal of Innovation Management*, Vol. 21, No. 05

Vitt, E., Lukevich, E. and Misner, S. (2002) *Business Intelligence: Making Better Decisions Faster*. Redmond, WA: Microsoft Press.

Volk, R., Stengel, J. and Schultmann, F. (2014) "Building Information Modelling (BIM) for Existing Buildings – Literature Review and Future Needs", *Automation in Construction*, Vol. 38. pp. 109–127.

Wong, J.K.W. and Zhou, J. (2015) "Enhancing Environmental Sustainability over Building Life Cycles through Green BIM: A Review", *Automation in Construction*, Vol. 57. pp. 156–165.

Xun, X., Ling, M. and Ding, L. (2014) "A Framework for BIM-Enabled Life-Cycle Information Management of Construction Project", *International Journal of Advanced Robotic Systems*, Vol. 11, No. 8, p. 126.

Zanni, M.-A., Soetanto, R. and Ruikar, K. (2014) "Defining the Sustainable Building Design Process: Methods for BIM Execution Planning in the UK", *International Journal of Energy Sector Management* Vol. 8, No. 4, pp. 562–587.

Evolution of the Coordination of Activities Aimed at Building Knowledge in the Wikipedia Community

Sebastian Skolik
Management Faculty, Częstochowa University of Technology, Częstochowa, Poland
sebastian.skolik@wz.pcz.pl

Abstract: The first decade of the 21st century spawned the intense development of online communities of practice. The largest knowledge-sharing communities were formed in several dozen language versions of Wikipedia. Defining rules for cooperation was necessary to ensure the desired content quality created by Wikipedians. It was essential to develop the appropriate initiatives, tools, and space for effective activity coordination within the service. Previous research in this area pointed to the role of leadership, group size, and tools facilitating work automation in creating actionable strategies and in the self-organization of work. This paper aims to characterize the variability in creating new concepts of cooperation in selected language versions of Wikipedia and identify the factors of participating in various forms of cooperation. The author assumes that the greater number of initiatives a user enters contributes to an increase in their overall activity. The research conducted was both qualitative and quantitative. A netnographic approach was used, as well as a statistical analysis of user activity records. Thanks to the netnographic research, the stages of Wikipedia's evolution were identified. Quantitative research has shown a correlation between the number of activity areas (a user's affiliation to WikiProjects) and their overall activity (the number of edits made). A change in Wikipedians' activity style was also observed depending on their seniority on the website. The study's conclusions may be helpful for organizations using crowdsourcing to achieve their own goals.

Keywords: coordination of activities, knowledge management, knowledge sharing, variability in online communities, Wikipedia users

1. Introduction

Coordination of actions and synchronization of attitudes and goals is a common phenomenon in human behaviour (Manc-Bogdańska, 2009; Deutsch, Coleman, and Marcus, 2011). It occurs spontaneously in unorganized crowds, which is described as activating 'swarm mode' when individuals satisfy their need to participate in large events (Haidt, 2014). Belonging to the Wikipedia community can also be considered participating 'in something great.' Some researchers stress that Wikipedia is the biggest project ever created by mankind (Jemielniak, 2013).

There is a clear tendency to 'fork' in Wikipedia, as in other free culture movement projects. Over time, multiple variants of solutions emerge and become different technical and social systems. This is similar to biological speciation, whereby distinct clades evolve. In Wikipedia, the isolating factor that leads to the emergence of diverse collaboration forms is not geographical remoteness, but the different cultures from which Wikipedians are recruited (see: Karczewska, Kukowska 2021).

One element differentiating Wikipedia environments is WikiProjects, which take different forms in different language versions. They are dedicated to particular areas of knowledge or specific tasks performed on Wikipedia. Much of the research to date on collaboration between Wikipedians (Wikipedia contributors) has explicitly focused on the analysis of WikiProjects (see: Forte et al., 2012; Morgan et al., 2013; Platt and Romero, 2018). Other work demonstrates the role of technical support, especially bots, in creating a coordination platform in the Wikipedia environment (Gaio et al., 2009; Müller-Birn, Dobusch, and Herbsleb, 2013).

The afore-mentioned authors focus on self-organization processes, the relationship between social factors and work efficiency, and the role of automation in improving collaboration between Wikipedians. However, a synthetic approach showing changes in forms of activity coordination is missing, especially taking language versions other than English into account. This paper aims to present Wikipedia's evolution concerning work coordination and indicate the relationship between Wikipedians' activity and their participation in work coordination through their involvement in WikiProjects. The paper then reviews the literature on work coordination, mainly concerning the functioning of WikiProjects. The methodology covers qualitative and quantitative research, as well as the research hypotheses and data collection method. The research results identify the Wikipedia environment evolution stages and verify the assumed hypotheses.

2. Literature review

When many social initiatives emerged online at the outset of the 21st century, it was assumed that spontaneously forming crowds would become increasingly important in creating and disseminating knowledge. However, it turned out that in Wikipedia, shapeless groups quickly transform into organized communities (see: Dobusch and Kapeller, 2017). Communities, unlike crowds, create networks between users who often interact with each other and consciously build joint action strategies. While openness and transparency foster greater engagement in coordinating the actions of many individuals, they can also lead to increased tensions. In turn, the occurrence or levelling of tensions depends on the fit of the joining novices and configurations of strategizing practices (Felin et al., 2017, p. 172 after Dobusch and Kapeller, 2017). It results in the constant negotiation of action strategies. Some researchers note that a small minority of the most entrenched users control adherence to the rules, which are often unavailable to novices (Shaw and Hill, 2014; Gilbert and Zachry, 2015).

The users' knowledge is essential for coordination in terms of what actions to take to adapt their competencies and interests to the current community needs (Forte et al., 2012). In order for this knowledge to be shared effectively, some Wikipedians need to give up content creation in favour of coordinating the activities of others. Collaborative tools are developed globally at the MediaWiki software level, in local Wikipedia language versions, or at the WikiProjects theme level (see: Morgan et al., 2013). Some of them make it easier to perform actions (e.g., adding footnotes), while others facilitate the identification of problematic behaviour (vandalism, spam). They not only contribute to greater efficiency, but become integral to the core user experience (Geiger, 2014; Gilbert and Zachry, 2015).

There are two types of coordination mechanisms in peer production communities. The first concerns the effective communication of social information, e.g., regarding rules and procedures. The second type is algorithmic mechanisms, understood as the transformation of formal or informal rules into algorithmic instructions executed by bots or scripts. Algorithmic mechanisms can be scalable and limit arbitrary behaviour, while social mechanisms can cope with exceptional situations better. Edits performed by automata are generally not challenged by community members (Geiger, 2011; Müller-Birn, Dobusch and Herbsleb, 2013).

Depending on the type of task and the size of the group, the costs of cooperation increase. This can lead to results that are much weaker than expected. According to Brooks's Law, adding manpower to a delayed software project makes it more delayed (Brooks 1975 after Kittur, Lee, and Kraut, 2009). If a task is performed independently of others, an increase in the number of project members does not increase coordination costs, but they become larger as such dependencies increase. In Wikipedia, previous studies have shown that simple tasks attract more people and produce good results for low coordination tasks. In the case of high coordination tasks, the benefits occur for small teams. (Kittur, Lee, and Kraut, 2009).

The issue of community dispersal is also problematic for coordination in online communities of practice. The lack of formal guidelines on how to perform work limits the effectiveness of self-organized groups. Frequent contact between individuals is essential here. However, the dominant forms of communication are asynchronous, leading to misunderstandings. As a result, discontinuity problems are common, and initiatives are abandoned as a result (see: Armstrong and Cole, 2002; Watson-Manheim, Chudoba, and Crowston, 2012; Rezgui and Crowston, 2018).

There is no clear link between belonging to a WikiProject and the type of work carried out - creating content or coordinating the work of others. Only a minority of WikiProjects contain groups of closely cooperating users, often coordinating activities and jointly editing the content of encyclopedia articles concurrently. In most cases, interaction is the responsibility of a small subgroup within the larger WikiProject community, which participates less in terms of creating article content (Morgan et al., 2013).

The collaborative literature lacks a broader view of Wikipedia as an evolving socio-cultural system. Making statements about change occurring is insufficient to accommodate such an approach, but there is also a need to identify what the evolution is acting upon. Concerning management, Nelson and Winter (1982) found that the primary element that would need to be studied in work organization evolution is that of routine activities. Stańczyk-Hugiet, Piórkowska, and Stańczyk (2016) point out that issues concerning optimizing an organization's strategy, life cycle, and adaptation to its environment are also studied in this area. In Wikipedia, it is impossible to easily categorize activities in terms of co-created content. Instead, user activity logs can be used, while also

broken down by type and activity area. In the context of activity coordination, the editing frequency of pages related to the meta-space (where public discussions often take place) and WikiProjects (if there is a dedicated meta-space in a given language version) can be taken into account. Wikipedia pages that are not articles, depending on their function, are located in different namespaces, and their titles have specific prefixes (e.g., Wikipedia: or Wikiproject:). In this article, the author focuses on a descriptive account of the evolution of forms of coordination, as well as on a quantitative account of the variation in meta-space and Wikiproject space editing by individuals claiming affiliation with WikiProjects.

3. Methodology

To examine the evolution of coordination in Wikipedia, both qualitative and quantitative research methods were used. The qualitative research was netnographic by nature (see: Kozinets, 2010). It included systematic participant observation that has been carried out since 2005, mainly on the Polish-language Wikipedia, and discourse analysis on Wikimedia projects. Regarding forms of coordinating work, the observation also included several of the major language versions. Participation meant taking an active part in editing pages, undertaking and initiating discussions on collaboration issues, as well as co-creating collaboration strategies. In addition, notes were kept on field research, and documentation was collected to track significant changes in Wikimedia (see: Skolik, 2014). This approach made it possible to outline the evolution of coordination forms in Wikipedia and formulate research questions and hypotheses.

The quantitative research was conducted in February and March 2022. The author posed the question as to whether the style of user activities changes with Wikipedia's development. In addition, he wanted to find out whether participation in more WikiProjects translates into overall user activity and user activity related to the activity coordination.

In order to answer the questions put forward, the following hypotheses were formulated:
H1. The more WikiProjects a Wikipedian participates in, the greater their overall activity on Wikipedia.
Wikipedians, as volunteers, decide for themselves what they want to do and how often they edit on Wikipedia. Not all active users even belong to WikiProjects. The number of activity areas should therefore not affect the overall activity. However, declaring participation in more WikiProjects may increase intrinsic motivation to edit.

H2. The more WikiProjects a Wikipedian participates in, the higher their activity in WikiProjects relative to their overall activity.
Declaring an activity in a WikiProject may involve more of a commitment to coordination. This generally means higher costs for creating encyclopaedia content due to the need to coordinate activities with other WikiProject members.

H3. Wikipedia editing style changes over time which is evident in the editing statistics of Wikipedians from different "generations."
With the experience of the whole community, new rules of operation are developed, translating into changing forms of cooperation. New solutions may be more attractive to newcomers than people who are used to older arrangements for coordinating work.

People who declared such participation on their own user pages were selected as participants of the WikiProject. An alternative way would have been to choose people who had signed up for a particular WikiProject, but indicating this on one's own page was considered a more straightforward declaration of participation. The number of edits made was taken as an indicator of Wikipedians' activity. Overall activity, in this case, means the number of all edits made by a user. Edits refer to the creation and modification of Wikipedia page content. Changes in the average number of all edits, edits in meta-space and edits in Wikiproject space were taken as changes in editing style. Wikipedians who set up their user pages in five-year periods were arbitrarily chosen as the generation, starting with the first to declare themselves as members of WikiProjects. The creation of a user page indicates a stronger connection with the community.

The selection of language versions for the quantitative study was carried out in several stages. First, versions were selected in which declarations of WikiProject affiliation on Wikipedia pages could be easily identified. A particular category existing in 34 language versions (*Wikipedians by WikiProject*) was used for this purpose. In the next step, the language versions of Wikipedia in which a Wikiproject space existed were selected: Spanish,

French, Esperanto, Polish, Korean, Japanese, and Romanian. Due to the time-consuming nature of acquiring results, three of them were chosen for further research: Polish (plwiki), Korean (kowiki), and Romanian (rowiki), which belong to different language families. The PetScan tool generated data on user pages containing declarations of affiliation with WikiProjects. For plwiki, there were 2337 users, for kowiki 839, and rowiki 88. The final step in the data collection was to check how many WikiProject affiliation statements were on each user page, how many edits each Wikipedian had made, and to categorize the selected Wikipedians in terms of their affiliation to a 'generation.' XTools was used to count the number of edits made by a given user.

4. Results

Based on netnographic research, including multi-year participant observation, several phases in the evolution of forms of activity coordination on Wikipedia have been identified:

2001 - 2004: solution testing phase. Initially, coordination took place through user pages and external communication channels. Subsequently, meta spaces and discussion pages were assigned to each namespace. Some meta-pages were used to discuss the whole project or specific processes, e.g., discussions on deleting articles. Others were used to develop tutorials, policies, and guidelines, which were copied and used in different language versions. Communities tested the capabilities of wiki software in the context of collaborative work. The first wiki-projects in meta-space were also started (e.g., *Wikipedia:WikiProject Biography*).

2005 – 2008: phase of increasing diversity. In some language versions, a separate namespace was created for the WikiProjects (e.g., *Wikiprojekt:Biografie* in the Polish-language version). This was a time of intensive development of many areas of collaboration and recruitment of new Wikipedians. Forking tendencies were more prevalent in different collaboration rules, policy modification, specialized guidelines, and locally created tools (e.g., scripts). Such trends were also apparent in different patterns of collaboration within WikiProjects.

2009 - 2012: stagnation phase. Wikipedians had previously created new initiatives assuming that they would be sustainable. After 2008, the rapid growth in the number of edits and users broke down, and a phase of stagnation ensued. There were far fewer new initiatives, and some of the old forms were being phased out. In addition, it became more challenging to modify previously adopted rules, even if the communities admitted that they were flawed.

2013 - 2017: institutional support phase. There was the institutionalization of procedures for recruiting and motivating participation. Cooperation with external cultural and educational institutions for knowledge sharing became more frequent. Volunteers recruited from such institutions joined task forces that were poorly integrated into the Wikipedia communities. The gradual disappearance of activity in WikiProjects could be observed. Previously initiated spontaneous and short-term actions to develop a given area of knowledge turned into cyclical events.

From 2018: Formalization phase of the cooperation strategy. An institutional selection of initiatives that could receive further support from the Wikimedia Foundation, which looks after the projects, became apparent. There was some sustainability for those initiatives that had previously been explicitly formalized, e.g., in the form of interface changes. A global strategy for the Wikimedia movement began to emerge and values characteristic of corporate cultures began to be adopted. At the same time, spontaneous grassroots actions began to disappear.

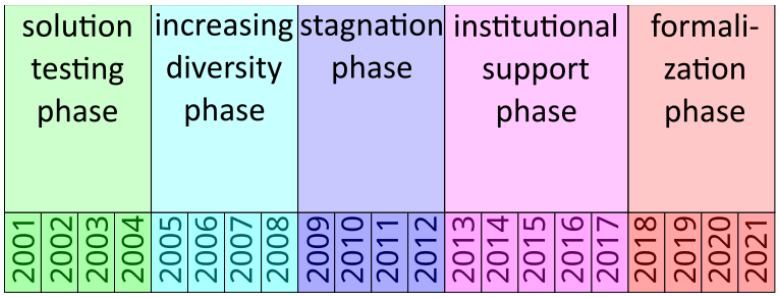


Figure 1: Timeline of the evolution of forms of activity coordination on Wikipedia

In parts of the quantitative research, the assumed hypotheses were verified. Data was collected from three language versions with a separate namespace for WikiProjects. It was also possible to identify Wikipedians

declaring participation in WikiProjects on their user pages. In plwiki, the namespace for WikiProjects was separated in 2007, while categories for WikiProject participants were created in 2006. In kowiki, the corresponding years were: 2011 and 2014, and in rowiki: 2007 and 2012. During the course of data collection, it was noticed that in the Polish and Korean language versions after 2010, WikiProjects created for cooperation with educational institutions appeared several times. Relatively many participants were enrolled in them, but their activity was low.

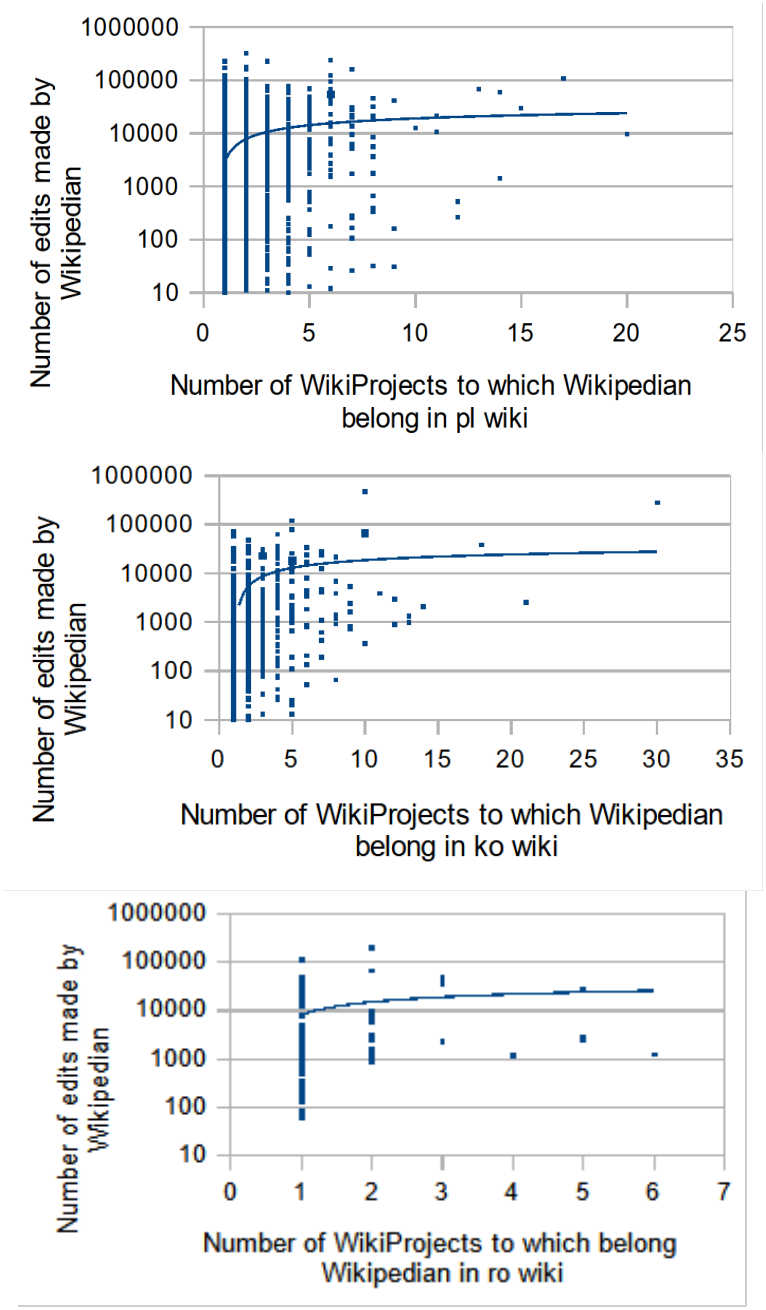


Figure 2: The relationship between the number of WikiProjects to which Wikipedians belong and the number of edits they have made. The data refers to users who have made a minimum of 10 edits in plwiki and kowiki (top two graphs) and a minimum of 50 edits in rowiki (bottom graph)

To verify H1, the correlation between the variables was calculated: (1) the number of WikiProjects to which Wikipedians belonged according to declarations on user pages and (2) the number of all edits made by them that were not deleted. As expected, there was a positive correlation between these variables for $p<0.05$, verifying H1. In plwiki, Spearman's rho correlation equals 0.327 for all users surveyed, 0.325 for those who made a minimum of 10 edits, and 0.325 for Wikipedians with a minimum of 50 edits. In kowiki, these values were 0.410; 0.393 and 0.350 respectively. In rowiki, the correlation's strength was the highest at 0.640 for all surveyed users

and 0.400 for Wikipedians, with a minimum of 50 edits. It is noticeable that the strength of the correlation was moderate and decreased as Wikipedians' activity increased. The logarithmic regression curves for these variables are shown in Figure 2.

To verify H2, the author examined the correlation between the variables: (1) the number of WikiProjects to which Wikipedians belonged, according to declarations on user pages, and (2) the ratio of the sum of edits they made in the Wikiproject space and in the WikiProject discussion space to the number of all edits they made. Significant correlations were found only in the Romanian-language version of Wikipedia. In this case, Spearman's rho correlation equals 0.642 for all subjects and 0.302 for Wikipedians who made at least 50 edits. No statistically significant correlations were obtained for participants in the Polish and Romanian language versions of WikiProjects. In spite of the significant correlation between variables, in rowiki H2 was rejected. Declaring participation in a more significant number of WikiProjects may therefore affect the total number of edits made, but does not necessarily translate into greater involvement in coordinating activities.

In order to verify H3, descriptive statistics were compared for four variables concerning an arbitrarily selected four 'generations' of Wikipedians. These variables were as follows: (1) the number of total edits made by individual Wikipedians, (2) the number of edits made by them in total in the Wikiproject space and in the Wikiproject discussion space, (3) the number of edits made by individual Wikipedians in the meta-space, and (4) the proxy of edits in the WikiProject relative to the total number of edits made by individual Wikipedians. The edits of Wikipedians declaring affiliation to Polish and Korean language WikiProjects were analyzed. The differences between the number of edits in subsequent generations are presented in box plots (Figures 3 and 4).

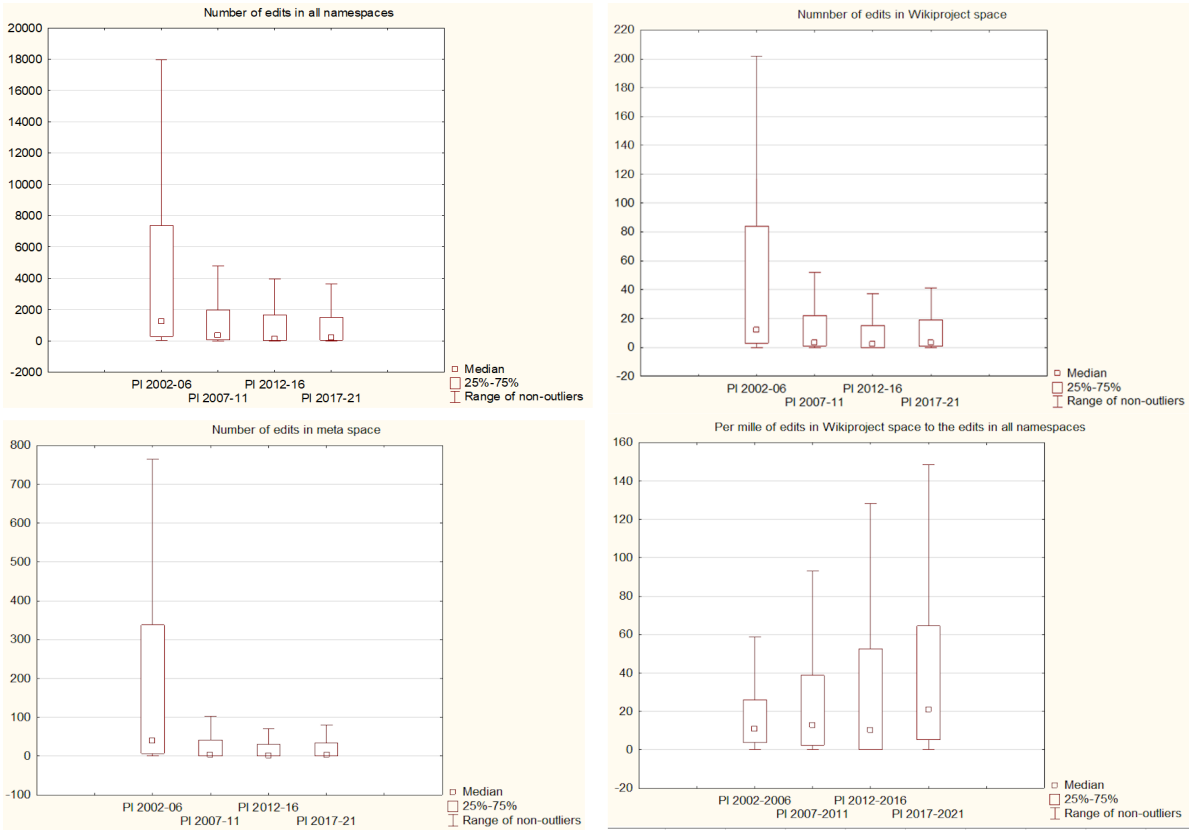


Figure 3: Changes in editing style across generations of plwiki users. Box plots show the total number of edits, the number of edits in WikiProjects, the number of edits in meta-space, and the number of edits in WikiProjects.

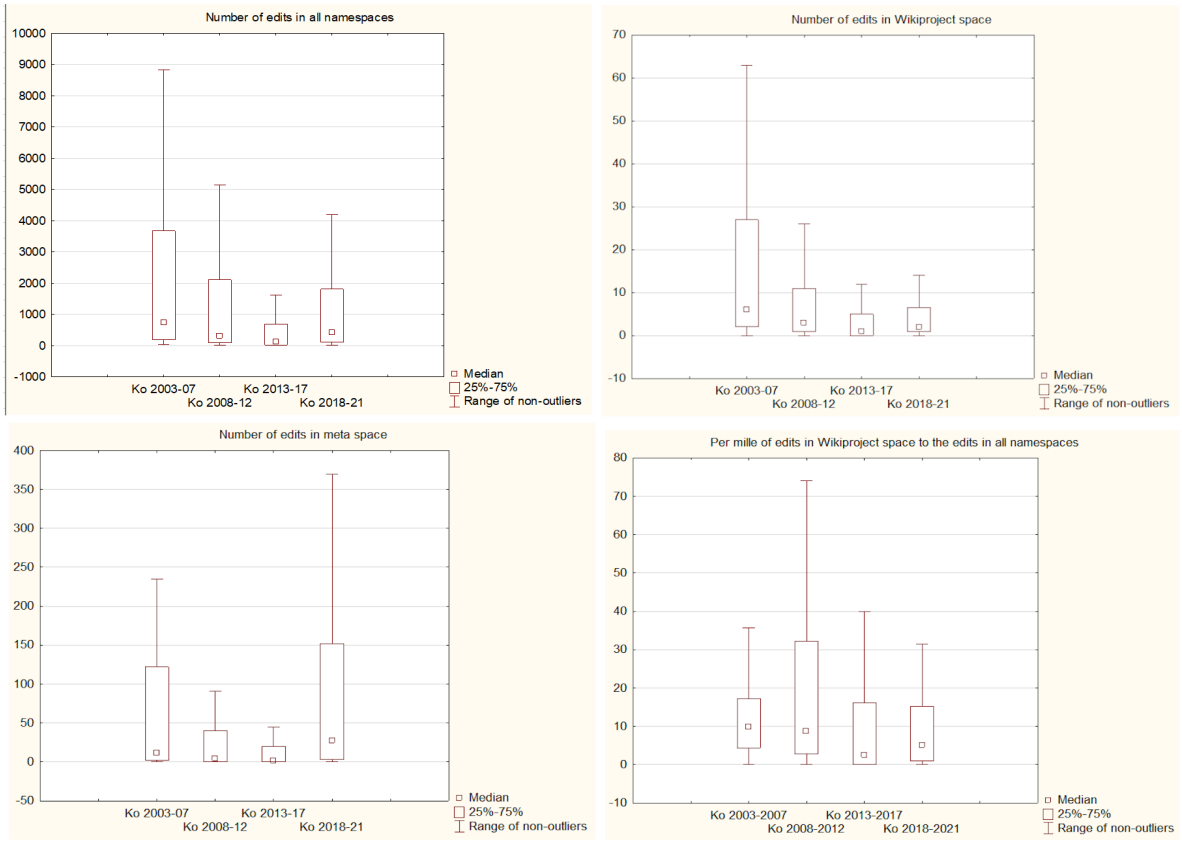


Figure 4: Changes in editing style across generations of kowiki users. Box plots show the total number of edits, the number of edits in WikiProjects, the number of edits in meta-space, and the number of edits in WikiProjects.

Most of the participants in the WikiProjects belonged to the second generation. In plwiki, it was 1225 people, while in kowiki 363, which represented almost half of the respondents in both cases. In contrast, people from the first generation were the most involved. They made the most edits, including edits in meta-space and in WikiProjects. However, this did not translate into the proportion of edits related to coordinating activities. In the Korean version, the ratio of edits in WikiProjects to the total number of edits was slightly higher in the first two generations. In plwiki, it increased with each generation. The accepted hypothesis can be verified positively, however partially. In plwiki, there is a clear difference between the involvement of the first and subsequent generations. In kowiki, there is a downward trend and a renewed increase in commitment in the last generation.

5. Discussion

Performing quantitative research using a netnographic approach allowed the author to capture the relationship between diversity and engagement. Less variety in the forms of collaboration may have weakened the motivation to act among users. The increase in the number of WikiProjects to which Wikipedians belonged encouraged their greater activity. At the same time, the creation of new forms of collaboration decreased from 2009 onwards, with some initiatives subsequently dying out.

Greater diversity may initially have been associated with spontaneity in creating new initiatives. Over time, the technostructure expanded, and the personal stake in engaging internet users to collaborate shifted to automated and templated messages. Gaio et al. (2009) hypothesized that template messages posted to articles and prompting people to edit were a fundamental coordination mechanism. However, they were often treated as unnecessary embellishments outside the English language version and were gradually eliminated in some language versions. Similarly, the assumption of Müller-Birn, Dobusch, and Herbsleb's (2013) that bot edits are not challenged because adverse reactions to their actions are not visible would have to be rejected. This is more a result of trust in the bot operators rather than the bots themselves, which by default are not visible in the changelogs. On more than one occasion, however, users expressed a lack of trust in particular bot operators.

Stagnation was associated with the habits of using developed forms of collaboration. Thus, tensions between newly joining users and practices developed by active users (Dobusch and Kapeller, 2017) are not unique to describing coordination problems. Furthermore, the emphasis on facilitating activities for newcomers leads to changes in such practices and interface changes, which creates tensions between active users and the initiators of such changes.

The reduced activity among the next generation of Wikipedians surveyed may have been related to the problem of control over the results of activities in individual WikiProjects. The need for greater control necessitated spending more time on preparation and, as a result, dampened enthusiasm for the tasks. Over time, regular campaigns with simple, easily controlled tasks became more popular than regular WikiProjects. When several actions were organized simultaneously, only a few people participated in each of them. This resulted in lower efficiency as Kittur, Lee, and Kraut (2009) showed that simple tasks work better when more people are involved.

Limiting activity among subsequent generations of the surveyed Wikipedians may have been associated with the problem of controlling the results of activities in individual WikiProjects. Newcomers have to master rules that were created by previous generations. Goldspink (2009) argued that user engagement is less influenced by reputation and more by identification with the community and values. Nevertheless, these observations applied to Wikipedians who were active until 2009 and participated in creating the rules. After that, it was more common for users to use their own pages to brag about their achievements, which fostered competition rather than cooperation.

The quantitative research results presented here concerned a narrow scope of activity. It concerned editing pages dedicated to coordination activities, namely WikiProjects and meta pages. Not every such edit had to be associated with a coordination activity, and coordination itself may also manifest itself in undertaking discussions in other namespaces. The hypotheses adopted require further verification, involving more language versions of Wikipedia.

6. Conclusions

Based on the research conducted, a conclusion may be drawn about the relationship between the diversity of coordination forms and motivation to work. If the total number of edits increases with the number of projects to which a Wikipedian belongs, a decrease in the number of active WikiProjects may contribute to a reduction in the motivation to work. A large variety of choices of work to be done may engage people more effectively in the action at hand.

Although the non-professional knowledge workers on Wikipedia are volunteers, over time, they may develop an inner compulsion to continue what they have started or even a form of editing addiction. Routine activities may compensate for the lack of spontaneous approaches to co-creation that characterized the early stages of the project's development when there was a high level of approval for testing. When a systematic approach is widespread, it is easier to impose rules close to those of formalized organizations.

The hypotheses posed have been partially verified and are insufficient to generalize conclusions in terms of the entire population. Their confirmation in a larger number of language versions would require much more time for data collection and analysis, but also the involvement of social experts operating in different language versions of Wikipedia.

References

Armstrong, D.J. and Cole, P. (2002) *Managing distance and differences in geographically distributed work groups*, In: P. Hinds and S. Kiesler (eds.), *Distributed Work*, MIT Press, Cambridge, pp. 167–186.

Brooks, F.P. (1975) *The mythical man month*, Addison-Wesley Longman Publishing Co., Inc. Boston, MA.

Deutsch, M., Coleman, P.T., and Marcus E.C. (2011) *The handbook of conflict resolution: Theory and practice*, John Wiley & Sons, San Francisco.

Dobusch, L. and Kapeller, J. (2017) "Open strategy-making with crowds and communities: Comparing Wikimedia and Creative Commons", *Long Range Planning*, Vol 51, No. 4, doi: 10.1016/j.lrp.2017.08.005.

Felin, T., Lakhani, K.R., Tushman, M.L. (2017) "Firms, crowds, and innovation", *Strategic Organization*, Vol 15 No. 2, pp. 119-140.

Forte, A., Kittur, N., Larco, V., Zhu, H., Bruckman, A. and Kraut, R. (2012) *Coordination and Beyond: Social Functions of Groups in Open Content Production*, In: Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW, Seattle, Washington, pp. 417-426.

Gaio, L., Rossi, A., Besten, M. and Dalle, J.-M. (2009) *Coordination, Division of Labor, and Open Content Communities: Template Messages in Wiki-Based Collections*, Department of Computer and Management Sciences, DISA Working Papers, University of Trento, Trento, pp. 1-17.

Geiger, R.S. (2011) *The lives of bots*, In: G. Lovink and N. Tkacz (eds), *Critical point of view: A Wikipedia Reader*, Institute of Network Cultures, Amsterdam, pp. 78–93.

Geiger, R.S. (2014) "Bots, bespoke, code and the materiality of software platforms", *Information, Communication & Society*, doi:10.1080/1369118X.2013.873069

Gilbert, M., and Zachry, M. (2015) Tool-Mediated Coordination of Virtual Teams in Complex Systems, In: *Proceedings of the11th International Symposium on Open Collaboration (OpenSym '15)*. ACM, San Francisco, Art. 12, doi: 10.1145/2788993.2789843.

Goldspink C. (2009) "Social Self Regulation in On-line Communities: The Case of Wikipedia", *International Journal of Agent technologies and Systems*, Vol 1 No. 1, pp. 19-33.

Haidt, J. (2014), *Prawy umysł. Dlaczego dobrych ludzi dzieli religia i polityka?*, Smak Słowa, Sopot.

Jemielniak, D. (2013) *Życie wirtualnych dzikich: netnografia Wikipedii, największego projektu współtworzonego przez ludzi*, Poltext , Warszawa.

Karczewska A., Kukowska K. (2021) *Cultural Dimension of Femininity: Masculinity in Virtual Organizing Knowledge Sharing*, In: A. Garcia-Perez, L. Simkin (eds.), *Proceedings of the 22 nd European Conference on Knowledge Management ECKM 2021*, pp. 414-422.

Kozinets, R.V. (2010) *Netnography: Doing Ethnographic Research Online*, Sage, Thousand Oaks.

Kittur, A., Lee, B. and Kraut, R. (2009) *Coordination in Collective Intelligence: The Role of Team Structure and Task Interdependence*, In: Proceedings of the 27th International Conference on Human Factors in Computing Systems, CHI 2009, Boston, pp. 1495-1504.

Manc-Bogdańska, B. (2009) *Koordynacja w zespołach zadaniowych. Perspektywa dynamiczna*, In: Borkowski, W., Winkowska-Nowak K. (ed.) *Układy złożone w naukach społecznych*, Scholar, Warszawa, pp. 79-136.

Morgan, J., Gilbert, M., McDonald, D. and Zachry, M. (2013), *Project talk: coordination work and group membership in WikiProjects*, In: Proceedings of the 9th International Symposium on Open Collaboration, WikiSym + OpenSym 2013, Hong Kong, doi: 10.1145/2491055.2491058.

Müller-Birn, C., Dobusch, L. and Herbsleb, J.D. (2013) *Work-to-rule: the emergence of algorithmic governance in Wikipedia*, In: Prinz, Wolfgang and Satchell, Christine (ed.), *Proceedings of the 6th International Conference on Communities and Technologies*, ACM, New York, pp. 80-89.

Nelson, R.R., Winter, S.G. (1982) *An Evolutionary Theory of Economic Change*, Belknap Press, Cambridge.

Platt, E.L. and Romero, D.M. (2018) *Network Structure, Efficiency, and Performance in WikiProjects*, In: Proc. 12th International AAAI Conference on Web and Social Media (ICWSM), pp. 251-260.

Rezgui, A. and Crowston, K. (2018) *Stigmergic Coordination in Wikipedia*, In: Proceedings of the 14th International Symposium on Open Collaboration, ACM, Paris, Art. 19, doi: 10.1145/3233391.3233543.

Skolik, S. (2014) Qualitative Research on the Organization of Work in Internet Prosumer Projects, In: D. Jemielniak (ed.), The Laws of the Knowledge Workplace. Changing Roles and the Meaning of Work in Knowledge-Intensive Environments, Gower, Surrey.

Stańczyk-Hugiet, E., Piórkowska, K., Stańczyk, S. (2016) "Ewolucyjny nurt w naukach o zarządzaniu. Stan wiedzy", *Przegląd Organizacji*, Vol 2, pp. 7-15.

Shaw, A. and Hill, B.M. (2014) "Laboratories of Oligarchy? How the Iron Law Extends to Peer Production", *Journal of Communication*, doi:10.1111/jcom.12082

Watson-Manheim, M.B., Chudoba, K.M. and Crowston, K. (2012) "Perceived discontinuities and constructed continuities in virtual work", Information Systems Journal, Vol 22, No. 1, pp. 29–52.

Wikipedians by WikiProject, [online], https://www.wikidata.org/wiki/Q7216670, (accessed on 2022-03-01).

Cultural Semiotics in Strategy Conversation: Taking a Position on Strategy Through Knowledge Transfer

Graeme CM Smith
Solent Business School, Solent University, Southampton, UK
graeme.smith@solent.ac.uk

Abstract: This study reviews knowledge management as a construct for analysing strategy discourse; identifying key strategy artefacts; and how they may be interpreted by key stakeholders engaged in strategy discourse. The importance of storytelling and narrative in the development of strategy is recognised. In developing the notion of strategy as a people orientated construct, this study provides a theoretical foundation for the determination of how stakeholders in strategy may take a position on strategy. This study defines an organisational model of the social interactions affecting knowledge transfer within organisations arising from problems of knowledge location, retention, and transfer. This ontological enquiry captures the epistemological characteristics of strategy artefacts interpreted by stakeholders in a senior management team. This paper goes on to underpin the value of a semiotic view as a diagnostic tool to determine the position that stakeholders take in the context of existing strategy discourse. From an etymological perspective this study posits a typology based upon a semiotic framework to help diagnose how stakeholders take a position based on their interpretation of key strategy artefacts; and to understand the nature of interpretation as a means of intervention by which the strategy narrative may be reshaped. What is of interest is how storytelling and narrative empowers individuals as they seek to disseminate and transfer knowledge from the past to shape the future. This study reveals the inflection that individuals may exert on knowledge artefacts; and the motivation of those who trade in knowledge assets, through storytelling and narrative, as players in the game of strategy search for coping strategies to adapt to the new reality. Ultimately this study provides new insight into the power of semiotics in the early stage; and constructivism in the later stages of the knowledge management continuum; and describes how participants in strategy adopt a position on strategy.

Keywords: knowledge management, knowledge transfer, critical discourse analysis, semiotics, strategy discourse, story telling and narrative

1. Introduction

There is a symbiotic relationship between knowledge management and strategy discourse in seeking to control strategic outcomes through storytelling and narrative (Sloan, 2017). There is a considerable weight of argument (Jelenc, 2009; Loncar, 2017; Skokan et al., 2013; Sloan, 2017) that views strategic thinking as an intent-driven approach to strategy formulation that includes inquiry, reflection, and discourse as knowledge is transferred through a dialogue that continually tests and challenges the underlying premise of the strategy. At the heart of successful business strategies is the ability of senior and middle managers to interpret meaning, and transfer that meaning through storytelling and narrative (Jorgensen & Boje, 2006). This interpretation suggests that interaction between stakeholders within the business seems to change the meaning of strategies through the interpretive lens of Semiotics.

(Mouritsen, 2004) develops this line of enquiry by asserting that intellectual capital gains its legitimacy from its capacity to intervene in the worldview of others. state that these human constructs are not innocent concepts, tools, or methods; they are instruments used by stakeholders in changing social reality and therefore cannot be separated from relations of power. (Chandler, 2007) views semiotics in the same way that (Blackman & Smith, 2006) do, but from a knowledge transfer perspective all of this is based upon (Stamper et al., 2001) and (Miles et al., 1978). It is this concourse that ultimately led to Semiotics in Strategy by (Smith, 2013).

1.1 Strategy Discourse

Strategy can be framed as a knowledge management issue if it can be regarded that knowledge transfer is a construct of strategy discourse (Zheng et al., 2010). Knowledge management combines several theories (Baskerville & Dulipovici, 2006) from existing research into a caucus of innovative concepts of its own. Knowledge may be framed as beliefs, norms and values that provides a framework for evaluating and contextualising new experiences. Originating in the minds of others, in organisations, it may become documented in routines, processes, practices, norms and folklore through storytelling and narrative (Davenport & Prusak, 2000).

It is this concept of strategy as discourse that is of increasing interest (Ezzamel & Willmott, 2008). Academic researchers have drawn on a variety of discursive approaches to study strategy in this context adopting a post-

structuralist approach (Knights & Morgan, 1991), critical discourse analysis (CDA) (Balogun et al., 2014), narrative perspectives (Barry & Elmes, 1997; Fenton & Langley, 2011); and rhetoric (Samra-Fredericks, 2005) to better understand the linguistic aspects of strategy discourse.

While CDA is rooted in the study of applied linguistics and explores the power implications that may exist in social intercourse through strategy discourse (Laine & Vaara, 2007), it also focusses on storytelling and narrative practices more generally (Balogun et al., 2014). A narrative perspective encourages a focus on storytelling in organisations (Boje, 2001). According to (Johnson, 2006) strategic conversation is separable from the related construct of strategic thinking in that:

1. It occurs throughout the organisation and not just in the senior management domain.
2. It involves explicit communication between staff members.
3. And recognises that strategy conversation is quite separate from strategy planning and occurs before, during and after strategy planning in both a formal and informal basis.

There has also been work examining how strategy discourse is used to legitimise and naturalise particular actions, activities and artefacts such as airline alliances in (Vaara et al., 2004); or strategic plans (Vaara et al., 2010); and (Samra-Fredericks, 2005) examined how actors can use rhetorical skills to position themselves as knowledgeable in terms of strategic planning, enabling them to obtain power and authority. Here the focus is on strategy not as a noun (what an organisation is or has) but as a verb (strategise); what strategy does. (Fontanille, 2012) argues that this semiotic function occurs as actors accomplish a division between our exteroceptive and interceptive worlds. This world view takes the form of “taking a position”. The transitive nature of “taking a position” is the act of prolonging an existing axiom whilst in the process of creating a new axiom via the process of semiosis

1.2 The Semiotic Landscape

The field of semiotics as characterised by Saussure, and Peirce et al (Jastroch & Marlowe, 2010), follows the notion that communication is based on codes consisting of symbols and signs interpreted by cultural convention, which has numerous implications for the sourcing, sharing and use of knowledge The underlying hypothesis of semiotics is that any communication system works on the basis of codes. Codes are systems of symbols which are determined by cultural convention for the purpose of representing information and transferring it from a point of origination to a destination (Jastroch & Marlowe, 2010). They must be shared so that decoding becomes possible.

Semiotics involves the study of 'signs' (codes) in language, and of anything which 'stands for' something else. In a semiotic sense, signs take the forms of words, images, sounds, gestures, and objects (Chandler, 2007). Semiotics is the study of signs and sign-using behaviour. It focuses on meaning derived rather than the choice of words. This theory of signs tries to generate laws & principles that explain the signification process. Peirce categorised signs into three main types:

1. An icon, which resembles its referent (such as a road sign for an accident-prone area);
2. An index, which is associated with its referent (as smoke is a sign of fire); and
3. A symbol, which is related to its referent only by convention (like the red light at a traffic signal).

(Peirce, 1931) demonstrated that a sign can never have a definite meaning, and that the meaning must be continuously qualified. This implies that even though people seemingly use the same language, generation of meaning is a unique internal experience, which means that no two people will generate identical meanings from any given construct. Peirce in (Bergman, 2009) focuses on communication as an ongoing process of signification. Peircean semiotics is seen as a philosophy of communication, in addition to its being a theory of signs that may be applicable to the study of rhetoric (strategy discourse). Peirce defines rhetoric as a condition under which a sign may determine the interpretant sign of itself and of whatever it signifies, or may as a sign, bring about a physical result (Bergman, 2009).

This paper develops the notion of knowledge management as a basis for organisational learning set in strategy narrative. And develops this philosophical position through the lens of semiotic theory, and the importance of semiotics, to storytelling and narrative in the context that regulate behaviour toward establishing a position in strategy. In this paper, the focus is not so much on the stakeholders of discourse, but rather the influences on why strategy conversation changes as the nature of the story is changed.

1.3 The Basis of a Semiotic Approach

It is this sense of meaning making as stakeholders transfer knowledge, which requires a semiotic view on the interpretation of signs and codes in storytelling and narrative that lies at the heart of this enquiry. In his work on the Semiotic Ladder (Stamper, 1973), Stamper's view on signs as physics, empirics, and social world; are not that far removed from Peirce's triadic semiotics defined as Representamen, Object and Interpretant. The purpose of these constructs was to define a process by which individuals make sense of signs and codes. What they have in common is context in the sense that stakeholders in strategy seek to establish a position through their interpretation of signs and codes inherent in strategy narrative (Warren, 1999) in (Smith, M., 2010).

Storytelling and narrative in strategy is the product of formal and informal relationships between individuals and groups. This interpretative process requires an articulation and application of strategy artefacts, facilitated through interaction and shared experience (von Krogh et al., 2012). (Inkpen, A. C., 2000) also identified transparency or openness in interpretation, as critical for consensus in strategy. (Robichaud et al., 2004) argue that language, spoken or written in texts, is the key to understanding how an organisation can be both a single entity and be made up of many different entities, and it is through an analysis of organisational discourse that a meta-conversation can be identified. Meta-conversation is presented as a bridge to opposing views that are seen at one and the same time, to be pluralistic and unitary; multivocal and univocal.

Thus, semiotics is a theory of how actors produce, interpret, and negotiate meaning of strategy through signs. A sign which the interpreter has signified gives us an insight into their 'stance' in the world, with respect to a specific part of the world, that part framed by the interest of the interpreter. The caliginous nature of the sign sets the intensity of the process of interpretation by the observer as they seek to reduce ambiguity and doubt; and acclimate to a new convention. In so doing, observers start to adopt a spatial relationship where world views approximate either in a univocal or plurivocal stance. This semiotic function of deconstructing and contesting the realities of signs will therefore reveal whose realities are privileged and those who are not (Chandler, 2007).

1.4 The Research Gap

Substantial research and existing literature resources seem to have a preoccupation and focus on the outcomes of strategy in terms of failure or success. The problem with this focus is that the genesis of success or failure of strategy is spatially quite far removed from the outcome of strategy. The gestation and development of strategy is an intensely people orientated process; and to that end, the success or failure of the strategy is fundamentally reliant on how key stakeholders (actors) interpret a wide array of data and information (artefacts) as part of a dynamic strategy narrative that seeks consensus in forming objectives usually in a shifting dynamic strategy environment. (Gagne, 2009) acknowledges that the study of knowledge in organisations has included studies on the nature of knowledge and on the process of knowledge sharing but she also asks for a more complete diagnosis of strategy narrative intervention, as well as the critical evaluation and review of existing models of knowledge-sharing behaviour. (Emenalo, 2011) further discusses what is described as the human-centric theory without detailing the politics that may motivate the trading of strategy artefacts. In recent years there has been an attempt to codify organisational culture within the field of strategy as practice (Johnson, G. et al., 2008); and there is a burgeoning caucus of literature on the science of semiotics as a means of intervention in advertising (Chandler, 2015), and wider social research (Chandler, 2007).

However, there has still been no serious attempt at using semiotic theory to diagnose the durability of the strategy narrative. Nearly 10 years later not much seems to have change according to (Sitz, 2008) who proposed a 'semiotic' analysis from a hermeneutic perspective on discourse analysis. While Jastroch and Marlowe (2010) recognised the need to research changes in meanings attached to strategy discourse through a semiotic process.

Many readers of strategy have flirted with the notion of semiotic theory in the field of strategy as practice, but the flirtation is fleeting and does not attempt to read strategy from a semiotic locus in depth. This hasn't stopped some readers from advocating that this is perhaps an area of future study. As far back as 2000 there was an appreciative research gap into the use of semiotics to diagnose strategy narrative (Easterby-Smith, M., 1997; Easterby-Smith, Mark, 1999; Evans & Easterby-Smith, 2000).

2. Methodology

The locus of this research was the senior management strategy team at Solent University. The university had just invoked a new strategy that invoked organisational change as it faced challenge market conditions in the

provision of higher education in the United Kingdom, which had been subjected to significant deregulation pursuant to Government policy changes.

The research was both exploratory, in the sense that this research seeks to understand the interpretation of artefacts in strategy that influence stakeholders in taking a position using existing semiotic theory; and exploratory in the sense that this research attempts to elucidate why stakeholders in strategy may take such a position and uncover the abductive reasoning (Atkin, 2008; Peirce, 1931) (also called abduction, abductive inference, or retroduction) of logical inference starting with an observational set of variables (signs, codes, and icons).

Each code was enveloped in a short narrative to identify meaning for the respondents. To seek the simplest and most likely explanation for taking a position as a means of management intervention; as a form of pragmatism, an approach that evaluates beliefs in terms of the success of their practical application. This research used a Q-Sort methodology (Krivokapic-Skoko & O'neill, 2011; Watts, S. & Stenner, 2012; Zabala et al., 2018), that helped establish a discovery of how stakeholders in strategy take a position and explore the possibility that the semiotics of strategy may elucidate a more instructive set of statements for the Q-Set Concourse.

2.1 Why Q Sort?

Q Methodology yields more nuanced and complex opinion (Kamal et al., 2014). It offers a middle ground between the structure of surveys and the depth of interviews and combines the advantages of both. It is most frequently administered with individuals, and in such cases, it is relatively free of certain psychological biases such as dominance effect (Mukherjee et al., 2015), which can affect methods administered in groups (e.g., focus group discussions) (Rastogi et al., 2013). Thus, the Q-sort should identify what the participants‟ perspectives give to the subject, not just their perspectives in general but the social viewpoint (Watts & Stenner, 2012).

2.2 Concourse and Condition of Instruction

In Q Methodology the term concourse is used to refer to the totality of communication on a topic. It also acts as a 'condition of instruction' (Watts, S. & Stenner, 2005) for the participants and guides the sorting process. It is intentional that the construct of each statement was generic for each of the 47 codes identified as having meaning in the strategy narrative, based upon the ubiquity of the symbols and artefacts in strategy discourse.

The condition of instruction provides the context by which respondents interpret each of the 47 codes and place them on the grid:

To what extent do you agree with the following statements in regard to the current Solent University Strategy?

The research question plays an important part in any Q Methodology study. It dictates the nature and structure of the Q-Set generated. It also acts as a 'condition of instruction' (Watts & Stenner, 2005) for the participants and guides the sorting process. In addition, (Wint, 2013) mentions that it is a suitable research approach for a sensitive topic, such as strategy development, where the participants could express their opinions based on their experience by sorting the Q-set, without embarrassment or fear of sanction.

5	4	3	2	1	0	-1	-2	-3	-4	-5
1	2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21	22
	23	24	25	26	27	28	29	30	31	
		32	33	34	35	36	37	38		
			39	40	41	42	43			
				44	45	46				
					47					
2	3	4	5	6	7	6	5	4	3	2

Scale

Q Set

Concourse

Figure 1: Q-Set Concourse

2.3 Sampling

The primary interest of this study is to establish key dynamics in strategy and how these may influence the outcome of strategy. To that end the Senior Management Team at Solent University was identified as a possible locus for this research. This stakeholder group was involved in the development and implementation of a strategy in a large city-based University challenged my significant changes in the higher education market. The strategy had been agreed three years prior to this study and the senior management team was actively involved in the operationalising of this strategy. There were 18 people in this group that included the Vice-Chancellor; Head of Strategy Development; and the Heads of School from across the organisation.

2.4 Data Collection and Extraction

The research tools were sent to all members in the senior management group. URLs were provided for online access to the survey instrument, and this solicited 10 respondents out of the 18 that constitute the group, a 55% response rate. There was some intervention by the researcher with some respondents who required assistance to help them navigate through complexity in the online tools. The methods of data extraction techniques used IBM SPSS 24 software calculating the Q Sort data derived from the respondent base. The basis of this analysis was used to interpret the data and justify findings from the source data. The relationship of variables to the underlying factors was determined by the weighting in the eigenvalues and factor loadings using factor analysis techniques. These loadings were indicative of perceptions held because of interpretation of strategy narrative codes.

3. Data Analysis and Findings

This initial investigation by factor analysis suggested a strong univocal voice in the strategy narrative and it appeared that the level of ambiguity was low. (Chandler, 2007) defines a univocal narrative as one where there is clear consensus, however the lower factor loadings do suggest a pattern of divergence from this univocality concourse. (Robichaud et al., 2004) suggest an alternative approach to that presented above in the notion of meta-conversation conferred as a means of illuminating opposing views to be 'pluralistic and unitary; or multivocal and univocal. As Chandler, (2007) defines a plurivocal ('polyvocality' where there are multiple voices) narrative as one where there is partiality in the way stakeholders interpret strategy narrative, since strategizing involves multiple contexts where competing goals and interests abound (Balogun et al., 2014).

The incidence of divergence from a univocal narrative gave rise to the notion of the existence of groupthink within the strategy group. Groupthink is a psychological phenomenon that occurs within a group of people in which the desire for harmony or conformity in the group results in an irrational or dysfunctional decision-making outcome (Janis & Mann, 1977) and this may give rise a tendency to filter narrative, a standard agency problem, where managerial disclosure preferences are not aligned with those of key stakeholders. Factor analysis was conducted on the Q Sort data to identify clusters of the variables (or items) and how they are inter-related to produce factors. The clusters of variables resulting from this analysis served as a reference to further investigate meaning as a strategy discourse (Asnawi et al., 2012).

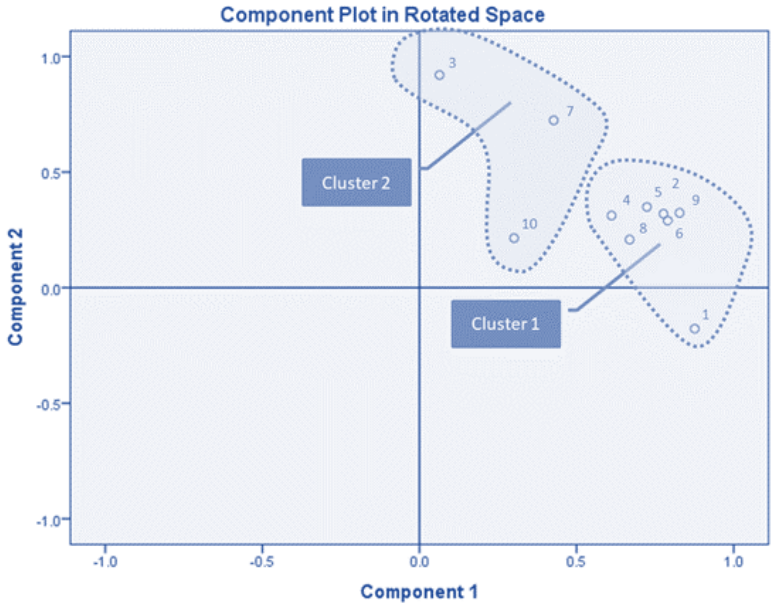


Figure 2: Factor Analysis Component Plot in Rotated Space by Respondent

The suggestion of sub-groups within the strategy group supports the (Watts & Stenner, 2012) view that the benefit of Q Factor Analysis is its focus on the correlation and analysis of similitudes among individuals, and at the same time is ideal for the purpose of development a typology. In this regard cluster analysis, to identify profiles and types of individuals that respond similarly to a certain set of variables. Consequently, individuals are factorised based on responses to variables, and not to variables based on responses given by individuals.

A suggestion in the data is one of a top-down strategy discourse that may be exhibiting the characteristics of discourse orthodoxy. According to (Johnson et al., 2008) rationality is a central component of the orthodox language of strategy and from a management perspective, appearing rational is key to making strategy, to be rational is to be seen within the strategy group to be making persuasive sense (Green, 2004). They may adopt this form of strategy discourse not just because they are themselves persuaded of the logic of a strategy, but because they believe that by doing so their arguments carry more weight with others, it is the typical way in which strategy is communicated or because, by so doing, it positions themselves as indispensable to strategy (Knights, 1992).

Failure in strategy is primarily due to widely divergent interpretation of strategy artefacts. In the process of habituation, it leads to a final logical interpretant that may lack stasis; is ambiguous, uncertain, anxious, and sometimes antagonistic (Bergman, 2009). This antagonism develops and intensifies as strategy narrative forms around the artefacts and is subsequently earned in a hostile environment full of agency that demands contingency. The success of contingency ultimately depends on the ability of strategy stakeholders to interpret new artefacts and habituate new logical interpretants safely.

3.1 Cluster 1 Characteristics – The Choir

Factor analysis on this respondent base elicited a set of factors that were defined as Doubting; Spatial Relevance; Fluid Habituation; Estrangement; Valence; and Syntactic Compound. In turn, doubting arose through a lack of confidence in the way the strategy narrative presented the strategy artefacts. This doubting seemed to create a feeling of spatial distance from the artefacts and their relevance to the stakeholders in situ. There is an identifiable ambiguity that may be leading to a very fluid and loose habituation in the sense that respondents in this cluster moved their position regularly regarding the strategy, the interpretation of this factor may be defined as a form of fluid habituation in that stakeholders are trying to achieve consensus in interpretation but perhaps the lack of community contradicts this effort (Bergman, 2009).

This form of disorientation was also evident in a sense of respondent estrangement from the strategy artefacts. Peirce states that qualsign is a quality of the representamen that functions like a sign but cannot act like a sign until it is embodied (Short, 2007). In this sense the lack of participation in the strategy narrative may point to strategic drift. There is a strong individual valance (interpretation) of artefacts that does not translate into a

consensus interpretation, and this will undermine team effort as players play the game in isolation of others. Participants struggling with the syntax of interpretation calls into question the strategic orthodoxy. This inability to define a relationship may lead to a feeling of isolation and partiality; and participants will begin to question their own contribution and that of others as they struggle with conventional syntax within the strategy. (Nobre, 2019) recognises the social constructivist perspective within organisations, which are viewed as social constructs, is also relevant to organisational semiotics. Information is a central concept that may be analysed through diverse perspectives and semiotics offers a framework which allows us to interpret information at syntactic, semantic, pragmatic, and social levels. Syntax deals with signs without regard to their meaning; semantics deals with the signification of signs in all modes of signifying; pragmatics deals with the origin, uses and effects of signs within the behaviour in which they occur.

3.2 Cluster 2 Characteristics – The Architects

Factor analysis on this respondent base elicited a set of factors the at were defined as Conviction, and Scepticism. The main factor from this group could be defined as one of conviction through a strong involvement in strategy and therefore awareness of artefacts and assumptions being rendered by laws that make it conventional. The strong factor loadings suggest a closeness to the development of strategy and a strong belief in the interpretation of strategy artefacts that lead to a consensus. Further analysis defined those respondents' individual as being very much involved in the development of the original strategy narrative. This may lead to the cluster as being doctrinal and maybe even pontifical in their beliefs. This analysis may be delineating a spatial gap between top down and bottom-up strategy discourse where managers are trying to reconcile capacity and perhaps even the viability of their own domain guided by a bottom-up strategy discourse with that of a top down, command-and-control strategy discourse where the strategy narrative outlines the scope of strategy.

Surprisingly there was another significant factor identified that can only be considered a scepticism in this respondent base. It appears that the architects of strategy value personal benefit and autonomy perhaps driven by the need to engineer strategy as objective orientated. There seems was an emerging level of doubt in the clarity of strategy that is weakening their commitment to it. Primarily driven by a lack of faith in the respondents in Cluster 1 being able to carry out the objectives in the strategy narrative. According to this (Johnson et al., 2008) stakeholders may seek to resolve this discourse from different perspectives; implementation and control; sense making; reinterpretation and adjustment as they seek to adjust to a new strategy paradigm.

4. Conclusion

The striking thing of note is the significant dissimilarity in the factor loadings extracted between the two Clusters. These loadings in Cluster 1 were significantly lower than those in Cluster 2 who may be seen as 'following' strategy. Their remoteness from the construct of artefacts in some instances makes it difficult for these stakeholders to associate the value of these artefacts to the discourse of the strategy. This left them free to question the validity of these artefacts and create spatial distance between some artefacts as well as the aims and objectives of strategy.

That said, the strong closeness to the development of strategy by the stakeholders in this group may have given rise to a forced interpretation to achieve consensus, in other words group think. There was some evidence that the orthodoxy of The Architects of strategy were not confident in The Choir's ability to achieve strategy goals. This lack of confidence seems to be coming from them questioning the resources available to those in Cluster 1. Being sceptical of others' ability should not be confused with cynicism. However, there is a conviction in the strategy narrative that is perhaps not matched by the quality of the artefacts that it is based upon.

Identifying and studying the stakeholders involved in strategy is particularly important since stakeholders can then be invited to participate in sessions where cognitive mapping techniques can be used to identify and justify the means of intervention with as systematic and interdisciplinary approach. A collaborative approach can effectively engage the stakeholder group in a more meaningful discourse to tackle the challenge. The existence of a plurality of points of view will allow those concerned with strategy discourse to examine possible approaches to the problem, different intervention methods, and decision-making protocols. Therefore, the methodological process combines stakeholder's analysis with cognitive mapping (Eden, 1988) for purposes of knowledge acquisition and problem structuring.

Cognitive mapping is a casual-based mapping technique where concepts representing elements of a complex problem are organised and structured using the semiotic square. Hence, elements or concepts are represented

as nodes, while bubbles represent the level of perceived influence in the strategy narrative. In particular, cognitive mapping is well suited for complex problems where many aspects and dimensions of the problem are difficult to comprehend adequately, or in some cases may even be totally indeterminate (Ferretti, 2016).

It was surprising that few theories of semiotics in strategy existed, but that did not stop many commentators attesting to the fact that this should be an area of key academic theory development. So, the implication for the researcher was clear, an examination of existing independent, isolated and in some cases sovereign theories that could be rendered by combination into a concourse on the semiotics of strategy. The disadvantage was the arcane nature of semiotic writing based on theories that are nearly 100 years old in some cases, particularly so as modern teaching in semiotics tends to concentrate on the advertising and media landscape. This study may act as point of reference and a pylon for future research work in strategy as practice.

References

Asnawi, A. L., Gravell, A. M., & Wills, G. B. (2012). Factor Analysis: Investigating Important Aspects for Agile Adoption in Malaysia. Paper presented at the 60-63. 10.1109/AgileIndia.2012.13 https://ieeexplore.ieee.org/document/6170013

Atkin, A. (2008). Peirce's Final Account of Signs and the Philosophy of Language. *Transactions of the Charles S. Peirce Society, 44*(1), 63-85. https://www.jstor.org/stable/40321236

Balogun, J., Jacobs, C., Jarzabkowski, P., Mantere, S., & Vaara, E. (2014). Placing Strategy Discourse in Context: Sociomateriality, Sensemaking, and Power. *Journal of Management Studies, 51*(2), 175-201. 10.1111/joms.12059

Barry, D., & Elmes, M. (1997). *Strategy retold: toward a narrative view of strategic discourse*

Bergman, M. (2009). *Peirce's Philosophy of Communication*. Continuum.

Blackman, D., & Smith, G. C. M. (2006). Knowledge Management Across Nations. *The International Journal of Knowledge, Culture, and Change Management: Annual Review, 4*(1), 0-0. 10.18848/1447-9524/CGP/v04/49353

Bonn, I., & Pettigrew, A. (2009). Towards a dynamic theory of boards: An organisational life cycle approach. *Journal of Management and Organization, 15*(1), 2-16.

Chandler, D. (2007). *Semiotics: The Basics* (2nd ed. ed.). Routledge Ltd. 10.4324/9780203014936

Chandler, D. (2015). A World without Causation: Big Data and the Coming of Age of Posthumanism. *Millennium - Journal of International Studies, 43*(3), 833-851. 10.1177/0305829815576817

Easterby-Smith, M. (1999). *Organizational learning and the learning organization* (Reprinted ed.). Sage.

Eden, C. (1988). Cognitive mapping. *European Journal of Operation Research, 36*(1), 1-13.

Emenalo, C. O. O. (2011). Towards a human-centric theory of the firm. *Business Schools Under Fire,* , 192-211. http://www.econis.eu/PPNSET?PPN=715701010

Evans, N., & Easterby-Smith, M. (2000). *The Nature of Organizational Knowledge*. Sage.

Fenton, C., & Langley, A. (2011). Strategy as Practice and the Narrative Turn. *Organization Studies, 32*(9), 1171-1196. 10.1177/0170840611410838

Ferretti, V. (2016). From stakeholders' analysis to cognitive mapping and Multi-Attribute Value Theory: An integrated approach for policy support. *European Journal of Operational Research, 253*(2), 524-541. 10.1016/j.ejor.2016.02.054

Fontanille, J. (2012). *The Semiotics of Discourse*. Peter Lang.

Gagne, M. (2009). A model of knowledge-sharing motivation. *Human Resource Management, 48*(4), 571-589. 10.1002/hrm.20298

Green, S. E. (2004). A Rhetorical Theory of Diffusion. *The Academy of Management Review, 29*(4), 653-669. 10.2307/20159076

Inkpen, A. C. (2000). Learning Through Joint Ventures: A Framework Of Knowledge Acquisition. *Journal of Management Studies, 37*(7), 1019-1044. 10.1111/1467-6486.00215

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. Free Press.

Jastroch, N., & Marlowe, T. (2010). Knowledge Transfer in Collaborative Knowledge Management: A Semiotic View. *Journal of Systemics, Cybernetics and Informatics, 8*(6), 6-11. https://doaj.org/article/fe6a28047c0f48749d1b892fe61e80ca

Jelenc, L. (2009). *The Impact of Strategic Management Schools and Strategic Thinking on The Performance of Croatian Entrepreneurial Practice*

Johnson, G., Scholes, K., & Whittington, R. (2008). *Exploring corporate strategy* (8. ed. ed.). Financial Times Prentice Hall.

Johnson, I. (2006). *Strategic Conversation: Defining, Measuring and Applying the Construct in Organisations* http://www4.gu.edu.au:8080/adt-root/public/adt-QGU20070228.135219

Jorgensen, K. M., & Boje, D. M. (2006). Conceptualising intellectual capital as language game and power/Commentary: Time, place and mind of intellectual capital: on Jørgensen's "Conceptualising intellectual capital as language game and power". *Journal of Intellectual Capital, 7*(1), 78-92.

Kamal, S., Kocór, M., & Grodzinska-Jurczak, M. (2014). Quantifying Human Subjectivity Using Q Method: When Quality Meets Quantity. *Qualitative Sociology Review, 10*(3) https://search.proquest.com/docview/1625668894

Knights, D. (1992). Changing Spaces: The Disruptive Impact of a New Epistemological Location for the Study of Management. *The Academy of Management Review, 17*(3), 514-536. 10.5465/AMR.1992.4281996

Knights, D., & Morgan, G. (1991). Corporate Strategy, Organizations, and Subjectivity: A Critique. *Organization Studies, 12*(2), 251-273. 10.1177/017084069101200205

Krivokapic-Skoko, B., & O'neill, G. (2011). Beyond the qualitative-quantitative distinction: Some innovative methods for business and management research. *International Journal of Multiple Research Approaches, 5*(3), 290-300. 10.5172/mra.2011.5.3.290

Loncar, M. (2017). The Impact of Strategic Management and Strategic Thinking Approaches on Business Performance of Companies. *European Project Management Journal, 7*(1), 85-98.

Miles, R. E., Snow, C. C., Meyer, A., & Coleman, H. (1978). Organizational Strategy, Structure, and Process. *The Academy of Management Review, 3*(3), 546-562. https://search.proquest.com/docview/1305657273

Mouritsen, J. (2004). Measuring and intervening: how do we theorise intellectual capital management? *Journal of Intellectual Capital, 5*(2), 257-267. 10.1108/14691930410533687

Mukherjee, N., Hugé, J., Sutherland, W. J., McNeill, J., Van Opstal, M., Dahdouh-Guebas, F., Koedam, N., & Anderson, B. (2015). The Delphi technique in ecology and biological conservation: applications and guidelines. *Methods in Ecology and Evolution, 6*(9), 1097-1109. 10.1111/2041-210X.12387

Nobre, A. (2019). *The foundations of the Semiotic Learning Perspective - conceptually innovating Organisational Learning*. Escola Superior de Ciências Empresariais do Instituto Politécnico de Setúbal Campus do IPS, Estefanilha.

Peirce, C. S. (1931). In Hartshorne C., Weiss P.(Eds.), *Collected Papers of Charles Sanders Peirce*. The Belknap Pr. of Harvard University Press.

Rastogi, A., Hickey, G. M., Badola, R., & Hussain, S. A. (2013). Diverging viewpoints on tiger conservation: A Q-method study and survey of conservation professionals in India. *Biological Conservation, 161*, 182-192. 10.1016/j.biocon.2013.03.013

Rhodes, C., & Brown, A. D. (2005). Narrative, organizations and research. *International Journal of Management Reviews, 7*(3), 167-188. 10.1111/j.1468-2370.2005.00112.x

Robichaud, D., Giroux, H., & Taylor, J. R. (2004). The Metaconversation: The Recursive Property of Language As A Key To Organizing. *Academy of Management. the Academy of Management Review, 29*(4), 617-634. https://search.proquest.com/docview/210980650?accountid=13969

Samra-Fredericks, D. (2005). Strategic Practice, 'Discourse' and the Everyday Interactional Constitution of 'Power Effects'. *Organization, 12*(6), 803-841. 10.1177/1350508405057472

Short, T. L. (2007). *Peirce's Theory of Signs*. Cambridge University Press.

Sitz, L. (2008). Beyond semiotics and hermeneutics; Discourse analysis as a way to interpret consumers' discourses and experiences. *Qualitative Market Research, 11*(2), 177-191.

Skokan, K., Pawliczek, A., & Piszczur, R. (2013). Strategic Planning and Business Performance of Micro, Small and Medium-Sized Enterprises. *Journal of Competitiveness, 5*(4), 57-72. 10.7441/joc.2013.04.04

Sloan, J. (2017). *Learning to Think Strategically* (Third edition ed.). Routledge.

Smith, G. C. M. (2013). Semiotics as Strategy. Paper presented at the *Semiofest 2013,* None given. https://www.semiofest.com/2013/graeme-smith-uk/

Smith, M. (2010). Building institutional trust through e-government trustworthiness cues. *Information Technology & People, 23*(3), 222-246. 10.1108/09593841011069149

Stamper, R. K., Liu, K., Clarke, R. J., & Andersen, P. B. (2001). Organisational semiotics: informatics without the computer? *Information, Organisation and Technology - Studies in Organisational Semiotics* (). Kluwer Academic Publishers.

Vaara, E., Kleymann, B., & Seristö, H. (2004). Strategies as Discursive Constructions: The Case of Airline Alliances. *Journal of Management Studies, 41*(1), 1-35. 10.1111/j.1467-6486.2004.00419.x

Vaara, E., Sorsa, V., & Pälli, P. (2010). On the force potential of strategy texts: a critical discourse analysis of a strategic plan and its power effects in a city organization. *Organization, 17*(6), 685-702. 10.1177/1350508410367326

von Krogh, G., Nonaka, I., & Rechsteiner, L. (2012). Leadership in organizational knowledge creation. *Journal of Management Studies, 49*(1), 240-277. http://www.econis.eu/PPNSET?PPN=684647672

von Krogh, G., Roos, J., & Slocum, K. (1994). An Essay on Corporate Epistemology. *Strategic Management Journal, 15*(7), 53-71. https://search.proquest.com/docview/1305785741

Watts, S., & Stenner, P. (2005). Doing Q methodology: theory, method and interpretation. *Qualitative Research in Psychology, 2*(1), 67-91. 10.1191/1478088705qp022oa

Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research: Theory, Method, Interpretation* (1. publ. ed.). Sage.

Wint, F. E. (2013). *'Am I bothered?' - Using Q methodology to explore what bothers young people on Facebook* http://etheses.whiterose.ac.uk/4493

Zabala, A., Sandbrook, C., & Mukherjee, N. (2018). When and how to use Q methodology to understand perspectives in conservation research. *Conservation Biology, 32*(5), 1185-1194. 10.1111/cobi.13123

Zheng, W., Yang, B., & McLean, G. N. (2010). Linking organizational culture, structure, strategy, and organizational effectiveness: Mediating role of knowledge management. *Journal of Business Research, 63*(7), 763-771. 10.1016/j.jbusres.2009.06.005

The Impact of Leadership on Digital Learning in Health

Marit Meyer Solheim and Tale Skjølsvik
OsloMet - Oslo Metropolitan University, Norway
maritmey@oslomet.no
talesk@oslomet.no

Abstract: Leaders have a key responsibility in providing employees with the necessary knowledge and training so that they can carry out their work. At the same time, advances in technology, changes in demographics, increased demands on health services and rapid developments of health professions are all elements that contribute to a particularly enhanced demand for upgrade of employees' competences. The role of leadership in meeting these demands and developing competence in health is limited. This is particularly true for competence development through the use of digital tools. Through a structured search in the Social Citation Index and the Science Citation index (in Web of Science) we review past research and develop key insights that address how leadership can be linked to digital learning within health. In particular, we use a relevant and extensive set of search terms in the areas of nursing and health, leadership, knowledge development and digital learning. A key finding from this search was the lack of existing research, which suggests that more research and broader structured searches are needed. This is particularly imminent following the covid-19 pandemic, which has demanded the digitalisation of many fields where education and health have had to undertake considerable changes. We identified three main core stakeholders relative to whom leadership is essential in understanding its impact on digital learning: patients, students and health professionals. Further, results pointed to learning effects as well as barriers and enablers of effect as key dimensions that leaders need to understand and consider. Underlying any effect of leadership and digital learning initiatives are modern tools of technology, including the right information, system and support that enhances resource efficiency. Finally, the leadership effect on learning is context dependent and related to culture, motivation, reflection, behaviour and digital competence.

Keywords: health, nurse, leadership, learning, competence, digital

1. Introduction

Successful digital transformations, where digital technology is used to fundamentally change the value creation logic of an organisation for the better, more profitable and sustainable, demand leadership and that organisations have the right capabilities (Westerman et al, 2014; Weber, Büttgen and Bartsch, 2022). Such transformations imply that leaders understand digital solutions, their application as well as their value. During Covid, many organisations have been forced to apply and use digital solutions that to a limited degree have been utilised optimally for strategic long-term value creation. Going forward it seems particularly essential to understand how digital tools can be applied for long term benefits in organisations. Also, gaining insights on the dimensions of leadership that is essential in enhancing the use of digital tools seems particularly important.

In looking at literature about transformational leadership (Bass & Avolio, 1994), four dimensions have been pointed out as particularly essential: idealised influence through leading by example, intellectual stimulation through learning, inspirational motivation by inspiring to greater heights and individualised consideration through coaching. In stimulating digital transformation, knowledge and learning is essential. Digital learning tools are core resources in most organisations and are often crucial to employees' knowledge development. By studying the use of digital learning tools as such, it is possible to both understand the relevance of leadership for learning, but also to study the direct implication of the development of transformational capabilities in organisations. The utilisation of these tools is in many cases far below their potential.

Digital solutions can enhance value creation in many organisations and sectors, but particularly so in health (Ruggeri et al, 2013). An important challenge facing leaders in this context, is to integrate human and information technology systems into the organisation in a way that provides maximum benefits (Avolio et al, 2000). Developing insight into the role of leaders in enabling benefits and enhancing digital learning is essential for the future of health. In this paper, we want to contribute to a more in-depth understanding of the knowledge sub-dimensions of transformational leadership and the impact of leadership on employee learning in health organisations. In particular, we ask the following research questions:

1. What trends can be identified in the field of health when it comes to the role and impact of leadership on digital learning?
2. What are the main topics in developing a conceptualization of leadership in digital learning?

To answer these questions, we first introduce key theoretical perspectives on leadership in the health sector. In turn, we carry out a structured literature review. Finally, we present our findings and potential avenues for future research in an integrated model and a concluding discussion.

2. Theoretical background

In understanding the role of leadership in digital learning, we know more generally that leadership has an extensive impact on knowledge management in organisations (Nguyen & Mohamed, 2011). However, it is only over the last couple of decades that research has started looking at more specific roles and styles of leadership and its impact on knowledge management in organisations (e.g., Donate & De Pablo, 2015). These latter authors combine transformational and transactional leadership styles to propose a knowledge-oriented leadership style, which can be positively associated with knowledge management behaviour (Shamim, Chang & Yu, 2019). Donate and Sanchez de Pablo (2015) describe knowledge-oriented leadership as a mix of transformational and transactional leadership. In particular, they combine motivating and inspiring leadership with clear incentives. In practice, knowledge-oriented leaders guide employees to see the value of their work, while at the same time communicating clear expectations, eliminating barriers and clarifying the organisation's goals. This type of leadership also incorporates motivational elements such as opportunities for career development, increased responsibility and material rewards. Knowledge-oriented leadership is mentioned by many researchers as crucial in developing innovative organisations (e.g. Men & Jia, 2021; Donate and de Pablo, 2015; Ribiere and Sitar, 2003).

Health care organisations change constantly, have challenges in recruiting and retaining qualified employees, demand operations 24-hours a day, extensive delegation and limited team continuity (Vesterinen et al. 2013). This reinforces the importance of the health workers' competence, the need for replenishment of new knowledge and skills to be able to handle their work and suggests that digital learning is particularly suited (Fahlman 2012). In handling this, research suggests that health leaders most often use a democratic, affiliated, visionary or coaching leadership style, while they rarely use a commanding and isolating leadership style (Vesterinen et al, 2013). Another study concluded that affiliated and coaching leadership styles to be common (Kenmore, 2008). Thus, health offers an interesting extreme context to study leadership of digital learning solutions.

Understanding how leaders impact digital learning in organisations, Vermeulen et al (2015) suggest that the relationships are indirect, in the sense that leaders impact the employees feeling of mastery and attitudes, which in turn impact the intention to use digital tools. In a later study, Vermeulen et al (2017) further found that the learning climate in the form of collective reflection, tolerance for different opinions, and learning from mistakes also have an effect. Beyond these initial findings, limited research has been done to study how leadership impacts and can facilitate the use of digital learning tools in organisations. Thus, the main aim of the study below is to integrate findings from a particular sector in developing insight into existing research on the relationship between leadership and the use of digital learning tools in organisations.

3. Method

As the current study aims to review existing research on leadership of digital learning in health, we have adopted an inductive approach and used both quantitative and qualitative methods. This approach has allowed us to develop a solid understanding of how the research that integrates the areas of health, leadership and digital learning has developed. This method has also enabled us to tease out dominant themes of the identified articles, as well as potential avenues for future research.

3.1 Data collection and compilation

Systematic literature reviews typically go through three phases: planning, i.e., identifying the research question and defining boundaries; conducting, i.e., searching for and analysing relevant literature; and reporting, i.e. formalising the findings and developing implications (Tranfield et al, 2003). The first two phases will be described here, while the third phase, reporting, is described in the Findings section.

In the planning phase, we first formulated our research questions. We then defined the boundaries of our study to include academic articles published in the period up to 2022 in journals listed in Science Citation Index Expanded and Social Sciences Citation Index. These were chosen as they cover a broad range of journals in the fields of social science and technology. To produce a broad presentation of the impact of leadership on digital

learning in health, a systematic literature review was used. The search terms and the search field used can be found in table 1. An overview of the process used can be found in the flow-chart in Figure 1.

Table 1: Search terms/groups

Search in title	Search in abstract	Search in all fields	Number of papers	
nurse* OR health* AND learning OR knowledge OR "knowledge management" OR competence AND elearning OR e-learning OR "computer-based learning" OR "computerbased learning" OR "computer based learning" OR "digital learning" OR digital			309	
nurse* OR health* AND learning OR knowledge OR "knowledge management" OR competence AND elearning OR e-learning OR "computer-based learning" OR "computerbased learning" OR "computer based learning" OR "digital learning" OR digital	Leadership OR management		38	Keyword: 2 leadership 36 management
nurse* OR health* AND learning OR knowledge OR "knowledge management" OR competence AND elearning OR e-learning OR "computer-based learning" OR "computerbased learning" OR "computer based learning" OR "digital learning" OR digital		Leadership OR management	69	Keyword: 5 leadership 65 management
nurse* OR health* AND learning OR knowledge OR "knowledge management" OR competence AND elearning OR e-learning OR "computer-based learning" OR "computerbased learning" OR "computer based learning" OR "digital learning" OR digital		Leadership OR management	61	Deleted document types: meeting abstract and editorial material

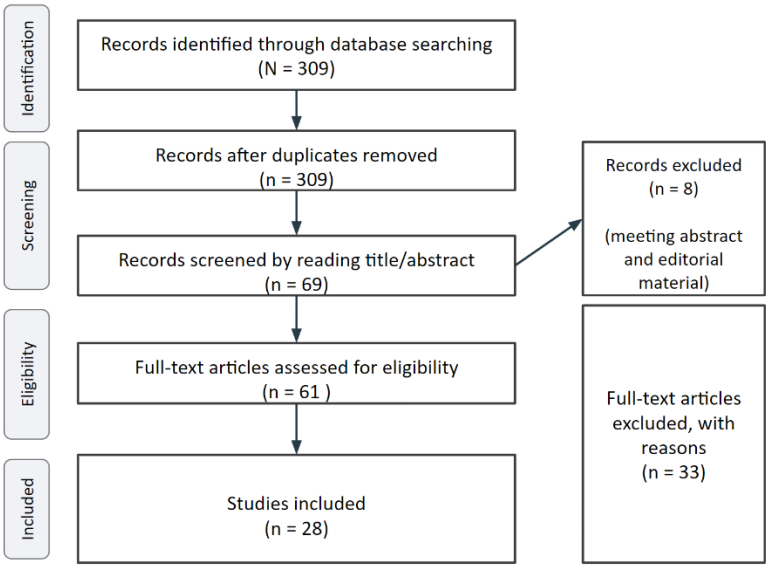


Figure 1: Flowchart of systematic review

61 papers were addressed for eligibility. These were grouped into three categories related to the learning subjects: Students-Educators, Patient-Relatives-Public Health and Health professions. 28 articles dealt with health professions, which was the topic we chose to study. The time frame of the study included publications up to and including the year 2021. An overview of the core search over time can be found in figure 2.

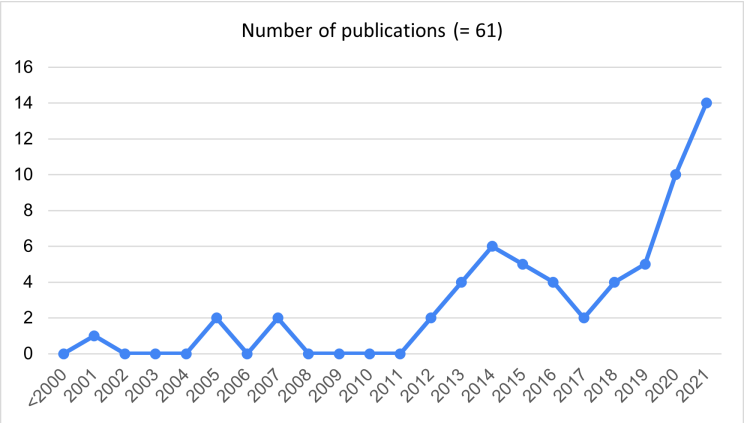


Figure 2: Historical overview of studies for search (described in figure 1)

4. Findings

The literature search intended to provide an overview of articles dealing with leadership of digital learning in health services up to and including the year 2021. We wanted to look more closely at the role, importance, and nature of leadership in digital learning. Many of the identified papers were written in 2020 and 2021, which suggest an increased relevance of this topic during the pandemic. We found that the leadership of digital learning related to different stakeholders, which is essential for developing an in-depth understanding of leadership. Beyond these stakeholders, we found that the papers could be separated into 5 main themes: (1) Effect of learning technology, (2) Barriers and enablers to success, (3) Leadership and management, (4) Modern technology, in addition to (5) Other. The other category included a wide and diverse set of papers and will not be covered in the following.

4.1 Stakeholders of learning leadership

In understanding leadership in digital learning, the literature study showed the relevance of understanding the stakeholder and learning subjects. Most of the identified studies discussed the use of digital learning among health professionals (28), students and educators' use in teaching contexts (19), and patients and their relatives (14), where e-learning was used to create knowledge and mastery of illness together with digital learning in the field of public health. Health professions rather than patients are central to our research, which concern the health organisations as such. Still, identifying these different stakeholders seems essential for leadership of digital learning.

4.2 Key themes of leadership in digital learning in health

Based on the qualitative and iterative content analysis, four main research themes were identified: (1) the effect of learning technology, (2) barriers and key factors for success, (3) leadership and management, and (4) modern technology. Some studies included two themes, these publications are listed under both categories below in Figure 3, where the publications are shown over time. Each theme is described in more detail below.

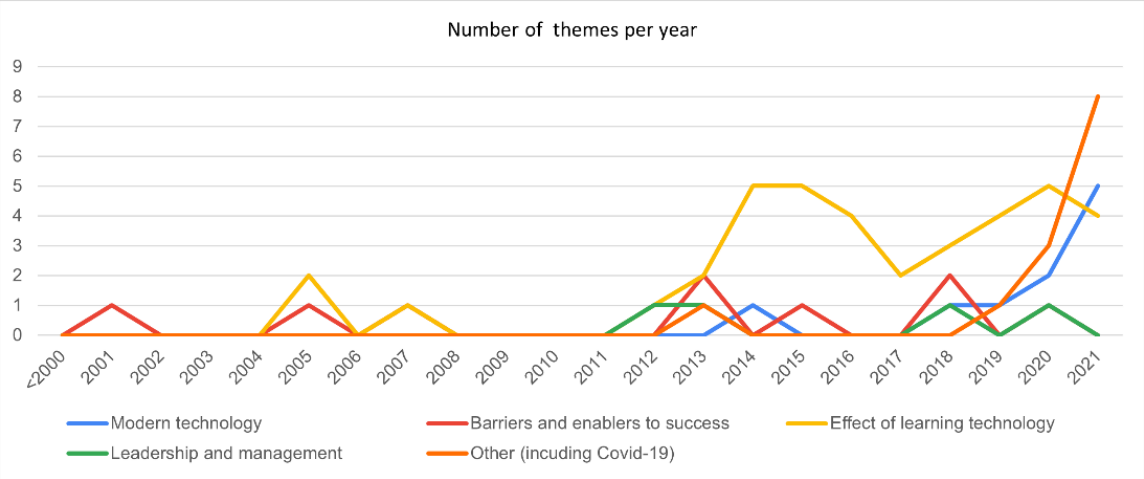


Figure 3: Overview of identified research themes over time

4.2.1 Effect of learning technology

Over the years, several studies have examined the effect of using digital learning. This applies to both health professional education and health organisations.

Digital learning can be defined as the technical solution used to support teaching (Suhonen, 2005; Basak et al, 2017). Examples of this are digital learning tools, online study programs and online learning resources. Digital learning is a term that is increasingly used about the use of information and communication technology in teaching. E-learning (Electronic learning) and m-learning (Mobile learning) overlap, and both can be seen as subgroups of digital learning. (Basak et al, 2017).

Different studies show different results, but they often conclude that digital learning programs are far more effective than no training and as effective as traditional teaching (Ruggeri et al. 2013; George et al. 2014). Wang et al. (2021) point out that few studies have explored the effectiveness of e-learning tools for health care

providers. They conclude that both clinicians and primary health care professionals improved their knowledge with e-learning activity in continuing medical education.

In measuring effect, a study of the relationship between nurses' satisfaction with the use of e-learning showed that satisfaction was related to information quality, system quality, support service quality and instructor quality and that this contributed significantly to perceived benefits, confirmation and flow (Cheng, 2014). The nurses' satisfaction with the use of a mixed e-learning system led to their continued intention to use the system. Standsfeld et al. (2015) investigated the feasibility, adherence, and probable effectiveness of using e- learning for managers. They found a small benefit of the intervention on well-being that was positively related to the use of the mixed methods in learning.

There is a wide range of alternative measures of effectiveness in the identified papers, and extensive more research is needed in these areas to clarify concepts, and in particular with regards to the effect of leadership to enable and support learning effects.

4.2.2 The potential of modern technology

New digital tools and digital technologies already offer unique opportunities for health research, but it has not yet been widely recognized as an important factor for sustainable workplace improvement (Ellis et al. 2021). While the potential of modern technologies is addressed, the real role of leadership is making this happen is treated to a limited degree. For example, Chandrasekaran et al (2014) describes e-learning as a cutting-edge tool for refining doctors' knowledge, attitudes, and practice using module-based e-learning courses combined with skills training in practice in neonatal medicine in India. The benefits described was to save resources, where uniform standardised learning and the possibility to effectively spread learning to many participants, was emphasised.

Further, Sheikh et al. (2021) concluded that robotics and artificial intelligence have the potential to improve both the quality and efficiency of health and care delivery in the UK, but that it also provides unique opportunities for health research and policy development. They however also address the leadership responsibility to ensure that there is room to learn from past mistakes and adapt digital tools to local needs and contexts. Organisations facing digitisation processes need to develop the right skills and capabilities to support employees so that leaders can aim for the best outcomes. In such a process, the focus is not on digital skills but on the leadership and change management skills needed to be present to achieve the desired effect. An open culture, varied knowledge of employees used where the need arises, willingness to innovate, a culture that welcome feedback and seek constant improvement is something that managers should strive for if they are to achieve the potential that lies in the digitalisation of organisations (Sheikh et al, 2021).

4.2.3 Barriers and enablers to success

Five papers have a special focus on barriers to and sources of success within health professions. Over 20 years ago, Herrin (2001) addressed the responsibilities of leaders and encouraged them to familiarise themselves and understand how technology will affect the future of the profession. She points out that health should use e-learning programs based on principles of adult education where employees can bring their work experiences into the learning activity. The study showed that nurses who learn to solve real patient problems through their e-learning experience will continue to use such learning tools. Herrin addresses the leadership challenge that arises when nurses do not see a clear benefit from using e-learning and therefore become sceptical of implementation and use. To meet employees' personal learning needs, nurse executives need effective ways to further develop and assess the organisation's knowledge.

Ruggeri et al. (2013) refer to a large number of previous studies that examined e-learning systems in health compared to face-to-face learning. Advantages such as convenience, availability and time are emphasised. Internal organisational challenges that were highlighted are: professional silos, static curricula and own perception of 'information overload'. In response to these challenges, e-learning provides flexible, affordable, user-centred and easily updated learning opportunities. Still, they find that the effectiveness of e-learning varies from context to context and demands the users' motivation and digital competence. They also highlighted critical success factors for e-learning as essential, such as allocation of time for training, incentives for learning, a supportive culture, information and technology support as well as an organisation that facilitates the use of e-learning.

Furthermore, Alrahbi et al. (2020) highlight the challenges of adopting health information technology in health care organisations. They point to challenges such as balancing cost and time, lack of knowledge about the benefits of the technology being introduced, insecurity about whether the investment in technology gives desired results, lack of ability in exploiting the opportunities in existing and new technology in practice, integrating new technology with existing technology, interoperability, and a culture driven by top management as key challenges. They suggest that technology must be strongly linked to the ability to create a knowledgeable organisation, a transparent environment, and informed decisions in everyday life to enable enhanced value creation.

4.2.4 Leadership and management

Childs et al. (2005) find several elements that must be adapted by the organisation and management for e-learning to be used and remain in use over time. Important elements that leaders can facilitate are to have a national approach and local strategies that are supported by the organisation's processes and procedures. They argue for a positive connection between the use of e-learning and that the people in the organisation have a strong commitment to learning, are willing to change, make evaluations during the process and integrate learning in their organisational plans. To achieve the desired effect, management support, skills training, good resource management and technical and administrative support are also needed.

Hamilton (2008) encourages transformational leadership for e-learning, where leaders share vision and values, focus on innovation and creativity, work to create an environment that is flexible and can change when needed, but also have employees who take responsibility, show respect for each other and is open to diversity (Fahlman, 2012). Health workplaces therefore need managers who support distributed management, are strategic and service-based and generate teamwork and community building, have shared decision-making, and ethical and caring behaviour (Fahlman, 2012; Neill & Saunders, 2008).

Fahlman (2012) refers to Gilmartin and D'Aunno's (2007) literature review of empirical studies of management in the health workplace for the period from 1989–2005. They point to different leadership styles being suitable for dealing with the challenges in the healthcare workplace. They concluded that participatory and person-focused leadership styles are associated with reduced work stress, increased group cohesion, empowerment and self-efficacy associated with job satisfaction and retention. She also refers to Cummings et al. (2010) systematic literature review on leadership styles in nursing from 1985–2009 which identified that a people-focused leadership practice in this context can be linked to improved results (Fahlman, 2012).
Fahlman (2012) describes different leadership and management styles and their benefits and limitations:

1. In the case of distributed management, leaders are encouraged to contribute to their knowledge and skills into the leadership community (Harris, 2004). This leadership style only works in teams where participants see the benefits and potential of such collaboration (Thornton, 2010).
2. Serving leadership requires a leadership style in which the leader takes on the role of servant rather than focusing on self-interest (Stone et al, 2003). The leader must be aware that the organisation's goals must take precedence over individuals' own goals if this leadership style is to be suitable (Sendjaya et al, 2008). Learning organisations are typically built by servant leaders (Senge, 1997). Leadership that utilises distributive leadership at the overall administrative level combined with servant leadership at the departmental level can be the critical bridge to effectively engage in the use of e-learning (Fahlman 2012).
3. Contingency leadership has leaders who strive for maximum performance among employees. They are thus dependent on the interaction between organisation, people, tasks and environment (Bolden et al., 2003). This form of leadership is suitable for monitoring small groups rather than leading learning organisations into the future (Aronson, 2001).
4. Transactional leaders base their leadership style on conditional reinforcement (Bass & Steidlmeier, 1999). Employees are motivated by positive or negative feedback. This leadership style uses control strategies and is suitable if one wants to maintain the status quo (Aronson, 2001).
5. Transformational leadership is based on collaboration between leaders and employees and where there is a shared interest in achieving common goals (Burns, 1978). Consideration for others is central and it is suitable with organisations with cultures with high ethical standards (Bass & Steidlmeier, 1999). This form of leadership is suitable in times of change (Vera & Crossan, 2004).
6. Strategic management, where planning and top-down leadership is being challenged in modern times with high complexity and increasing amounts of data (Ireland & Hitt, 2005; Floyde et al. 2013).

7. The implementation of a knowledge management base in an organisation promotes the sharing of tacit knowledge (Podgorski, 2010; Floyde et al 2013).

5. Concluding discussion

Above we used a structured literature review to develop insight concerning the role and nature of leadership in the implementation and use of digital learning in health. A key finding was the lack of existing research in this field, which suggests that more research and broader structured search seem essential. This is particularly imminent following the covid-19 pandemic, which has demanded the digitalisation of many fields, and learning in organisations due to rapidly changing conditions.

Additionally, we identified the core stakeholders relative to which leadership is essential: patients, students and health professionals. This paper aims to primarily understand health professionals. Additionally, the research pointed to learning effects as well as barriers and enablers of effect. Underlying any effect of leadership and digitallearning initiatives are modern tools of technology including the right information, system and support that enhances resource efficiency. Leaderships' effect on learning is viewed as context dependent and related to culture, motivation, reflection, behaviour and digital competence. These relationships are illustrated in figure 4.

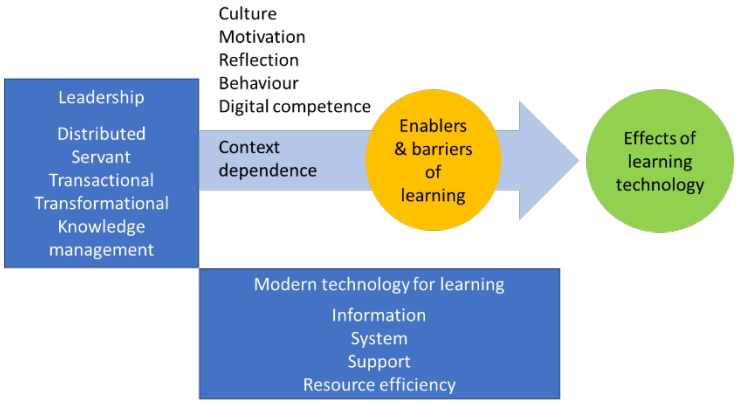


Figure 4: Integration of findings'

A number of leadership traditions have been linked to digital learning in existing research, but there seems to be limited research that has studied their impact, strengths and weaknesses, and particularly so in health. There is room for more research in this area to develop our understanding further.

The population development in many countries is moving in the direction of an increasing proportion of the elderly. The need for health services and digitalisation of health services can be a crucial contribution to improving welfare. Ensuring that effective learning tools are in place is crucial for this to happen. This article has taken a first step in developing a better understanding of the role of leadership in this development.

References

Alrahbi, D.A, et al. (2020) "Challenges for developing health-care knowledge in the digital age", *Journal of KnowledgeManagement.* Vol. 26, No. 42.

Avolio, B. J., Kahai, S. and Dodge, G. E. (2000) "E-leadership: implications for theory, research, and practice", *Leadership Quart*, Vol. 11, pp 615–668.

Aronson, E. (2001) "Integrating leadership styles and ethical perspectives", *Canadian Journal of Administrative Science,* Vol. 18, pp 244-256.

Basak S.K., Wotto M. and Belanger P. (2018) "E-learning, M-learning and D-learning: Conceptual definition and comparative analysis", *E-learningand digital media,* Vol. 15, No.4, pp 191–216.

Bass, B.M. and Avolio, B.J. (1994) "Transformational leadership and organizational culture", *The International Journal of Public Administration, Vol.* 17.3-4, pp 541-554.

Bass, B. M. and Steidlmeier, P. (1999) "*Ethics, character, and authentic transformational leadership" The Leadership Quarterly,* Vol. 10, No.2, pp 181 -217.

Bolden, R. et al. (2003) "A review of leadership theory and competency frameworks" *Centre for Leadership Studies, University of Exeter.*

Chandrasekaran, A., Thukral, A. and Deorari, A. (2014) "E-Learning in Newborn Health – A Paradigm Shift for Continuing Professional Development for Doctors and Nurses", *Indian journal of pediatrics*, Vol. 81, No.12, pp 1376-1380.

Cheng, Y-M. (2014) "Extending the expectation-confirmation model with quality and flow to explore nurses continued blended e-learning intention*", Information technology & people,* Vol.27, No. 3, pp 230-258.

Childs, S. et al. (2005) "Effective e-learning for health professionals and students—barriers and their solutions. A systematic review of the literature—findings from the HeXL project", *Health information and libraries journal*, Vol.22, No.2, pp 20-32.

Cummings, G. G. et al. (2010) "Leadership styles and outcome patterns for the nursing workforce and work environment: A systematic review*", International Journal of Nursing Studies*, Vol.47, No.3, pp 363–385.

Donate, M. J. and de Pablo, J. D. S. (2015), "The role of knowledge-oriented leadership in knowledge management practices and innovation", *Journal of business research*, Vol.68, No.2, pp 360-370.

Ellis, R.B. et al. (2021), "Lessons Learned: Beta-Testing the Digital Health Checklist for Researchers Prompts a Call to Action by Behavioral Scientists", *Journal of medical Internet research*, Vol.23, No.12, e25414-e25414.

Fahlman, D. (2012) "Educational Leadership for E-Learning in the Healthcare Workplace"*, International review of research in open and distance learning,* Vol.13, No 2, pp 236-246.

Floyde, A. et al. (2013) "The design and implementation of knowledge management systems and e-learning for improved occupational health and safety in small to medium sized enterprises", *Safety science*, Vol.60, pp 69-76.

George, P.P. et al. (2014) "Online eLearning for undergraduates in health professions: A systematic review of the impact on knowledge, skills, attitudes and satisfaction", *Journal of global health*, Vol.4, No.1, 010406-010406.

Gilmartin, M. J. and D'Aunno, A. (2007) "Leadership research in healthcare", *The Academy of Management Annals,* Vol 1, pp 387-438.

Hamilton, F. (2008) "Servant leadership" *In A. Marturano & J. Gosling, (Eds.), Leadership: The key concepts,* pp 146-50, London: Routledge.

Harris, A. (2004) "Distributed leadership and school improvement", *Educational Management Administration & Leadership*, Vol.32, No.1, pp 11-24.

Herrin, D. (2001), "E-Learning: Directions for Nurses in Executive Practice", *The Journal of nursing administration,* Vol.31, No.1, pp 5-6.

Ireland, R.D. and Hitt, M. A. (2005) "Achieving and maintaining strategic competitiveness in the 21st century: The role of strategic leadership", *Academy of Management Executive*, Vol.19, No.4, pp 63-77.

Kenmore, P. (2008), "Exploring leadership styles", *Nursing Management*, vol. 15, no. 1, pp 24–26

Men, C. and Jia, R. (2021), "Knowledge-oriented leadership, team learning and team creativity: the roles of task interdependence and task complexity", *Leadership & Organization Development Journal*, Vol. 42 No. 6, pp 882-898.

Moher, D. et al. (2009) "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement", *Physical Therapy*, Vol. 89, No. 9, pp 873-880.

Nguyen, H. N. and Mohamed, S. (2011), "Leadership behaviours, organizational culture and knowledge management practices: An empirical investigation", *The Journal of management development*, Vol.30 (2), pp 206-221.

Neill, N.W. and Saunders, M.S. (2008) "Servant leadership enhancing quality of care and staff satisfaction", *The Journal of Nursing Administration*, Vol. 38, No.9, pp 395-400.

Podgorski, D. (2010), "The use of tacit knowledge in occupational safety and health management systems", *International Journal of Occupational Safety and Ergonomics (JOSE),* Vol.16, No.3, pp 283–310.

Ribiere, V.M. and Sitar, A.S. (2003) "Critical role of leadership in nurturing a knowledge supporting culture", *Knowledge Management Research and Practice*, Vol. 1 No. 1, pp 39-48.

Ruggeri, K., Farrington, C. and Brayne, C. (2013) "A Global Model for Effective Use and Evaluation of e-Learning in Health", Vol 19 No.4, pp 312-321.

Senge, P. M. (1997) "Creating learning communities", *Executive Excellence*, Vol.14, No.3, pp 17-18.

Shamim, S., Cang, S. and Yu, H. (2019) "Impact of knowledge-oriented leadership on knowledge management behaviour through employee work attitudes", *The International Journal of Human Resource Management*, Vol.30, No.16, pp 2387-2417.

Sendjaya, S., Sarros, J.C. and Santora, J.C. (2008) "Defining and measuring servant leadership behaviour in organizations", *Journal of Management Studies*, Vol. 45, No.2, pp 402-424.

Sheikh, A. et al. (2021) "Health information technology and digital innovation for national learning health and care systems", *Digital health*, Vol.3, No.6, pp383-396.

Standsfeld, S.A. et al. (2015) "Pilot study of a cluster randomised trial of a guided e-learning health promotion intervention for managers based on management standards for the improvement of employee well-being and reduction of sickness absence: GEM Study", *BMJ open*, Vol.5, No.10, e007981-e007981.

Thornton, K. (2010) "The nature of distributed leadership and its development in online environments", *Leadership in the digital enterprise: issues and challenges*, pp 1-14. Wellington, New Zealand.

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*, 14/3: 207–22.

Vera, D. and Crossan, M. (2004) "Strategic leadership and organizational learning", *Academy of Management Review*, Vol.29, No.2, pp 222-240.

Vermeulen, M. et al. (2017), "The role of transformative leadership, ICT-infrastructure and learning climate in teachers' use of digital learning materials during their classes", *British journal of educational technology*. Vol.48 , No.6, pp 1427-1440.

Vermeulen, M. et al. (2015), "Does transformational leadership encourage teachers' use of digital learning materials?" *Educational management administration & leadership*, Vol.4 , No. 6, pp 1006-1025.

Vesterinen S. et al. (2013), "Nurse Managers Perceptions Related to Their Leadership Styles, Knowledge, and Skills in These Areas—A Viewpoint: Case of Health Centre Wards in Finland", *International Scholarly Research Notices,* Vol. 2013, Article ID 951456, 8 pages.

Wang, Z-Y. et al (2021), "The effectiveness of E-learning in continuing medical education for tuberculosis health workers: a quasi-experiment from China", *Infectious diseases of poverty*, Vol.10 No.1, pp 72-72.

Weber, E., Büttgen, M. and Bartsch S. (2022), "How to take employees on the digital transformation journey: An experimental study on complementary leadership behaviours in managing organizational change", *Journal of Business Research,* Vol. 143, pp 225-238.

Westerman, G., Bonnet D., and McAfee, A. (2014) "Leading digital: Turning technology into business transformation". *Harvard Business Review Press*.

Knowledge Transfer Through Digital Education Technologies in Higher Education

Maria Jose Sousa[1], Luciana Aparecida Barbieri da Rosa[2], Carolina Martins Rodrigues[3], Waleska Yone Yamakawa Zavatti Campos[4] and Joanna Martinho Costa[5]
[1]Instituto Universitário de Lisboa and Research Center for Tourism, Sustainability and Well-being, Universidade do Algarve, Portugal
[2]UAB/IFRO, Brazil
[3]Research Center for Tourism, Sustainability and Well-being, Universidade do Algarve, Portugal
[4]PUC, Brazil
[5]ISCTE, Portugal
maria.jose.sousa@iscte-iul.pt

Abstract: Education is essential for the development of skills and talents that enable people to be productive citizens and active members of society. Traditional modes of education, on the other hand, are no longer enough to fulfill society's complex expectations, as people frequently change occupations, seek new educational possibilities, and struggle to manage life, work, and compete for educational demands (Houlden & Veletsians, 2019). The study's challenge derives from the foregoing: " What Information and Communication Technologies (ICTs) can be used in higher education to foster the learning-teaching process?" As a result of the findings of a literature study, it is now possible to identify information and communication technologies (ITCs) that may be employed in higher education to enhance the learning and teaching process.

Keywords: Knowledge Transfer, Digital Learning, Technologies, Higher Education

1. Introduction

Education plays a critical role in developing skills and abilities that enable individuals to become productive citizens and engaged members of society. Traditional forms of education, on the other hand, are no longer sufficient to meet the complicated demands of society, because individuals often change careers, seek other educational opportunities, and try to balance life, work, and conflicting educational demands (Houlden & Veletsians, 2019)

Thus, higher education has become increasingly important in today's world for scientific, social, and technological development (Morosini, 2014; Huang et al., 2020). However, with globalization and internationalization, universities must develop strategies aimed at improving their students (Cunha, 2014; Stevenson, 2010; Hedberg, 2017).

The use of Information and Communication Technologies (ITTs) has been directly impacting society. Thus, new global aspects emerge aiming at the engagement of individuals in a democratic way. Thus, digital technologies have become the main objective of educational policies in the European Union and are one of the main priorities of the 2020 Agenda (Gachago; Livingston, Livingston, 2010 Ivala, 2016).

The evolution of E-Learning over time represents the increasing integration of technology into the learning process to improve learning progress in light of the fourth industrial revolution 4.0 (Halili and Sulaiman, 2021).

In addition, they have played an important role in supporting the learning processes of classroom teaching and Ead of students in Higher Education (ES), based on active and autonomous learning processes of students developing primary skills for learning.

Amorim (2018) adds that these new perspectives for teaching will help in aspects beyond the classroom, that is, for living in society. However, "remote emergency teaching", which evolved in the strange environment of the pandemic, is not the same as E-Learning (Nuez-Canal & de Obesso, 2021).

In general, HEIs have invested in ITCs, in addition to having online services for students and teachers. Thus, several movements of technological inclusion are being seen in the didactic-pedagogical scenario. As a result, it

is becoming increasingly important for institutions to take proactive measures to promote the mental health of their students, such as hiring tutors to provide professional care (Sahu, 2020).

Based on the above, the problem of the study emerges: "What Information and Communication Technologies (ICTs) can be used in higher education to foster the learning-teaching process? Thus, the study aims to present information and communication technologies (ITCs) that can be used in higher education to foster the learning-teaching process. For a better understanding of the article, it is presented its roadmap, which begins with the literature review, followed by methodology, results, and conclusions.

2. Literature Review

2.1 Higher education institutions challenges

Digital technologies applied to education have transformed the learning process at all levels, with emphasis on higher education, which has experienced the modification of a traditional teaching structure to a dynamic digital environment mediated by information technologies (Castro, 2019; Nikou & Aavakare, 2021).

Higher education institutions are facing challenges related to digital education, such as the dispersal of knowledge on the web, massification, greater diversity of student learning styles, and decreased public funding (Arnold & Sangrà, 2018). Thus, there is a need to maximize school benefits and performance, while mechanisms are employed to foster student motivation and satisfaction (Nikou & Aavakare, 2021). The connection of a traditional classroom to virtual reality can be established through Open Educational Resources (OER) and are characterized as free open source educational tools from which it is possible to meet the personalized needs of users (Tang, 2021). Studies show that OERs can lower educational costs (Spector, Merrill, Elen, & Bishop, 2014) while they can favor the performance and learning of college students (Hilton, Gaudet, Clark, Robinson, & Wiley, 2013).

2.2 Technologies Applied to the Educational Field

The pandemic of Covid-19 has brought numerous challenges to maintaining the quality of higher education (Reis, Favretto, Favretto, Favretto, & Santos, 2022; Taglietti, Landri, & Grimaldi, 2021). Among these challenges, emerges the transition from teaching carried out on campus to technology-mediated learning, focusing on online education (Tang, 2021). The main technologies applied to the educational field involve interactive whiteboards, tools, and virtual learning environments such as Moodle, video conferencing, applications and software, games, tablets, and smartphones (Nikou & Aavakare, 2021).

2.3 Digital educational technology

Digital educational technology (TED) is a computer-based technology created or used in formal and informal teaching and learning activities (Castro, 2019). In this sense, e-learning was the predominant approach to distance education due to the use of information and communication technologies to improve learning and access to educational resources (Hamidi & Chavoshi, 2018). However, currently, e-learning has been replaced by what is called m-learning, or mobile learning. M-learning is an approach that differs from e-learning due to the intensive use of mobile systems, such as mobile phones and tablets, which become the main mechanism for access to educational information, including in higher education (Hamidi & Chavoshi, 2018; Sophonhiranrak, 2021).

2.4 M-learning

In m-learning, knowledge transfer is facilitated by connectivity between students (Hamidi & Chavoshi, 2018), so mobile devices allow immediate access to information, sanitation of doubts, access to podcasts and tutorials, videos and audios, educational games, e-books, document writing, participation in synchronous or asynchronous videoconferencing classes and lectures, and interaction in virtual learning environments (Criollo-C, Guerrero-Arias, Jaramillo-Alcázar, & Luján-Mora, 2021). Thus, mobile devices are not only means of access to resources but serve to connect students engaged in educational experiences and activities (Sophonhiranrak, 2021). Thus, mobile technologies allow universities to have flexibility and dynamism for students in the digital age (Criollo-C et al., 2021).

2.5 Hybrid teaching

In addition, there is hybrid teaching (blended learning), characterized by the combination of face-to-face, online and individualized learning, which in turn can accommodate different learning styles, and different individual

needs, from the incorporation of online teaching resources (Lazar, Panisoara, & Panisoara, 2020; Serrano, Dea-Ayuela, Gonzalez-Burgos, Serrano-Gil, & Lalatsa, 2019). The student population of higher education has increasingly diversified, adding to the demand for innovation and the requirement for digital literacy. This scenario fosters the search of students for higher education courses equipped with technological tools capable of preparing them for a dynamic, technological, global, and diversified labor market (Serrano et al., 2019; Smith & Hill, 2019). In addition to these potential benefits, research shows that blended learning is capable of having a greater positive impact on the performance of higher education students when compared to traditional education (Islam, Sarker, & Islam, 2022; Shu & Gu, 2018).

2.6 Developing skills and Sharing Knowledge

The training of competent professionals for the labor market is one of the roles of universities, and the technological environment has affected the way young people are trained and work in organizations (Au-Yong-Oliveira, Gonçalves, Martins, & Branco, 2018). In other words, social networks such as Youtube, Facebook, Instagram, LinkedIn, Google, Twitter, and platforms such as moodle, wiki, zoom, and TED affect the way professionals share information and knowledge, and it is necessary to build technical skills in higher education students (Nikou & Aavakare, 2021). From the acquisition of technological skills, higher education students are more likely to exchange and transfer knowledge for innovation (Al-Kurdi, El-Haddadeh, & Eldabi, 2018; Fischer, Guerrero, Guimón, & Schaeffer, 2021).

The transfer and sharing of knowledge through digital education in higher education are essential professional competencies (Al-Kurdi et al., 2018), which bring the need for sustainable management of resources (Abad-Segura, González-Zamar, Infante-Moro, & García, 2020). In this sense, the educational digitization of higher education is part of the fourth industrial revolution, which can attract more students, improve the experience of education, engender sustainability and facilitate access to teaching materials, among other benefits (Abad-Segura et al., 2020).

2.7 Emotions in digital learning

Discussions about educational technology in higher education need to favor the various learning needs, consider the emotions, feelings, identities, and affections of people (Castañeda & Selwyn, 2018), to highlight the need for social presence (Zou et al., 2021) and cognitive presence (Turula, 2018). In other words, the construction of digital craftsmanship involves digital literacy to confidently use ICTs for work, leisure, and communication (Spante, Hashemi, Lundin, & Algers, 2018).

2.8 Management of digital learning

A proper management of digital learning can facilitate the acceptance of learning technology by users in higher education (Fearnley & Amora, 2020), while allowing to expand the reach of the potentialities of the use of technology for learning (Castañeda & Selwyn, 2018; Hilli & Åkerfeldt, 2020). In this scenario, the role of higher education teachers is fundamental, given that a positive teaching attitude towards learning management systems is capable of increasing the acceptance of technology by users while enriching the teaching and exchange of knowledge among professionals (Fearnley & Blackberry, 2020).

3. Methodology

The methodology used in this research was qualitative in nature, with the exploratory objective to expand the discussions related to THE and ICT. Exploratory research is usually linked to a qualitative approach and its main characteristic is the lack of insufficient hypotheses or hypotheses (Aaker, Kumar & Day, 2004). The authors Bogdan & Biklen (1994) define qualitative methods as the observation and study of several documents that address the theme of research.

Exploratory research according to Gil (2008) aims to develop, clarify and modify concepts and ideas. This type of research is carried out especially when the theme under study is little explored, that is, to discover new ideas, explore alternatives, or diagnose experiences (Zikmund 2000). Scientific articles published in national and international journals were analyzed. Data were analyzed qualitatively using the content analysis technique (Vergara, 2009). For the external validity of the research, we reach a high sample of 133 articles to be analyzed using Microsoft Excel, and this allow generalizable results to populations. Also, the algorithm used for the search of articles were based on the keywords: Digital Higher Education + Technologies + Learning Software.

The articles were separated by software categories presented in the following table (Table 1).

Table 1: Categories of Software for Analysis

Categories of Software		Representative Software
Software for resources producing	PPT recording software Screen capture software The software for video production The software of original video producing The software of Multimedia learning resource-producing	PowerPoint and WPS in Windows, Keynote in IOS system Camtasia Studio, QuickTime, Adobe Premiere Huawei Course maker App Mobile phones, CamScanner Mystic raft, Adobe Captivate
Software for live teaching	All types of live streaming software, including software on interactive teaching, remote office, online-course	Remote office: ZOOM, TED Conversations Online course platforms: edX, Coursera, Udacity
Software for asynchronous teaching	All kinds of online teaching platforms at a national level, regional level, and university community level, as well as those launched by universities and enterprises	Course sharing platform edX, Coursera, Udacity
Software for self-regulated learning	Learning apps for all subjects	Youtube; Facebook; Instagram; Wikipedia; Linkedin; Google; Websites; Twitter
Software for knowledge construction	Cognitive tools, collaborative editing tools, virtual simulation tools, etc.	Cognitive tools: mind mapping, GeoGebra Collaborative editing tools: Knowledge forum, wiki, shimo.im, Tencent Document, Google Docs, Trello VR tools: PhET, Sandboxie, KRPano
Software for learning analytics	Apps, websites, and interactive class software supporting data analysis	Apps: Smart Partner
Software for practice and evaluation	All kinds of tools suitable for higher education and basic education	
Software for resources and class management	Apps for learning and class management, mini-programs in Wechat, as well as social software	Learning management systems: Moodle, Edmod, Schoolo, TalentLMS Class management apps: EasiCare, Mentimeter, Typeform. Social software: QQ Group, Wechat Group, Facebook, WhatsApp, Skype, and line.

4. Results

According to those premises, different types of tools and platforms were used in an integrated way to support online learning and teaching during the pandemic situation that the world faced since March 2020 and forced the Universities to go online. The analysis done, helped to identify the main technologies utilized for online education, which are summarized and classified into different categories based on their functions in Table 2.

Table 2: Software for knowledge transfer in Digital Education

Categories of Software		Representative Software	Links
Software for producing resources	PPT recording software	PowerPoint and WPS in Windows, Keynote in IOS system	PowerPoint:https://products.office.com/zh-cn/powerpoint keynote:https://www.apple.com/keynote/
	Screen capture software	Camtasia Studio, QuickTime, Adobe Premiere	Camtasia Studio:https://www.techsmith.com QuickTime:https://support.apple.com/quicktime Adobe Premiere https://www.adobe.com/cn/products/premiere.html
	The software for video production	Huawei Course maker App	https://coursemaker.org/

Categories of Software		Representative Software	Links
	The software of original video producing	Mobile phones, CamScanner	CamScanner:https://www.camscanner.com
	The software of Multimedia learning resource-producing	Mystic raft, Adobe Captivate	Mystic raft : https://en-vr.101.com Adobe Captivate:https://www.adobe.com/cn/products/captivate.html
Software for live teaching	All types of live streaming software, including software on interactive teaching, remote office, online-course	Remote office: ZOOM, TED Conversations Online course platforms: edX, Coursera, Udacity	ZOOM https://zoom.com.cn EdX https://www.edx.org Coursera https://www.coursera.org Udacity https://www.udacity.com/
Software for asynchronous teaching	All kinds of online teaching platforms at a national level, regional level, and university community level, as well as those launched by universities and enterprises	Course sharing platform edX, Coursera, Udacity	EdX https://www.edx.org Coursera https://www.coursera.org Udacity https://cn.udacity.com
Software for self-regulated learning	Learning apps for all subjects	Youtube; Facebook; Instagram; Wikipedia; Linkedin; Google; Websites; Twitter	Www. Youtube.com www.facebook.com
Software for knowledge construction	Cognitive tools, editing collaborative tools, virtual simulation tools, etc.	Cognitive tools: mind mapping, GeoGebra Collaborative editing tools: Knowledge forum, wiki, shimo.im, Tencent Document, Google Docs, Trello VR tools: PhET, Sandboxie, KRPano	mind mapping https://www.mindmapping.com Geogebra https://www.geogebra.org Knowledge forum http://www.knowledgeforum.com wiki http://wiki.com Shimo.im https://shimo.im/welcome Tencent Document, https://docs.qq.com/desktop Google Docs https://google-docs.en.softonic.com Trello https://trello.com Phet https://phet.colorado.edu/zh_CN/ Sandboxie https://www.sandboxie.com KRPano http://www.krpano360.com
Software for resources and class management	Apps for learning and class management, mini-programs	Learning management systems: Moodle, Edmod,Schoology, TalentLMS	Moodle https://moodle.org Edmodo https://api.edmodo.com Schoology

Categories of Software		Representative Software	Links
	in Wechat, as well as social software	Class management apps: EasiCare, Mentimeter, Typeform. Social software: QQ Group, Wechat Group, Facebook, WhatsApp, and Skype.	https://www.schoology.com TalentLMS https://www.talentlms.com EasiCare https://care.seewo.com Mentimeter https://www.mentimeter.com Typeform https://www.typeform.com/forms/ QQ https://im.qq.com WeChat https://weixin.qq.com Facebook http://www.facebook.com/ WhatsApp https://www.whatsapp.com/

Students used their smartphones to access most of these sorts of software because there was an emergency throughout the world, and many students didn't have PCs or laptops to attend online lessons. In this perspective, the relevance of MLearning (Mobile Learning) (Sungkur, et al, 2016), which is an extension of eLearning, should be discussed.

The use of mobile devices such as phones and tablets in the learning process has led to a rethinking of pedagogical techniques and learning aids, since mobile technology allows students to learn when and when they wish. Mobile learning is based on social constructivism and is student-centered (network learning).

These mobile technologies are a) portable: technology is available whenever the individual needs to learn; b) Individual: technology can be tailored to the individual's competencies, knowledge, and learning style; c) discrete: the student can capture situations and apply knowledge without the technology becoming overtly visible; d) Available: the individual can use technology anywhere to communicate with other individuals. e) adaptable: technology can be adapted to the context of learning and student's evolution skills and knowledge; f) persistent: the individual can use technology to manage lifelong learning, resources and knowledge will be immediately accessible, despite changes in technology; g) useful: the technology is adequate to the daily needs of communication, work, and learning; h) easy to use: the technology is easily understood and used by people with no prior experience. Because learning may be done anytime, anywhere, and with maximum portability, mobility, interaction, and connectivity.

Some of the main possible activities are presented in the following table (Table 3):

Table 3: Activities that enhance knowledge transfer and learning in Mobile Learning



The use of Digital Education practices integrated into teaching-learning, consider several types of activity that potentiates the knowledge sharing among professors – students: students-professors, and students – students.

5. Conclusions

Digital Education offers greater control and autonomy over learning itself and enables learning in context, that is, in the place, time, and conditions that the student judges most appropriate (i.e., through eLearning platforms or even educational games (Sousa & Rocha, 2017). It can help users become more productive by optimizing downtimes with information. Because of the prevalence of mobile devices, time and space constraints are removed, allowing for greater effectiveness and efficiency in teaching and learning. Mobile learning has been viewed as favorable to informal learning, with Web-based information that is easily transferrable to the small screen, such as photos, audio, and video, readily available (Friend & Militello, 2014; Sousa et al., 2017). Mobile learning gadgets, in addition to their portability, mobility, flexibility, and autonomy, provide on-demand capabilities, allowing you to have what you want when you want it and when you have the time. For future research the study of the emergent pedagogies associated to these technologies need to be identified and analyzed. This research has several contributions for practice, namely, the systematization and dissemination of knowledge about educational technologies and software, which allows the academics and researchers to apply them in their classes and research.

Acknowledgements

This paper is financed by National Funds provided by FCT- Foundation for Science and Technology through project UIDB/04020/2020

References

Aaker, D.A.; Kumar, V., & Day, G. S. (2004). Marketing research. São Paulo: Atlas.

Abad-Segura, E., González-Zamar, M. D., Infante-Moro, J.C., & García, G. R. (2020). Sustainable management of digital transformation in higher education: Global research trends. Sustainability (Switzerland), 12(5). https://doi.org/10.3390/su12052107

Al-Kurdi, O., El-Haddadeh, R., & Eldabi, T. (2018). Knowledge sharing in higher education institutions: a systematic review. Journal of Enterprise Information Management, 31(2), 226–246. https://doi.org/10.1108/JEIM-09-2017-0129

Amorim, José Pedro(Mature students' access to higher education: a critical analysis of the impact of the 23+ policy in Portugal. European Journal of Education, Glasgow, v. 53, n. 3, p. 393-413, 2018.

Arnold, D., & Sangrà, A. (2018). Dawn or dusk of the 5th age of research in educational technology? A literature review on (e-)leadership for technology-enhanced learning in higher education (2013-2017). International Journal of Educational Technology in Higher Education, 15(1). https://doi.org/10.1186/s41239-018-0104-3

Au-Yong-Oliveira, M., Gonçalves, R., Martins, J., & Branco, F. (2018). The social impact of technology on millennials and consequences for higher education and leadership. Telematics and Informatics, 35(4), 954–963. https://doi.org/10.1016/j.tele.2017.10.007

Bogdan, R. & Biklen, S. (1994). Qualitative Research in Education. Porto Editora.

Castañeda, L., & Selwyn, N. (2018). More than tools? Making sense of the ongoing digitizations of higher education. International Journal of Educational Technology in Higher Education, 15(1). https://doi.org/10.1186/s41239-018-0109-y

Castro, R. (2019). Blended learning in higher education: Trends and capabilities. Education and Information Technologies, 24(4), 2523–2546. https://doi.org/10.1007/s10639-019-09886-3

Criollo-C, S., Guerrero-Arias, A., Jaramillo-Alcázar, Á., & Luján-Mora, S. (2021). Mobile learning technologies for education: Benefits and pending issues. Applied Sciences (Switzerland), 11(9). https://doi.org/10.3390/app11094111

Cunha, Maria Isabel. The quality and teaching of graduation and the complex exercise of proposing indicators: is it possible to obtain advances? Evaluation (Unicamp), v. 19, p. 789-802, 2014.

Fearnley, M. R., & Blackberry, J. (2020). Learning Management System Adoption in Higher Education Using the Extended Technology Acceptance Model. IAFOR Journal of Education: Technology in Education, 8(2), 89–106.

Fischer, B., Guerrero, M., Guimón, J., & Schaeffer, P. R. (2021). Knowledge transfer for frugal innovation: where do entrepreneurial universities stand? Journal of Knowledge Management, 25(2), 360–379. https://doi.org/10.1108/JKM-01-2020-0040

Gachago, Daniela, Livingston, Candice, Ivala, Eunice. Podcasts: technology for all? British Journal of Educational Technology, Kingdom, v. 47, n. 5, p. 859-872, 2016.

Gil, A.C. (2008). Methods and techniques of social research.6th ed. São Paulo: Atlas.

Halili, S. H., & Sulaiman, S. (2021). Students' perception to integrate education 4.0 in Science programs. Multidisciplinary Journal for Education, Social and Technological Sciences, 8(1), 45-57. https://doi.org/10.4995/muse.2021.14768

Hamidi, H., & Chavoshi, A. (2018). Analysis of the essential factors for the adoption of mobile learning in higher education: A case study of students of the University of Technology. Telematics and Informatics, 35(4), 1053–1070. https://doi.org/10.1016/j.tele.2017.09.016

Hilli, C., & Åkerfeldt, A. (2020). Redesigning distance courses to support social and teaching presence in adult and upper secondary education in adult and upper secondary education. Education in the North, 27(2), 38–55. https://doi.org/10.26203/qvfj-1t89

Hilton, J. L., Gaudet, D., Clark, P., Robinson, J., & Wiley, D. (2013). The Adoption of Open Educational Resources by One Community College Math Department. International Review of Research in Open and Distributed Learning, 14(4).

Houlden, S., & Veletsians, G. (2019). A posthumanist critique of flexible online learning and its "anytime anyplace" claims. British Journal of Educational Technology, 50(3), 1005–1018. https://doi.org/10.1111/bjet.12779

https://doi.org/10.13140/RG.2.2.34706.89289

Huang, R., Tlili, A., Chang, T. W., Zhang, X., Nascimbeni, F., & Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: Application of open educational practices and resources. Smart Learning Environments, 7(1), 1–15.

Islam, M. K., Sarker, M. F. H., & Islam, M. S. (2022). Promoting student-centered blended learning in higher education: A model. E-Learning and Digital Media, 19(1), 36–54. https://doi.org/10.1177/20427530211027721

Lazar, I.M., Panisoara, G., & Panisoara, I. O. (2020). Digital technology adoption scale in the blended learning context in higher education: Development, validation, and testing of a specific tool. PLoS ONE, 15(7 July), 1–27. https://doi.org/10.1371/journal.pone.0235957

Morosini, Marília Costa. Quality of higher education and emerging contexts. Evaluation, Campinas; Sorocaba, SP, v. 19, n. 2, p. 385-405, 2014.

Nikou, S., & Aavakare, M. (2021). An assessment of the interplay between literacy and digital Technology in Higher Education. Education and Information Technologies, 26(4), 3893–3915. https://doi.org/10.1007/s10639-021-10451-0

Nuñez-Canal, M., & de Obesso, M. (2021, January). El modelo educativo híbrido: una respuesta necesaria de la enseñanza universitaria a partir de la Covid-19. Preprint.

Reis, M. A. F., Favretto, J., Favretto, N.M., Favretto, L.M. H., & Santos, R. P. (2022). Knowledge management in the classroom using Mendeley technology. Journal of Academic Librarianship, (September 2021), 102486. https://doi.org/10.1016/j.acalib.2021.102486

Sahu P. (2020). Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. Cureus, 12(4). https://doi.org/10.7759/cureus.7541

Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A., & Lalatsa, A. (2019). Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. European Journal of Education, 54(2), 273–286. https://doi.org/10.1111/ejed.12330

Shu, H., & Gu, X. (2018). Determining the differences between online and face-to-face student–group interactions in a blended learning course. Internet and Higher Education, 39(May), 13–21. https://doi.org/10.1016/j.iheduc.2018.05.003

Smith, K., & Hill, J. (2019). Defining the nature of blended learning through its depiction in current research. Higher Education Research and Development, 38(2), 383–397. https://doi.org/10.1080/07294360.2018.1517732

Sophonhiranrak, S. (2021). Features, barriers, and influencing factors of mobile learning in higher education: A systematic review. Heliyon, 7(4), e06696. https://doi.org/10.1016/j.heliyon.2021.e06696

Spante, M., Hashemi, S. S., Lundin, M., & Algers, A. (2018). Digital competence and digital literacy in higher education research: Systematic review of concept use. Cogent Education, 5(1), 1–21. https://doi.org/10.1080/2331186X.2018.1519143

Spector, J.M., Merrill, M. D., Elen, J., & Bishop, M. J. (2014). Handbook of research on educational communications and technology: Fourth edition. Handbook of Research on Educational Communications and Technology: Fourth Edition, 1–1005. https://doi.org/10.1007/978-1-4614-3185-5

Stevenson, E. & Hedberg, J. G. (2017). Mobilizing learning: a thematic review of apps in K-12 and higher education. Interactive Technology and Smart Education, Bingley, v. 14, n. 2, p. 126-137.

Taglietti, D., Landri, P., & Grimaldi, E. (2021). The big acceleration in digital education in Italy: The COVID-19 pandemic and the blended-school form. European Educational Research Journal, 20(4), 423–441. https://doi.org/10.1177/14749041211021246

Tang, H. (2021). Implementing open educational resources in digital education. Educational Technology Research and Development, 69(1), 389–392. https://doi.org/10.1007/s11423-020-09879-x

Turula, A. (2018). The shallows and the depths. Cognitive and social presence in blended tutoring. Technology, Pedagogy, and Education, 27(2), 233–250. https://doi.org/10.1080/1475939X.2017.1370388

Vergara, S.C. (2009). Projects and research reports in administration. São Paulo: Atlas Publishing House, 11th Ed.

Zou, W., Hu, X., Pan, Z., Li, C., Cai, Y., & Liu, M. (2021). Exploring the relationship between social presence and learners' prestige in MOOC discussion forums using automated content analysis and social network analysis. Computers in Human Behavior, 115(January 2020), 106582. https://doi.org/10.1016/j.chb.2020.106582

Knowledge Management of Business Ethics in Lithuanian Companies

Sonata Staniulienė, Giedrius Jucevičius and Kristina Grumadaitė
Vytautas Magnus University, Kaunas, Lithuania
sonata.staniuliene@vdu.lt
giedrius.jucevicius@vdu.lt
kristina.grumadaite@vdu.lt

Abstract: The never-ending series of ethical scandals in companies in various industries across the countries show that business ethics problems are not diminishing, so means to develop business ethics need to be sought to better serve the interests of stakeholders and society. As in other areas of management, knowledge and understanding of business ethics need to be developed, knowledge accumulated, transferred and applied, and knowledge management models and processes can be applied to this in societal, associative, organizational, and individual levels. Therefore, the aim of the research is to evaluate business ethics knowledge management in order to suggest for companies relevant business ethics knowledge management solutions. The survey is conducted in the case of Lithuanian companies by the method of a quantitative questionnaire survey of companies' employees. Although the companies demonstrate a high level of ethical knowledge of how to behave in a business environment, the study reveals some gaps in ethical knowledge management related to a mercantilist approach to knowledge management when business ethics knowledge is developed, consolidated, disseminated and applied when corporate representatives see it's. benefits. However, there is a lack of systematic knowledge sharing and transparency, knowledge accumulation and understanding of how to put ethical knowledge into business in practice. The study show high importance of moral leadership and leading by example in knowledge management of business ethics.

Keywords: knowledge management, business ethics, knowledge creation, knowledge storage, knowledge transfer, knowledge application

1. Introduction

At first glance, it seems to every employee in the company that it is not difficult to distinguish between what is ethical and unethical when conducting business. In human nature, it is coded to instantly assess and condemn what is good or bad according to the moral norms we have learned from childhood in a way of socializing in different collectives (Mujtaba and Sims, 2006). However, employees rarely begin to question his or her knowledge and beliefs in the context of business ethics until he or she encounters the first ethical dilemma when no one knows the right answer on how to behave appropriately and how to manage to respond to the interests of all stakeholders. As with any subject in business, business ethics must be learned, and companies' managers must ensure that knowledge of business ethics is managed: ethical knowledge must be created, accumulated, transferred and applied (Winiecki, Catlin and Ackler, 2020) in a systematic, consistent, and transparent manner (Türegün, 2017) to the organization's employees. Only then managers of the organization can prevent the rise of ethical scandals and ensure a sense of justice for all stakeholders about their business activities processes and results.

Recently a number of studies examines the models of knowledge management (i. e., Abdullah et al, 2005; Alavi and Leidner, 2001; Biloslavo and Zornada, 2013; King and Ko, 2001; Kyoratungye et al, 2009; Lai and Chu, 2000; Okunoye, 2003; Rubenstein-Montano, 2001; etc.). Many researchers analyse business ethics frameworks as well (i. e., Appelbaum et al, 2009; Carter, 2000, Di Lorenzo, 2007; Svensson and Wood, 2004; 2008; etc.), but there is still the lack researchers' attention to the research of management of company's ethical knowledge. Due to the mentioned reasons, further research in Lithuanian companies is needed to solve research problem how to manage the knowledge of business ethics in companies.

The aim of the research is to evaluate business ethics knowledge management. It is important in order to suggest for companies relevant business ethics knowledge management solutions, after examining the case of Lithuanian companies.

Research method used in this paper is quantitative method of survey.

2. Theoretical Background

Knowledge management has become important for businesses because it enables organizations to gain a competitive advantage and work effectively through the sharing and systematic complement of knowledge (Abdullah et al, 2005). In business, knowledge management is used to systematically manage information and competence to improve an organization's responsiveness, innovation, competence, and efficiency (Kyoratungye et al, 2009). According to Bukowitz (1999), knowledge management is the process by which an organization creates value from its knowledge or intellectual capital. Most often, generating value from knowledge involves sharing it among employees, departments, and even with other companies to create best business practices (Kyoratungye et al, 2009). It is clear that knowledge management plays an important role in creating corporate values and norms (Alavi and Leidner, 2001; Le Dinh et al., 2013).

Most authors describe knowledge management as a process consisting of separate sub-processes. Rubenstein-Montano et al (2001) describe a number of knowledge management frameworks, as well as Lai and Chu [2000], pointing out that knowledge management process is integrated based on the content of the process stages and suggest that the process should be divided into seven stages: initiation, generation, modelling, storage, distribution and transfer, use, and retrospective. Kinney (1999) defined knowledge management as the process by which an organization develops, captures, acquires, and uses knowledge to support and improve the performance of the organization. According to Kyoratungye et al, (2009) knowledge management is a management activity that develops, transmits, transfers, accumulates, and applies knowledge in decision-making to achieve organizational goals. Most scholars have identified the following sub-processes to describe the process of knowledge management: knowledge creation, storage, transfer, and application (Alavi and Leidner, 2001; Biloslavo and Zornada, 2013):

- Knowledge creation within an organization is a dynamic interaction of knowledge at the individual and social level, when new knowledge is generated in the learning process. Studies by some authors (e.g., Nonaka, 2000) suggest that different forms of knowledge (e.g., open documents, implicit knowledge) should be generated from a variety of internal and external sources.
- After the process of knowledge creation new knowledge must be stored for later use in the organization (Alavi and Leidner, 2001). Knowledge storage include ways to transform documents, models, human insights, and other artifacts into forms that facilitate their retrieval and transfer without losing the true meaning of knowledge (Staples et al, 2001). Using IT, organizations strive to embed knowledge about customers, projects, processes, suppliers, competition, technology, industry, and the organization's own knowledge that can be accessed or transferred.
- Knowledge transfer occurs at various levels of an organization, such as among individuals, groups, an organization, and organizations (Alavi and Leidner, 2001). Organizations strive to deliver the right knowledge in a timely manner to where it is needed. This process can be largely supported by ICT, social media (Hansen et al, 1999). Knowledge transfer take place through training programs, informal networks to be applied in the organizational decision-making process (Alavi and Leidner, 2001).
- Knowledge application can ensure that an organization's knowledge is a viable source of competitive advantage. For the available knowledge to be useful to the organization's stakeholders, it must help to respond their interests and achieve their goals.

The knowledge management framework is widely used by researchers to enable organizations to manage knowledge for the decision-making process in organizations (King and Ko, 2001) in multidisciplinary research (e.g., Le Dinh et al, 2015; Baesens et al, 2016; Wamba et al, 2017). However, it is not easy to obtain, store, interpret, and manage data to turn information into awareness and later into action (Sivarajah et al, 2017), as these processes vary depending on the type of knowledge intellectual capital the organization seeks to improve. Knowledge management processes are socially carried out activities that support individual and collective knowledge and interaction (Alavi and Leidner, 2001). According to Okunoye (2004), organizational variables in knowledge management include norms, shared values, and beliefs that underpin business ethics.

Gottlieb and Sanzgiri (1996), Svensson and Wood (2008), Di Lorenzo (2007), and other researchers raise many important ethical issues related to business. For instance, when it comes to business ethics, pressure from external stakeholders often requires accountability from the company. Thus, businesses are involved in the ethical processes in three main levels of business ethics - systemic order, corporate, and individual levels, also called macro-, meso-, and micro-levels (McDonald and Nijhof, 1999; Karmasin and Litschka, 2008; Horodecka, 2014):

- The macro-level is a systemic level dealing with benefit-sharing, justice, economic order, justice and legality.
- At the meso-level, business ethics relate to a company's approach to its owners and stakeholders and acts as an inter-organizational network.
- Micro-level is concerned with the individual ethics of managers, leaders and employees, in line with personal and professional values and norms in organizations.

There are different levels of ethical issues in organizations. McDonald and Nijhof (1999) emphasize that in order for meso-level ethical action to be effective, there must be certain theoretical assumptions at both the corporate (meso) and individual (micro) levels. This means that good governance can create an ethically supportive environment and behaviour. Appelbaum et al. (2009) state that the micro-level is considered to be the most important and can influence the development of a sustainable corporate ethical culture in the long run, and other areas are strategically important at the macro-level, but do not necessarily translate into strategic actions with positive and noticeable behavioural effects. On the one hand, business ethics has an external emphasis, given the gap between organizations' ethical actions and behaviour in their business practices and the market or public perception, on the other hand, corporate ethics has an intrinsic emphasis, given the gap between management's ethical actions and behaviour and staff perceptions in business practices (Svensson and Wood, 2004). Previous studies have ethically addressed limited parts of this idea in organizations, but not the whole process (e.g., Moberg, 2003; Carter, 2000). By combining business ethics levels and knowledge management models, their respective strengths can be harnessed. Their application is expanded and a synthesis of critical areas in which knowledge management can create processes of thinking and action conducive to the development of an ethical culture and the development of ethical behaviour in companies is presented.

After analysis of the process of knowledge management in the companies and levels of business ethics, raised on the discussion above, the subsequent research hypotheses are developed:
H1: Ethical business is developed through business ethics' knowledge creation.
It is based on the premise that ethical knowledge creation in macro-, meso-, and micro- levels of business ethics can lead to development of ethical business.
H2: Ethical business is developed through business ethics' knowledge storage.
It is grounded by the premise that ethical knowledge storage and accumulation in macro-, meso-, and micro-levels of business ethics can lead to development of ethical business.
H3: Ethical business is developed through business ethics' knowledge transfer.
It is assumed that the transfer of ethical knowledge in macro-, meso-, and micro- levels of business ethics can lead to development of ethical business.
H4: Ethical business is developed through business ethics' knowledge application.
It could be argued that applied ethical knowledge in macro-, meso-, and micro- levels of business ethics can lead to development of ethical business.

In order to find out whether business ethics is developed through knowledge management, quantitative research is carried out.

3. Research Method

Quantitative research method was selected for data collection, which aims to acquire quantitative information about many research objects (in this case, employees of Lithuanian companies). It was chosen to conduct an anonymous survey.

The research questionnaire, elaborated by authors, contains an introductory part, which defines who and for what purpose the research is carried out, emphasis on anonymity and twelve main questionnaire statements blocks: the first four are on knowledge in business ethics creation in macro-, meso- and micro-levels, next - to reveal ethical knowledge storage, transfer, and the last are related to the application of knowledge in business ethics. This set of questions is based on the four-component model of knowledge management of Alavi and Leidner (2001). Each component was analysed by the three-level model of business ethics by Appelbaum et al (2009). Respondents were asked to rate the accuracy of the presented feature by choosing an answer on a Likert scale from 1 to 5, where 1 means "Completely Disagree", 2 - " Partially Disagree", 3 - "Neutral Opinion", 4 - "Partially agree" and 5 - "Completely agree".). Demographic questions are placed at the end of the questionnaire. Participants were sent an invitation e-mail with a link to fill the online questionnaire.

The research sample was calculated on the basis of Paniotto formula (Kardelis, 2002). The Department of Statistics of Lithuania provided data that there were 1,423.000 persons who were working in 2022. The selected sample error size is 7%. Calculations show that 196 respondents need to be questioned to ensure the representativeness and reliability of the survey. The survey involved 214 respondents working in various Lithuanian companies, therefore it can be stated that the results of the survey are reliable.

50.2% of participants were till 25 years old, 22.2% - from 26 to 35, 6.7% - from 36 to 45, 11.1 % - from 46 to 55, and 4.4% - older than 56 years old respectively; 37.3% have university degree, 16.9% - college, 27.1% - secondary, 11.6% - vocational, and basic education; 40% worked in the same organization from 3 months to 1 year, 23.6% - from 1 to 3 years, 18.2% - from 3 to 10, 12.4% – more than 10 years respectively; 32.8% worked as specialists, 19.7%, - workers, 17.2% – service staff, 12.2% - managers, 9.4% - executives, and 7% as sellers; 68.9% work in private company, 19.1% - in state-owned, and 6.2% - in NGO; 40.9% of companies were big, 17.3% - medium, 20.9% - small, and 15.1% – in micro companies; 46.2% were service companies, 19.6% - selling, 14.2% - production, and 20% - mixed.

The obtained data were examined by the SPSS 21 software. Descriptive statistics, crosstabulation were used for data analysis. Mean values (M), medians (MD), standard deviation (SD) were calculated and analysed. According to the Kolmogorov-Smirnov test, the data is not normally distributed, as well, measured on a rank scale, therefore, nonparametric Spearman correlation coefficient (r) was used to determine the significance of the relationships: if $0<|r| \leq 0.3$, values are weakly dependent, if $0.3<|r| \leq 0.7$ - moderately dependent, and if $0.7<|r| \leq 1$ - strongly dependent. When the significance level was $p < 0.05$, the difference in indications between the dimensions was considered statistically significant.

4. Results and Discussion

In developing ethical knowledge at the macro-level, Lithuanian companies are developing the norms of behaving fairly, honestly, not lying (M-4.03, MD-4.00, SD-1.115), and respect the principle of equality (M-3.89, MD-4.00, SD-1.110). Though, the principles are often questioned in a variety of compromise situations (M-3.12, MD-3.00, SD-1.297), and employees are often convinced that ethical decisions are driven by the principle of selfishness (M-3.11, MD-3.00, SD-1.345). Assumed the importance to meet stakeholders' needs, companies seek to acknowledge how to respond to the interests of customers, buyers, consumers in the production / servicing (M-4.04, MD-4.00, SD-1,074), are quite active in cooperating with competitors, which have become partners following the change in their approach to competition (M-3.92, MD-4.00, SD-1.125). Companies are less likely to invite the stakeholders to discuss performance (M-3.26, MD-3.00, SD-1.272), and show less interest to hold roundtables, inviting various stakeholders to identify their interests and opportunities together (M-2.92, MD-3.00, SD-1.454). Employees of companies underestimate the possibilities to find out the solution to complex ethical situations thanks to governmental institutions (M-2.99, MD-3.00, SD-1.147). At the micro-level, a common practice is to increase awareness of what is right, moral, and what is not in the company by discussing with colleagues in informal way (M-3.93, MD-4.00, SD-1.105), less often - in communication with managers (M-3.52, MD-4.00, SD-1.209). Consensus within the team on what is moral and fair and what is not could be better (M-3.36, MD-3.00, SD-1.212).

When analysing how ethical knowledge storage occurs at the macro-level, it can be observed that some companies integrate it into social responsibility reports (M-3.04, MD-3.00, SD-1.375). However, companies' domains of ethical knowledge are not very accessible to the society, as companies focus on IT solutions seeking to accumulate knowledge (even via methods such as surveillance cameras (M-2.76, MD-3.00, SD-1,512)) but also to protect it, often on the grounds of competitive secrecy or personal data protection (M-3.79, MD-4.00, SD-1.307). At the meso-level, companies often establish code of ethics for their activities with other companies and stakeholders (M-3.64, MD-4.00, SD-1.363), with fewer having an appointed ethics board / committee / specialist (M-3.03, MD-3.00, SD-1.506). Employees state they are familiar with the moral standards in the company (M-4.02, MD-4.00, SD-1.115), but not much employees state that everything is clearly written in the detailed rules, instructions, standards, or other documents (M-3.55, MD-4.00, SD-1.284), there are many unwritten rules that employees simply know (M-3.73, MD-4.00, SD-1.282), though, a large number of employees have doubt in their work, how to deal with specific situations (M-2.83, MD-3.00, SD-1.279), ad a number of managers also hide information from employees that they do not need to know by their position (M-2.95, MD-3.00, SD-1.375), while colleagues are rather silent, seeing / hearing the unethical actions (M-2.94, MD-3.00, SD-1.260) instead of revealing this. At the micro-level, the most common practices for preserving ethical knowledge are focused on

keeping accumulated knowledge secret in the for internal needs, as the work or movement of most employees is tracked through IT programs (M-3.61, MD-4.00, SD-1.506), a large proportion of employees have signed non-competing agreements (M-3.86, MD-4.00, SD-1.004) and employees are required to sign a confidentiality agreements before the employment (M-3.78, MD-4.00, SD-1.306). Moreover, sometimes employees are required to keep the company 's secrets on illegal actions (M-2.23, MD-2.00, SD-1.438).

For business ethics knowledge transfer at the macro-level, companies communicate their values, mission, and credo (M-3.39, MD-4.00, SD-1.515), social responsibility (M-3.38, MD-3.00, SD-1.319) and social activities towards the society (M-3.06, MD-3.00, SD-1.327). At the meso-level, many companies voluntarily provide information to media on their activities and results (M-3.75, MD-4.00, SD-1.282). Incorrect information about goods and services provided to customers on labels / instructions is rare (M-1.81, MD-1.00, SD-1.165), as well as unethical / false advertising of the company's products / services (M-1.69, MD-1.00, SD-1.061). At the micro-level, the best transmitters of ethical knowledge are company's managers who become ethical and moral leaders (M-4.03, MD-3.00, SD-1.241), and their actions show employees that unethical activities are not tolerated in the company (M-4.03, MD-3.00, SD-1.241). Complaints about non-compliance of ethics are still quite rare among the employees themselves (M-2.57, MD-2.00, SD-1.347).

In the application of business ethics knowledge at the macro-level, the majority of respondents agree that companies primarily aim to create the greatest value for the stakeholders (M-3.76, MD-4.00, SD-1,065) and they are socially responsible indeed, confirming this through actions (M-3.56, MD-4.00, SD-1.294), engaged in charity (M-3.13, MD-3.00, SD-1.244), and their performance contributes to solving problems of society (M-3.72, MD-4.00, SD-1.419). Only a small number of companies significantly pollute the environment (M-1.65, MD-1.00, SD-0.999), though respondents acknowledged that the performance of most companies is detrimental to the health of society members in one or another way (M-4.21, MD-4.00, SD-0.908). In terms of stakeholders, business ethics is applied to help companies create benefits for local communities (M-3.65, MD-4.00, SD-1.257), and is rarely detrimental to them (M-1.64, MD-1.00, SD-1.011). The company seeks to meet the interests of all stakeholders in its activities (M-3.24, MD-3.00, SD-1.269), to perform their duties properly, to a high standard, even if this deters the customer (M-3.07, MD-3.00, SD-1.309). Also, the competition between the company and competitors is fair (M-3.76, MD-4.00, SD-1.186), competitors are competed in legal ways (M-4.14, MD-5.00, SD-1.083), in rare cases companies try to harm competitors (M-1.67, MD-1.00, SD-1.020). Companies perform their obligations to the partners by being able to complete their work on time in good faith (M-3.64, MD-4.00, SD-1.555), as well as to perform their financial obligations (M-2.83, MD-3.00, SD-1.445). Study shows intolerance for low quality of goods and services (M-1.94, MD-1.00, SD-1.218). Companies rarely bribe representatives of other institutions for the benefits (M-1.62, MD-1.00, SD-1.044) or better services (M-1.69, MD-1.00, SD-1.126). At the organizational level, words often coincide with actions in the company (M-3.76, MD-4.00, SD-1,050).

Those working in the same positions are paid the same salary (M-3.49, MD-4.00, SD-1,292), and misconducted employees are fired (M-3.09, MD-3.00, SD-1,460). Minorities and women are rarely discriminated (M-1.58, MD-1.00, SD-0.993), documents forged (M-1.71, MD-1.00, SD-1.142), salaries paid in an "envelope" (M-1.53, MD-1.00, SD-1.112), abuse of office (M-1.99, MD-1.00, SD-1.276), spying workers (M-1.88, MD-1.00, SD-1.214) are rarely observed. However, there are still a number of cases of unfair recruitment or dismissal of employees (M-2.09, MD-2.00, SD-1.214), bribes for promotion or recruitment (M-2.25, MD-2.00, SD-1.234), and exploitation of employees (M-2.14, MD-2.00, SD-1.302). A mercantilist approach to the application of business ethics is noticeable, as employees often know that their salary depend on the results achieved (M-3.50, MD-4.00, SD-1.390), so, the goal is to achieve it (M-2.98, MD-3.00, SD-1.343), and even high risk is justified for that (M-3.91, MD-4.00, SD-1.116), so it becomes normal for the employees to behave in a way that is useful in the case and change the position if needed (M-2.99, MD-3.00, SD-1.260). Despite such practices, many employees acknowledge there are employees / managers in the team whose actions cannot be morally justified (M-3.18, MD-3.00, SD-1.433), and that long run orientation of companies is the rather rear comparing to the short term (M-1.75, MD-1.00, SD-1.053).

Analysing business ethics knowledge management results, we can see that a lot of practices applied in accordance to ethical knowledge are interlinked together. There is statistically significant correlation between mismatches words with actions in the company and employee exploitation (0.594), there employees are required to maintain the secrets of the organization (-0.531), bribes are taken for promotion or hiring (0.506), and to maintain the company's secrecy about illegal activities, and counterfeit documents (e.g., financial statements) (0.547). Falsification of documents correlates to compensation for work partly in an 'envelope'

(0.568), bribes given to representatives of other institutions for the benefit or advantage (0.610), and unethical, false advertising of products or services (0.509). Links were found between abuse of office and bribes for promotion or hiring (0.542), to bribes to other institutions for convenience or benefit (0.524), or to employees for better services (0.507), forgery of documents (0.528), unfair dismissal (0.601), unethical, false advertising (0.552), tolerance of lack of quality in goods and services (0.504), exploitation of employees in the company (0.643), and mismatches words with actions (0.531). Bribes to other institutions for advantage or benefit relate to bribes to employees for better services (0.697), as well as to bribes for promotion or recruitment (0.504). Also, unethical, false advertisements correlates to the tolerance of lack of quality (0.596), the harm of company's performance to the local community (0.543), buyers, customers and consumers are given then incorrect information (0.545) and services (0.528).

Otherwise, there is a strong positive statistical correlation between the presence of the leaders of the company as ethical leaders and moral example and the importance of acting fairly, honestly and not lying in the company (0.582), coincidence of words in the company (0.637), and more respect for the principle of equality (0.608), as well as, if there is an opportunity in the company to discuss with managers in the team what is right, morality, and what is not (0.590). Having an company's code of ethics aligns with having an ethics council / committee / specialist (0.528), the company's efforts to protect personal data by investing in IT (0.603) and announcing social responsibility reports (0.537).

Summarized information by deriving the means of manifestation of various subprocesses in business ethics knowledge management is presented in the Table 1:

Table 1: The expression of knowledge management process stages in different levels of business ethics in Lithuanian companies (averages of M)

Business ethics level	Knowledge creation	Knowledge storage	Knowledge transfer	Knowledge application
Macro	2.90	3.20	3.28	3.22
Meso	3.43	2.93	3.41	3.71
Micro	3.60	3.45	3.31	2.73
Average:	3.31	3.19	3.33	3.22

Based of the study results, *H1: Ethical business is developed through business ethics' knowledge creation* is partly confirmed. Most of the companies in Lithuania accumulate acknowledgement of appropriate ethical values and norms in business within the company, less of ethical knowledge is acquired in communication with stakeholders, and the least source for that is the societal level, while overall level only slightly exceeds neutral position.

H2: Ethical business is developed through business ethics' knowledge storage is partly confirmed, because also, the overall level of signs of business ethics is even less so than the neutral assessment. Again, at the organizational level, knowledge of business ethics is largely institutionalized, and at the macro-level, sources of knowledge of business ethics are also found, but at the meso-level, there is a lack of consolidation of knowledge of business ethics.

H3: Ethical business is developed through business ethics' knowledge transfer is partly confirmed. Although this area has reached the highest level of resolution, it is still not well rated. Here, on the contrary, at the meso-level, the greatest effort is made to spread the message about the ethics of a company's business, while the dissemination of ethical knowledge at the societal and organizational levels is slower.

Finally, *H4: Ethical business is developed through business ethics' knowledge application* is also partly confirmed. The overall average is also just above the neutral position. The most insufficient expression of the application of business ethics knowledge is within companies, when at the stakeholder level the focus is on their application, at the societal level the applicability of business ethics knowledge is insufficient.

5. Conclusions

After the analysis of the scientific literature, it was determined that most scholars understand knowledge management as a process whose framework consists of the subprocesses of knowledge creation, storage, transfer, and application. However, knowledge management in relation to diverse nature of intellectual capital

may be different, especially when it comes to socially sensitive topics such as business ethics at the societal, stakeholder and organizational levels.

Quantitative research revealed that most Lithuanian companies develop appropriate ethical values and norms, the importance of which is recognized in business. Less of ethical knowledge is gained through communication with stakeholders, and the least exploited source is the societal level. At the organizational level, knowledge of business ethics is largely institutionalized, and at the macro-level, sources of knowledge of business ethics are also found, but at the stakeholders level, there is a lack of consolidation of knowledge of business ethics.

The transfer of business ethics knowledge reaches the highest level of expression. At the meso-level, the greatest efforts are made to spread the message about a company's ethics in business, and the dissemination of ethical knowledge at the societal and organizational levels is worse. The underestimation of business ethics knowledge application is found in companies, when the focus is on its application at the stakeholder level, and the applicability of business ethics knowledge at the societal level is insufficient.

For further studies in other companies, the subprocesses of knowledge management can be applied to evaluate the expression level and develop business ethics knowledge management, embedded at different levels of business ethics. The analysis of the links between the research questions lead to the understanding that the managers plays a very important role in moral leadership and leading by example creating ethical business, with high level of respect to the interests of external and internal company's stakeholders and society on the whole.

Acknowledgements

Research conducted under the project "Smart development of organizational knowledge ecosystem", S-MIP-21-49.

References

Abdullah, R., Sahibuddin, S., Alias, R. A. and Selamat, M.H. (2005) "A Framework for Knowledge Management System Implementation in Collaborative Environment For Higher Learning. *Journal of Knowledge Management Practice*, March.

Alavi, M. and D. E. Leidner (2001). "Review: Knowledge Management and Knowledge Management System: Conceptual foundations and research issues". *MIS Quarterly,* Vol. 25, No. 1, pp 107-136.

Appelbaum, S.H., Vigneault, L., Walker, E. and Shapiro, B.T. (2009) "(Good) corporate governance and the strategic integration of meso ethics". *Social Responsibility Journal*, Vol. 5, No. 4, pp 525-539.

Baesens, B., Bapna, R., Marsden, J.R., Vanthienen, J. and Zhao, J. L. (2016) "Transformational Issues of Big Data and Analytics in Networked Business". *MIS quarterly*, Vol. 40, No 4, pp 807-818.

Biloslavo, R. and Zornada, M. (2013) "Development of a Knowledge Management Framework Within the Systems Context". *Strategic Human Resource Management at Tertiary Level*, pp 137-151.

Bukowitz, W. and Williams, R. (1999) *The knowledge management fieldbook*, Pearson Education Limited.

Carter, C.R. (2000) "Ethical issues in international buyer-supplier relationships: a dyadic examination", *Journal of Operations Management*, Vol. 18, No.2, pp 191-209.

Di Lorenzo, V. (2007) ''Business ethics: law as a determinant of business conduct'', *Journal of Business Ethics*, Vol. 71, No. 3, pp 275-299.

Gottlieb, J.Z. and Sanzgiri, J. (1996) ''Towards an ethical dimension of decision making inorganizations'', *Journal of Business Ethics*, Vol. 15, No. 12, pp 1275-1285.

Hansen, M. T., Nohria, N. and Tierney, T.J. (1999) "What's Your Strategy for Managing Knowledge?". *Harvard Business Review*, Vo. 77, No. 2, pp 106-117.

Horodecka, A. (2014) "The Meaning of the Concept of Human Nature in the Organization and Ethical Concepts Supporting CSR". Społeczny wymiar działalności biznesowej, pp 7-22.

Karmasin, M. and Litschka, M. (2008) *Wirtschaftsethik - Theorien, Strategien, Trends*. Verlag, Berlin.

Infrastructural Considerations.

King, W. R. and Ko, D. G. (2001) "Evaluating knowledge management and the learning organization: An information/knowledge value chain approach". *The Communications of the Association for Information Systems*, Vol. 5, No. 1, pp 19-22.

Kinney, T. (1999) "Knowledge Management, Intellectual Capital and Adult Learning", *Adult Learning*, Vol 10, No. 2, pp. 2–3.

Kyoratungye, K., Aduwo, J.R., Mugejjera, E. and Lubega, J.T. (2009) "Knowledge Management Frameworks: A Review of Conceptual Foundations and a KMF for IT-based Organizations". Strengthening the Role of ICT in Development, Vol. 25, pp 35-57.

Lai, H. and Chu, T. (2000) "Knowledge Management: A Review of Theoretical Frameworks and Industrial Cases". *Proceedings of the 33rd Hawaii International Conference on System Sciences – 2000*, pp 1-10.

Le Dinh, T., Rickenberg, T., Fill, H.G. and Breitner, M.H. (2015) "Enterprise content management systems as a knowledge infrastructure: the knowledge-based content management framework". *International Journal of e-Collaboration,* Vol. 11, No. 3, pp 49-70.

McDonald, G. and Nijhof, A.A. (1999) ''Beyond codes of ethics: an integrated framework for stimulating morally responsible behaviour in organizations'', *Leadership & Organization Development Journal*, Vol. 20, No. 3, pp. 133-146.

Moberg, C.R. (2003) "Evaluating the relationship between questionable business practices and the strength of supply chain relationships", *Journal of Business Logistics*, Vol. 24, No. 2, pp 1-19.

Mujtaba, B.G. and Sims, R.L. (2006) "Socializing Retail Employees in Ethical Values: The Effectiveness of the Formal versus Informal Methods". Journal of Business and Psychology, Vol. 21, No. 2, pp 261-272.

Nonaka, I. (2000) "A dynamic theory of organizational knowledge creation". *Knowledge, groupware and the internet*, pp. 3-42.

Okunoye, A. (2003) "Context-Aware Framework of Knowledge Management Cultural and Infrastructural Considerations". *Organizational Information Systems in the Context of Globalization. Working Conference on Information Systems Perspectives and Challenges in the Context of Globalization*. Athens, Greece, June 15-17, (IFIP 2003), pp 59-71.

Rubenstein-Montano, B., Liebiwitz, J., Buchwalter, J. and McCaw, D. (2001) "A systems thinking framework for knowledge management". *Decision Support Systems,* Vol. 31, No. 1, pp 5-16.

Sciences – 2000

Sivarajah, U., Kamal, M. M., Irani, Z. and Weerakkody, V. (2017) "Critical analysis of Big Data challenges and analytical methods". *Journal of Business Research*, Vol. 70, pp 263-286.

Staples, D.S, Greenaway, K. and McKeen, J.D. (2002) "Opportunities for research about managing the knowledge-based enterprise". *International Journal of Management Reviews,* Vol. 3, No. 1, pp 1-20.

Svensson, G. and Wood, G. (2004) "Corporate ethics and trust in intra-corporate relationships", *Employee Relations Journa*l, Vol. 26, No. 3, pp 320-336.

Svensson, G. and Wood, G. (2008) ''A Model of Business Ethics'', *Journal of Business Ethics*, Vol. 77, No. 3, pp 303-322.

Türegün, N. (2017) "Ethical Awareness, Ethical Decision Making, and Transparency: A Study on Turkish CPAs in Istanbul". *Accounting from a Cross-Cultural Perspective*, IntechOpen, London.

Winiecki, D., Catlin, L. and Ackler, H. (2020) "Developing and Applying Knowledge and Skills in Ethics and Professional Morality: An Evidence-based Practice Paper". *2020 ASEE Virtual Annual Conference Content Access.*

Wamba, S.F., Gunasekaran, A., Akter, S., Ren, S.J.F., Dubey, R. and Childe, S. J. (2017) "Big data analytics and firm performance: Effects of dynamic capabilities". *Journal of Business Research*, Vol. 70, 356-365.

Future Maritime Transport Systems and Integrated Planning

Trine Marie Stene, Kay Fjørtoft and Even Ambros Holte
SINTEF, Trondheim, Norway
Trine.m.stene@sintef.no
Kay.fjortoft@sintef.no
Even.holte@sintef.no

Abstract: Transport systems are becoming increasingly interconnected, automated, and complex, from a human centred approach to digital connectivity. This involves new opportunities but also implies new vulnerabilities. This paper present maritime transport challenges when implementing automated vessels, and especially how this may affect cooperation between organisations. Moreover, the inclusion of vessels with different levels of automation (LoA) will change the interactions between technology (vessels), managers and operators. The purpose is to identify how socio-technical perspectives represented by the Integrated planning (IPL) concept and resilience perspectives can be beneficial when implementing autonomy. Cooperation in a future maritime transport system (MTS) including autonomous vessels will frequently be between unequal actors, involving both conventional and automated vessels and several control centres. Resilience engineering (RE) may contribute to a paradigm shift towards a more proactive perspective. It is important ensuring that new ways of working, regulations and standards are in accordance with practice between strategical, tactical, and operational levels. The paper presents the IPL related to an ongoing Norwegian project for preparation and management of potential brittleness and risks, uncertainties and unknowns when executing transport operations. Particular attention is on integrated planning both between different actors and at different management levels.

Keywords: Integrated planning, Autonomy, Maritime, Transport system, Resilience, Ecosystem

1. Introduction

The capacity of transport supply chains has increased dramatically. One trend is bigger vessels in combination with faster transitions to land-based modes and interconnection to terminals (Rodrigue, 2020). The biggest container vessels could transport up to 8.000 TEUs (Twenty-foot equivalent units) in the mid 1990's. Today this is more than 20.000 TEUs. Economy driven development shifts cost and environmental footprint per transported unit downwards (Notteboom, et al, 2022), it has also increased complexity, dependencies and vulnerability of the Maritime Transport System (MTS) due to increased cargo volumes.

Moreover, the increase in transport capacity also involves more actors. Disruptions of chains may provide far-reaching disturbances, e.g. the container vessel Ever Given blocking the Suez-canal in March 2021 resulting in temporarily stopping more than 400 vessels from passing through (Lee & Wong, 2021). After the channel opened up, due to terminal lack capacity to handle all new demands at the same time, transport was delayed even further.

Developing new MTS with autonomous solutions should learn from conventional shipping experiences when developing new rules and technologies, in addition to building resilience into the MTS by identifying critical elements and developing plans to handle changes and disruptions. Automation of supply chains should be based on understanding traffic and collaboration practices from conventional vessels.

The purpose of this paper is to identify how integrated planning and management concepts can be beneficial when implementing autonomy. Traditional planning normally considers only one transport element, as one vessel or one specific operation. A vessel sailing schedules (voyage plan) and sailing status is seldom connected and proper integrated with the whole transport system. Bringing resilience into planning is important, focusing on both technical, human and organisational levels.

Figure 1 illustrates the complexity of stakeholders involved today, including operational interaction with authorities, and main nautical operations supporting the vessel. Future shipping (autonomous) must understand how the system is organised today, e.g. exchange of mandatory services information, and navigational and operational information exchange with stakeholders and ICT systems.

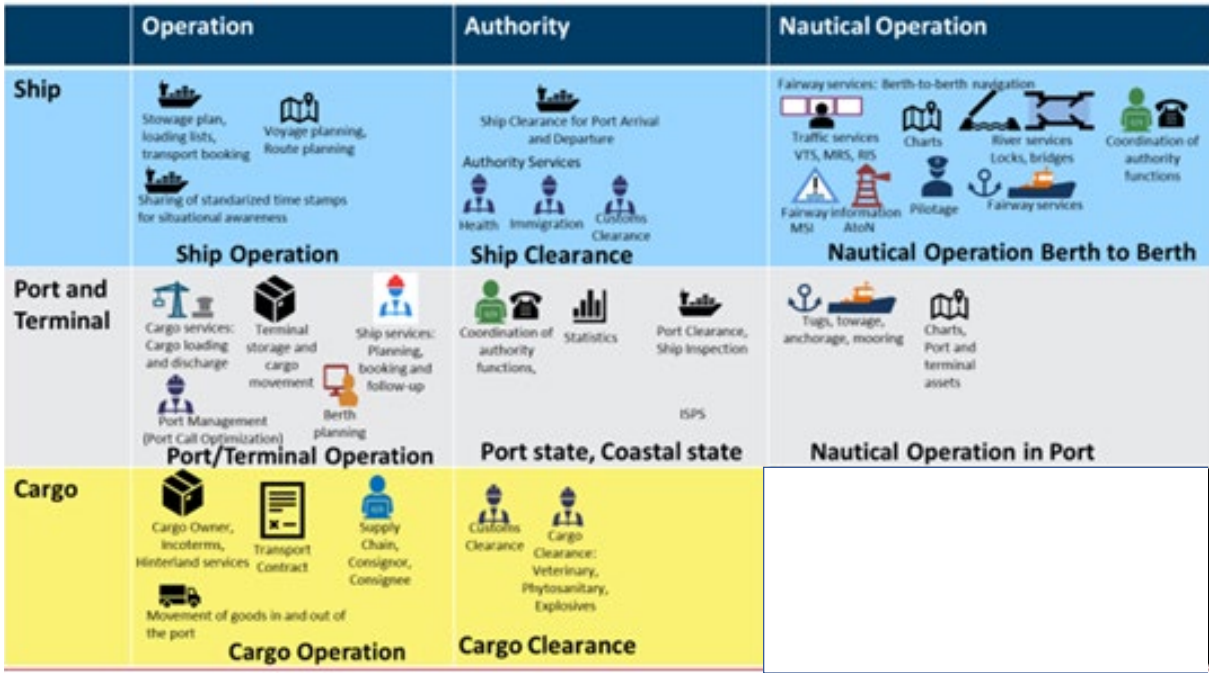


Figure 1: Collaboration between ship, port and terminal, and cargo. (Rødseth, et al., 2020)

International Maritime Organisation (IMO, 2021) describes defined levels of autonomy related to future maritime transport operations:

1. *Degree One: Ship with automated processes and decision support:* Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.
2. *Degree Two: Remotely controlled ship with seafarers on board:* The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.
3. *Degree Three: Remotely controlled ship without seafarers on board:* The ship is operated from another location, no seafarers on board.
4. *Degree Four: Fully autonomous ship:* The operating system of the ship can make decisions and determine actions by itself.

2. Integrated Planning (IPL)

The Integrated Planning (IPL) is based on experiences from petroleum industry, reported in Ramstad, Halvorsen and Holte (2012). Capabilities and enablers in Table 1 are described later in this chapter.

Table 1: IPL enablers and capabilities (Ramstad, Halvorsen, Holte, 2012)

Enablers	**Capabilities**			
	Competence	Commitment	Collaboration	Continues learning
ICT	Available tools Utilizing tools Potentials in tools	Utilizing defined tools Following and updating info Involvement in design process	Integration and harmonization Aggregated and filtered info Collaboration platform	Time, arenas, focus
Roles and work processes	Holistic understanding Planning competence Change competence	Compliance and accountability Common goals Reciprocity	Defined in work processes Role descriptions specific on collaboration	Local interpretation Experience transfer and mentoring
Arenas for plan collaboration	Know the arenas Competence one use The planner as facilitator	Commitment participation Prepared and involved Joint problem solving	Defined goals and participation Regular and structured collaborative	Broad participation

The concept includes a model and methodological structure for IPL. The IPL concept is based socio-technical theory and represents a holistic perspective on planning, emphasizing the interplay between planning horizons, between organizational units, and among cross-organisational partners.

2.1 From traditional planning to integrated planning

Table 2 presents some key IPL principles compared to more traditional planning approach. Describing planning as an activity is the function of selecting enterprise objectives and establishing policies, procedures, and programs necessary for achieving them (Kerzner, 2013), while planning in an operational environment is usually understood as creating a predetermined course of action within a forecasted environment. Since increased digitalization opens for improved efficiency across different actors, the resulting increased complexity of operational systems requires proactive and robust planning. Critical interdependencies between activities and actors must be coordinated through increased interaction, information sharing and collaboration between stakeholders.

Compared to traditional planning, the IPL concept is particularly useful when focusing on the entire operational system, especially interfaces and interdependencies of activities and resources across organizational boundaries. The aim is to avoid "silo planning" resulting in inefficient and unexpected disruptions in transport operations and increased cost for the total system (Ramstad, et al, 2014).

Table 2: Comparison of key IPL principles and more traditional planning principles (Ramstad, et al., 2014)

Categories	Integrated Planning	Traditional Planning
Planning activity	Proactive, robust (and agile)	Reactive
Integration	Between organizational disciplines and planning horizons (strategic, tactical and operational), and across organizations and locations	Limited integration and involvement, largely dependent on organizations and physical location
Collaboration	Multidisciplinary collaboration at designed coordination arenas	Expert planning, single discipline
Competence	Knowledge about the operational system, dependencies, consequences	Limited knowledge and focus on dependencies and consequences of changes in plans to the total operational system
Commitment	Commitment to IPL planning processes and plans	Commitment to single discipline plans
Learning, improvements	Analysis and sharing of experiences across units & disciplines	Learnings within disciplines/siloes

2.2 The four IPL Capabilities – Cultivating IPL practices

Human and organizational capabilities shall ensure sustained implementation and improvement of IPL practices. Continuous attention and focused leadership are needed for cultivation, and thus contribute to establish an organizational culture that builds and maintains sustainable practices.

1. *Competence* is defined as "to know how to do things", including knowledge and skills to perform work tasks. Designed IPL work processes involve professionals and decision-makers in all domains and at different levels. Defining necessary competence and expectations related to key roles in IPL (planner, leaders, task responsible) is vital; general planning competence (knowledge about work processes and implementation of them in a local context, knowledge of ICT tools), in addition to operational experience. The planners have a key role as facilitator to ensure inclusion of competent participants in arenas for cross-domain collaboration. Virtual and face-to-face meeting require communicative skills.
2. *Commitment* relates to organizational practices and individual as well as collective orientations towards defined roles and processes, i.e. objectives and processes to reach them. Joint commitment to an overall goal is an important part of IPL practices. Furter, involvement, participation and trust in the IPL development process are essential for commitment to established integrated transport systems and plans, and compliance with defined organizational roles and responsibilities. All necessary roles need to

commit to participating in collaborative arenas, and to arrive prepared and ready for active dialogue and discussions about prioritizations, i.e. organizational culture and ambition towards a common goal. Decisions at the operational level require practical expertise and planning that also consider changing contextual and situated demands.

3. *Collaboration* is a process in which different entities share information, resources, and responsibilities to jointly plan, implement, and evaluate a program of activities to achieve a common goal. Since transport operations involve numerous participants, roles and services, collaboration is a key asset for achieving efficient operations. When establishing integrated plans, collaboration often goes across organizational and geographical boundaries. Harmonised ICT tools are essential, including access to integrated data systems, real-time information, and adapted details to the individual recipient needs. Shared ICT systems should visualise roles in established transport plans as well as for situational awareness along a transport chain. In addition to arenas, collaboration requires willingness and ability among organisation members. Creating a constructive collaboration climate and interaction across boundaries require open communication, trust, dialogue, and positive conflict and deviation negotiations.
4. *Continuous learning* is understood as organizational learning and applicable changes in planning practices based on social learning, collective reflections, and experience sharing. Plan coordination arenas may function as efficient learning arenas in a collective learning process across boundaries. These should be based on open communication, actively participation, involvement by all disciplines, and willingness for collaboration. Integrated plans can function as common reference for communication, reflections, and shared understanding of demands/possibilities along a transport chain.

2.3 The three IPL Enablers – Designing infrastructure for IPL practices

The IPL enablers are based on Argyris (1992) regarding organisational contributing capabilities, e.g. role and responsibility structure, information system, and procedures.

1. *ICT solutions* are important for coordinating activities across planning levels. Planning levels are categorized at *strategic* (long-term, 2-5 years), *tactical* (mid-term, 6-24 months), and *operational* (short-term up to 3 months). The transport system complexity makes this demanding due to i.e. operations involving numerous actors (across organizational domains and companies), high risk operations, varying information integrity, and constantly changing environment. Further, information integrity and automatic transfer of real time data are absolute necessity to create integrated plans trusted by all stakeholders. Thus, ICT tools need to 'make the invisible visible'. Relevant and harmonized planning tools for implementation of IPL are related to: Real-time information for short-term planning; Aggregation of data, information processing and sharing; Visualization of plan interdependencies and consequences of plan changes; Collaboration surfaces, facilitating communication and collaboration across organizational, professional, and geographical boundaries.
2. *Roles and processes* supporting implementation of IPL practices should be easy to identify in digital work processes descriptions. Focus on both horizontal and vertical functions and coordination are recommended to establish common premises for decision making and prioritizing of resources, tasks, and actions. Important roles are the planner, the task responsible and the leadership.
3. *Arenas for plan collaboration*. Complexity of prioritization and coordination requires a forum for: interpretation and communication of plan data, development of shared understanding of interdependencies, structured and facilitated coordination across domains, collective learning and continuous improvement, and coordination of conflicts and deviations between parties.

3. Theoretical perspectives

3.1 Sosio-technical theory – Planning

As organisations are becoming more interrelated and complex, system theories are focusing both on the individual organisation and the relation between organisations. The IPL concept is based on a socio-technical approach to organisational learning. Planning supports decision making, facilitating identification of alternative future activities and selection of most appropriate activity considering all available factors. The challenge is to represent reality as simple as possible but as detailed as necessary, without ignoring any serious real-world constraints. A holistic understanding of operations contributes to increase system agility and thus ability to exploit opportunities in change and plan deviation.

Plans can be regarded as tools for coordination and communication, creating the basis for a common understanding of the situation. Planning as a *'resource for action*' (Gautherau and Hollnagel, 2005) indicates a discrepancy between *predicted and actual* performance (Ramstad, Halvorsen and Holte, 2012). Continuous deviation or change management is seen as an integral part of operational planning.

The IPL concept makes visible interdependencies across planning levels, vertically, as well as within each planning level, horizontally. IPL does not only integrate activity plans vertically across planning levels, but also integrates operational plans across domains at operational level. IPL affects the entire value chain of operations and coordination of activities. Operational practice is based on coordination between several organizational units with their own sets of goals and constraints. IPL is concerned with unify all stakeholder plans and consider how they mutually affect each other.

3.2 The Ecosystem – The system of interest

To transform the IPL concept to autonomous shipping, it is vital to define significant stakeholders and system of interest. Even though the ecosystem is a subtle and complex concept, Pickett and Cadenasso (2002) argue that it may simplify the complexity of other ecological concepts, and that three key dimensions make the concept both complex and broadly useful.

1. *Meaning* (definition) – is associated with physical environment in a specific place and is applicable to any case where organisms and physical processes interact in some spatial area. The system can be of any size but has an explicit spatial extent with specified boundaries. Further, ecosystems may change regarding composition, content, and duration, and may include humans and their artefacts.
2. *Model*s (applied in concrete or specific situations) – Describe the content and processes necessary for operationalize usable tools. Ecosystem models encompass a wide range of perspectives, and may be verbal, graphical, diagrammatic, physical, og quantitative. The focus may vary from e.g. energy, nutrients, and organisms. All models specify the nature of complexities, locations, and include interactions. The steps needed to establish the domain of a model (Pickett and Cadenasso, ibid): (a) Identify the components (e.g. biological, social, or geophysical entities) of the model, (b) State the spatial and temporal scale addressed, (c) Delimit the physical boundaries of the system, (e) Articulate the connections among the components (e.g. directly, tight coupled, hierarchical), and (f) Identify the constraints on system behaviour. Dynamic ecosystem models focusing on resilience appear to be especially appropriate for human ecosystems and the assessment of sustainability.
3. *Metaphors* – may be the ecosystem as e.g. a machine or an organism. Behavioural metaphors include ecosystems as resilient structures or ecosystems as fragile structures. One major benefit of the ecosystem concept is its ability to reflect a wide array of processes, values, and kinds of interactions. In addition, the models may indicate outputs into socially valuable terms (as ecological footprint, safety/ resilience).

3.3 Resilience

Ecosystem resilience. Resilience thinking emerged out of dissatisfaction with models of ecosystem dynamics in ecological science in the 1970s (Cote and Nightingale, 2012). Resilience thinking proposes a systems approach to human-environment relations that fits well with attempts to predict or model social-ecological change. However, the authors propose to include dynamics of societal change in definitions and analysis of *resilience in socio-ecological systems (SES)*, e.g. social sciences perspectives on *agency*, *power,* and *knowledge*. Sociocultural contexts and power will help to capture underlying heterogeneities across different social-ecological systems dynamics. Further, a move towards *situated systems* and cultural and political categories of specific contexts, helps capture more realistic options available to specific SES to respond to change and variability.

Resilience Engineering (RE) uses a variety of definitions (Woods, 2015), including resilience as (1) *rebound* from trauma and return to equilibrium; (2) synonym for *robustness*; (3) *graceful extensibility* (opposite of brittleness) when surprise challenges boundaries; (4) *network architectures* that can sustain the ability to adapt to future surprises as conditions evolve. Woods distinguish resilience and robustness. While robustness refers to being able to deal well with *known unknowns*, resilience refers to being able to deal well with *unknown unknowns* and handle troubles that were not foreseeable. Two latest definitions have recently emerged due to challenges regarding how systems may adapt to manage increased complexity, e.g. risk of brittleness and failure when events push the system up to and beyond its boundaries for handling changing disturbances and variations.

Arenas for collaboration enable stakeholders to reflect on how goals are being managed. The concept of *polycentric governance architecture* (PGA) is lately introduced in RE to increase the knowledge of how networks cooperate, adapt to future challenges and how it is possible to facilitate adaptive responses as a challenge unfolds (Woods, 2020).

Due to complexity, there will always be gaps between network partners' perspectives on goals and cooperation. All systems pursue multiple goals that interact and can conflict (Wood and Branlat, 2011). Critical properties of polycentric systems mentioned; Reciprocity, commitment to build common ground and to align goals across centres and levels, ability to shift forms of coordination across centres, anticipate bottlenecks ahead, and how initiative is delegated and regulated. Further, they notice two critical challenges: Regulation of interactions across centres, in addition to underlying architectural principles leading to resilience in polycentric systems. PGA principles may contribute to manage human adaptive systems to recognize signs of operating on the limits and how to have the capacity to move as conditions change.

4. Integrated planning when implementing autonomous vessels in MTS

4.1 The MARMAN project

MARMAN (Maritime Resilience Management of an Integrated Transport System) project aims to explore what forms of regulatory, managerial, and operational competencies will be needed when faced with increased connectivity and automation. The project (2021 – 2024) focuses on implementation and application of vessels with different levels of automation. Maritime resilience management is based on a socio-technical approach and is adapted to integrated planning area. In the resilience area, scientific insights and operational practices is seen in concert to prepare for normal variability of practice, expected and unexpected events.

4.2 IPL - The Maritime Transport Ecosystem

The first step in creating an IPL concept is to *define relevant stakeholders and functions*, including interrelations and collaboration. Collaboration in large scale, complex, socio-technical systems may be considered as systems-of-systems (Relling, Praetorius and Hareide, 2019). The authors describe the MTS as collaborative, integrated and context dependent due to geographical locations and development over time.

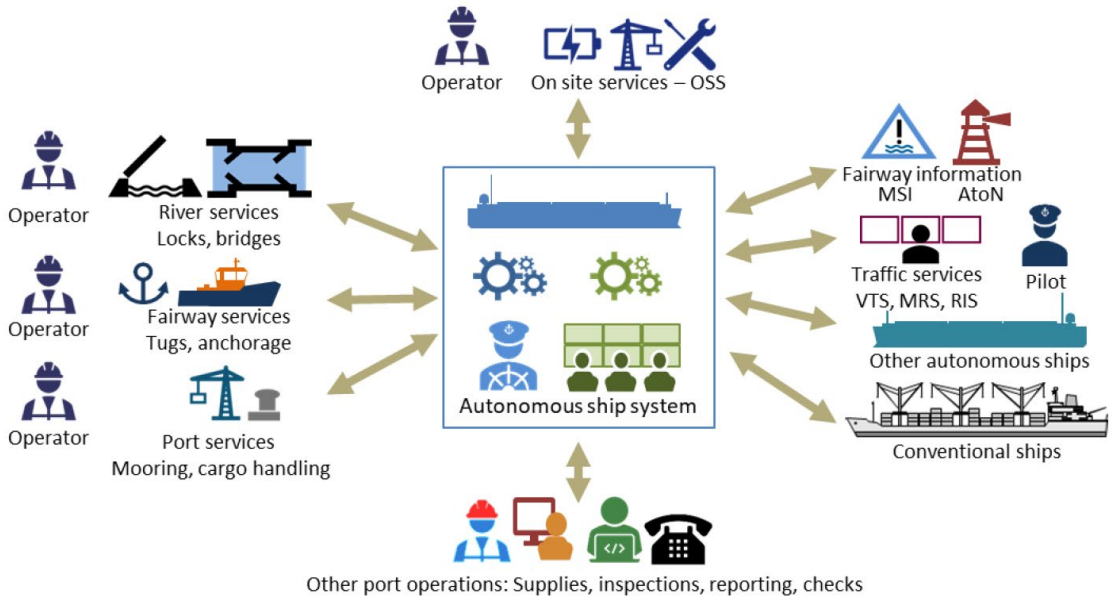


Figure 2: The physical context of the autonomous ship (Rødseth, et al., 2020)

Main components and key actors in the physical context of the autonomous ship systems is presented in the EU project AUTOSHIP (Rødseth, et al., 2020).

1. *The physical autonomous ship system* depending on Levels of Autonomy (LoA), required crew and related onboard systems catering for secure and efficient autonomous operations. Further, necessary remote operations centres (ROC) of the ship management organisation handle daily operation of the ship, including exchange information with other ROCs or a Vessel Traffic Service, VTS.

2. *Conventional ships*: Pilots, bridge personnel and related ship management organisation, representing a significant challenge in terms of interaction.
3. *Other autonomous ships:* Covers onboard ship systems providing interface between crew and lower sub-systems onboard. Also requiring operational standards and protocols for safe and predicable navigation and manoeuvring behaviour.
4. *Ship crew:* Depending on degree of automation, crew may be onboard during parts or the entire journey.
5. *Vessel Traffic Services (VTS):* Providing operational support and coordination of maritime activity for the operational area in question.
6. *Local Monitoring Centre (LMC).* Similar function as VTS, but with an explicit focus on the local port and service providers, possibly also with the responsibility to manage and operate the exchange of information. A local centre will have good local information needed for planning, a real-time overview and follow-up information used by each SCC, or directly by Maritime Autonomous Surface Ships (MASS). In some cases, an LMC solution can be autonomous, or computer based itself, with no humans in the loop.
7. *Port and fairway services:* Supports navigation and manoeuvring of ships, including shipmaster, maritime pilot, tug master and operator of VTS.
8. *Port and land-based infrastructure.* MASS is expected to interact differently with the port infrastructure as opposed to present practice. Hence, planning and operation will also change. Land-based infrastructure – as cameras, radars and sensors along the fairway - are intended to ensure situational awareness for safe and efficient operation of MASS, as well as resilience.
9. *Context actors* as a variety of shipowners, the International Maritime Organisation (IMO), Flag States, Classification societies, also cover organisations and stakeholders affecting decisions.

The IPL concept includes strategical, tactical, and operational *management levels*. Relling, Praetorius and Hareide (2019) exemplifies actors in a Norwegian MTS at six level: Governmental level (Ministry of Transportation – MoT); Regulators and associations (MoT and the Norwegian Coastal Administration – NCA); Company (NCA and Department of Maritime Safety); Management (VTS managers of individual VTS centre); Staff (crew on duty); and Front-line operators and company staff (individual VTS-operators).

IPL Capabilities, Enablers and scenarios in a future MTS are presented in Table 3. Resilience perspectives are significant when operationalising these. MASS will increase complexity and influence interrelations, implying a need for handling both normal variability of performance and operations, and foreseen scenarios and unforeseen events. Cooperation is expected to be between unequal actors and imply new interactions between humans (managers, operators), technology (e.g. vessels), and digital infrastructure. Increasing dependence on information systems, and increasingly sharing of control of systems with automation, are creating a considerable potential for loss of information and control leading to new types of “human errors” (Leveson 2012).

The operational planning phase should consider and ensure new or changed resources and supplies to the vessel. While maintenance today is often done when sailing between ports, maintenance teams will likely be organised as local task forces doing required work during a port stay.

The planning of a voyage must include loading/unloading, docking, and transport between locations. SCC planning cover tactical and operational level of MASS operations, including daily dialogue with ports, conventional vessels, and other SCCs and stakeholders. This requires new awareness regarding, e.g. communication MASS and SCC, navigation, context, regulations, emergency, and mandatory reporting of the vessel journey.

Table 3: IPL capabilities to ensure a resilient MTS when implementing autonomous vessels

Autonomous and resilient transport systems	
Competence	An autonomous transport sector will change current the competence requirements. In addition to good seamanship counting for navigation, future operations will have more integrated human-machine interfaces. Human operators must rely more on technology and have the competence to understand why the technology takes decisions, e.g. Explainable Artificial Intelligence (XAI) where humans should understand the reasons for an action. Thus, more integrated ICT solutions are required, enabling seamless exchange of real-time and updated information. Autonomous shipping also expects to change the competence from "*how can I use the technology*" to "*what can the technology do for me*". Future competence will be more on how to operate the technology as well as how to support when required.

Autonomous and resilient transport systems	
	The introduction of ROCs, and possibly fewer crew onboard ships and terminals, new roles and related responsibilities must be defined – supported by clear and defined work process. Areas for collaboration must be accessible, enabling quick identification of possible conflicts of interest and unwanted consequences to changes of plans. In terms of resilience, robustness can be built into the system by defining actions to be performed in situations of automation shortfalls (Woods, 2015), emphasizing clearly defined roles and process, and ensuring required competence is built into the organization.
Commitment	As *trust* is a keyword, autonomous solutions will require a different approach for building trust between humans, organisations, and ICT. Trust is considered management, or responsibility of ensuring operations are compliant with plan, e.g. when MASS is about to be unloaded/loaded at a terminal, the process is likely a joint activity between terminal and vessel systems. To be an efficient operation, other ship-terminal operations must be considered in parallel, including defined roles and processes. In this context, arenas for collaboration are also important as enables for defining responsibility related to the plan and related sub-activities.
Collaboration	In autonomous shipping *collaboration* to achieve common goals will change from a human-to-system/computer collaboration and deciding action. One significant challenge is handling conflicts or deviations, e.g. MASS delay to port and inability to unload cargo according to pre-defined schedule. Collaboration *requirements*: seamless exchange of updated data/information across organisations, different ICT systems, defined roles and responsibility distributed across the system, and whom and how to collaborate.
Continuous learning	For autonomous systems, *continuously* learn from operation is one key successes, and the ability to make changes when new constraints occur. Both intelligent systems and involvement of humans must be counted for. Autonomy is still unmature. Knowledge is insufficient regarding generation of new accidents, technology challenging regulations, and simultaneous MASS and conventional practices. Lack of operational compliance of traffic rules at sea, the COLREG, challenge the development of new technology compliant with COLREG. Knowledge is missing on how the context will affect autonomy and commercial transport operations, and how to report potential difficulties and errors.
Resilience	The four *resilience principles* of Woods (2015) are highly relevant for all four Cs to build required resilience. Resilience as *rebound* should be applied when considering how to react to different actions and events, where stakeholders can use defined arenas to evaluate scenarios and make improvements e.g. how humans and automation should interact to improve operational resilience, and how clearly defined roles and processes may be established. *Robustness* can be built into the system by defining actions related to "What if" scenarios, and to plan work-process related to both expected and unexpected events. *Graceful extensibility* focuses on how different organizations and transport systems can cope with unexpected events and specifying required actions. *Network architecture* contributes resilient operations by defining specific network actions, evaluating functions and procedures for communication, and sharing of responsibilities. This may prove particularly important in defining situations which require cooperation between ship and ROC, or if normal communication links are disrupted and fallback opportunities are required.

5. Discussion – future maritime transport systems and integrated planning

Future maritime transport including autonomous ship will require new ways of working and new systems for IPL. The implementation of autonomy is likely to be done in steps, as example the vessel Yara Birkeland implementation will follow the levels of autonomy step-by-step. First, the vessel will be manned with navigators, next is partly remote-control centre operation, and finally the vessel technology will do the sailing.

Regards IPL, it is likely to follow same approach. First, humans in control and operators located where operations are executed, next is more remote planning but still in control by humans, and finally some of planning based on sensors and statuses along the transport chain, maybe automatic. As higher level, as more important it will be to understand decisions to enable humans to take control if required. Future maritime transport must therefore also be more integrated and connect organisations, humans, and technologies. Planning quality will be more important, and plans will be shared between stakeholders and systems at a higher degree than current practices. Mutually trust is important between systems and shared status during both planning, execution and follow-up after reaching the destination. Therefore, Commitment, Competence, Collaboration possibilities and Continuous learning will be extremely important for a successful execution.

Another significant element is how to build resilience into the system. Resilience is not only back-up system in case of technologies failure, it also addresses human knowledge regarding planning and execution of operations. Resilience should prepare for the unknown, but also use expertise and experiences from previous operations.

Following IPL, resilience should not only focus on one transport means, but ensure the total transport chain is integrated to meet challenges, and where all involved parties together solve these and select best possible solutions. The main success criteria is probably building trust between humans and organisations, to both technologies and data.

6. Conclusion

Increasingly complex and interconnected when implementing MASS into the MTS will require new ways of working, collaboration, and communication. Changes will affect management at the operational, tactical, and strategical level, in addition to the interactions between them.

The IPL concept, developed in the petroleum industry, may be beneficial when implementing MASS. The increased complexity is expected to increase the risk potential failure, and implementation of new technology in MTS may challenge the planning of changes in normal operations, foreseen deviations/catastrophes, in addition to unforeseen events. The development of an IPL concept for the MTS seems promising, and resilience perspectives may be beneficial when adapting the original IPL concept to MTS.

References

Cote, M. and Nightingale, A.J. (2012). Resilience thinking meets social theory: Situating social change in socio-ecological systems (SES) research. *Progress in Human Geography, Vol 36*(4), pp 475–489

Lee, J. M-y, & Wong, E. Y-c., (2021). Suez Canal blockage: An analysis of legal impact, risks and liabilities to the global supply chain. *MATEC Web of Conferences, Vol 339*

IMO (2021), IMO - MSC.1/Circ.1638 3 June 2021 - Outcome of The Regulatory Scoping Exercise for the Use Of Maritime Autonomous Surface Ships (MASS)

Kerzner, H. R. (2013) *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons

Notteboom, T., Pallis, A., and Rodrigue, J-P. (2022). *Port Economics, Management and Policy*, New York: Routledge. ISBN 9780367331559

Pickett, S.T.A. and Cadenasso, M.L. (2002). The Ecosystem as a Multidimensional Concept: Meaning, Model, and Metaphor. *Ecosystem, Vol 5*, pp 1-10

Relling, T., Praetorius, G. and Hareide, O.S. (2019). A socio-technical perspective on the future Vessel Traffic Services. *Necesse, Vol 4* (1), 112-129. DOI: 10.21339/2464-353x.4.1.1

Ramstad, L.S., Halvorsen, K. and Holte, E.A. (2012). Implementing Integrated Planning – Organizational enablers and capabilities. , In Tom Rosendahl & Vidar Hepsø (Eds): *Integrated Operations in the Oil and Gas Industry: Sustainability and Capability Development*.

Rodrigue, J-P., (2020). *The Geography of Transport Systems*. New York: Routledge. ISBN 978-0-367-36463-2

Rødseth Ø.J., Faivre J., Hjørungnes S.R., Andersen P., Bolbot V., Pauwelyn A.S., Wennersberg L.A.L. (2020) *"AUTOSHIP deliverable D3.1: Autonomous ship design standards"*.

Woods, D.D. (2015). Four concepts for resilience and the implications for the future of resilience engineering. *Reliability Engineering and System Safety* 141, 5-9

The Dynamics of Knowledge in the Implementation Of The Distribution Channels Changing Project Under Conditions of the Covid-19 Pandemic: A Case Study

Marcin Stępień
University of Technology Faculty of Management, Czestochowa, Poland
marcin.stepien@pcz.pl

Abstract: The purpose of the study is to identify and evaluate the impact of knowledge dynamics processes on the effectiveness of the project implementation of changes in product distribution channels under conditions of the COVID-19 pandemic. Implementation of changes is a result of external circumstances related to the COVID-19 pandemic. Adaptation activities can be based on project management aimed at changing existing distribution channels in a turbulent environment. With reference to the considerations presented in the study, it can be pointed out that knowledge management processes allow to observe and describe changes in the environment, indicating the justification of emerging threats and opportunities in the company's environment and the company's response, particularly under COVID -19 pandemic conditions, which fills an identified research gap. The implication from the research is that there is a significant impact of external conditions, shaped by the COVID-19 pandemic, on the implemented project of changing sales in different distribution channels, which can be neutralized by the effectiveness of knowledge management in the company. The research methods used to achieve the stated objective are literature study, descriptive analysis and case study. The empirical research was based on a company making its sales in the European market. The study period was 2018-2020. The research problem is important and current issue because of possibility of achieving companies knowledge increment and increase the effectiveness of project implementation in the perspective of changes in the external environment.

Keywords: dynamics of knowledge, change management, development strategy

1. Introduction

One of the key aspects of managing a business is addressing the challenges of adapting the business to a changing environment. Implementation and realization of change management project, caused mainly by external factors, is inseparably connected with one of the basic objectives of company's functioning, which is to realize sales on served markets.

The article aims to learn about and evaluate the implementation of the project of changes in product distribution channels implemented under conditions of pandemic COVID-19 sales. The volatility of the environment accelerates the processes of learning and integrating knowledge available in a company. Moreover, the increase in knowledge observed in pandemic conditions determines companies to change, especially in the area of distribution channels. The presented study refers to the project management of change in the area of product distribution channels. The research was conducted on the basis of an enterprise, realizing sales in e-commerce channels, for network and other customers. The research question whether the increase in knowledge about changes in the business environment, related to the commonly occurring pandemic phenomenon, has become the cause of the implementation of projects changing the management of the enterprise, implied by the change of product distribution channels, should have been broken down in a few smaller sub-questions in order to better structure the analytical part.

(research question) Has the increase in knowledge about changes in the business environment, related to the commonly occurring pandemic, become the reason for the implementation of projects changing the management of the enterprise, implied by the change of product distribution channels?

The research question was broken to better structure the analytical part;

1. whether the commonly occurring pandemic has become the reason for the increase in knowledge about changes in the business environment?
2. whether the increase in knowledge about changes in the business environment has become the reason for the implementation of projects changing the management of the enterprise?
3. whether the implementation of projects changing the management of the enterprise led to a change in product distribution channels?

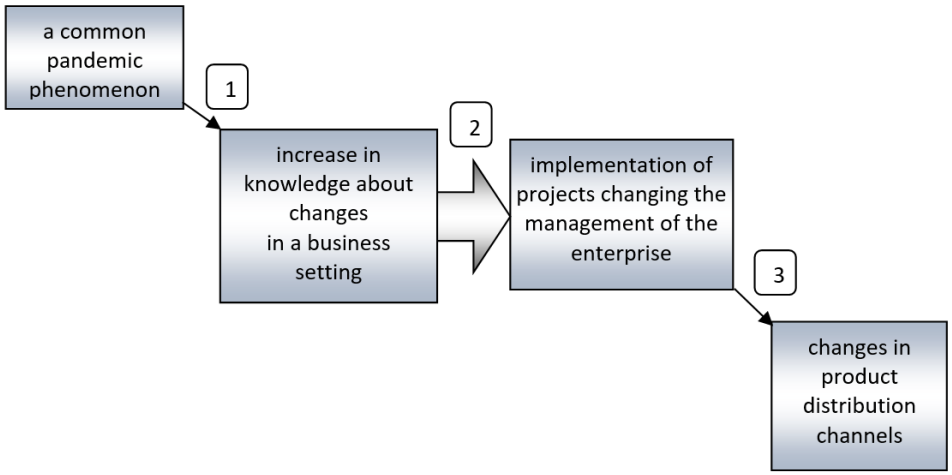


Figure 1: Research model

Source: own elaboration

2. Dynamic Capabilities in terms of project management

The search for a better understanding of the extract of dynamic capabilities is the result of continuous adaptation of enterprises to the conditions of the economic environment. In the literature on the subject, it is assumed that dynamic abilities reflect wisdom acquired on the basis of basic competences (Prahalad et al, 1990), knowledge of architecture (Henderson et al, 1990), or architectural competences (Henderson et al, 1994). It is worth noting that the concept of dynamic capabilities is linked to the process of market dynamics, as companies operating in a turbulent environment must modify existing knowledge in order to implement change projects that enable solving current problems (Eisenhardt et al, 2000; Wang et al, 2007). Changes caused by the COVID-19 pandemic are particularly important for knowledge growth, as they can help in the search for market advantages (Brusoni et al, 2001).

The volatility of the business environment, implies at the same time instability and the need for projects that adapt the business to the challenges of the economic environment (Kerzner, 2021). Volatility of conditions, which is characteristic of the modern economy characterized by the frequency of occurring transformations with significant scope and effects, which is generally referred to as turbulence (Brown et al, 2008; Tiganas, 2011).

The volatility of the economic environment caused by the COVID-19 pandemic, and the related uncertainty observed in the economic reality, implying at the same time instability, are features associated with the functioning of enterprises, visible especially in the product distribution channels operated. It means that, when everything is stable, while all variables are constant, the knowledge algorithm is stationary (North et al, 2018).

The ability to implement change projects is classified as a dynamic intangible resource (Bontis et al, 1999). According to Teece, dynamic capabilities are high-level competencies that determine a firm's ability to integrate, build and reconfigure internal and external resources and competencies in response to the changing business environment (Teece, 2007). The essence of these capabilities is not only the possession and use of resources, but also their development and renewal, which are possible through organizational learning processes (Łęgowik-Świącik 2021). Zollo and Winter, on the other hand, emphasize that dynamic capabilities are learned and enduring patterns of collective action through which an organization systematically creates and modifies operational routines to improve performance (Zollo et al, 1999; Venczel et al. , 2021). Thereby, the core component of an organization's dynamic capabilities becomes the organization's ability to change (Haas et al, 2018). This means that organizations have a specific configuration of resources, structures, processes, procedures that enable efficient design and implementation of not only a single change project, but a whole bunch of changes.

Despite the differences in defining the organization's ability to change, some characteristics of this construct can be observed. In addition, knowledge of the changes taking place (Bratianu, 2007) from the perspective of an organization's ability to change is particularly important in the dynamic environment created by a COVID-9

pandemic, where rapid and effective change is critical for survival and growth (Judge et al, 2009; Kok et al, 2012).

3. Identification of events that affect the volatility of the environment

The ability of an organization to implement a change project is a construct that resolves the peculiar conflict between change and stabilization, between exploitation and exploration, because it implies making changes and successfully maintaining daily activities at the same time (Meyer et al, 2006; Takagi et al, 2019). The ability of an organization to implement a change project is a construct that resolves the peculiar conflict between change and stabilization, between exploitation and exploration, because it implies making changes and successfully maintaining daily activities at the same time (Meyer et al, 2006; Takagi et al, 2019). Situations that threaten the continuity of long-term business operations that require the implementation of change projects can include for example natural disasters (earthquakes, tsunamis, typhoons and hurricanes, floods, volcanic eruptions or the occurrence of pandemics) (Kagaya, 2013).

The oldest typology of crises allows to distinguish two groups, the first one is crises caused by natural causal relations, the second group is related to crises caused by human activity (Otola, 2013). Additionally, B. Rike distinguished three groups of crises: natural, human-related and social (Rike, 2003). The presented classification criterion does not fully reflect the reality in which companies currently operate. I. I. Mitroff and M. C. Alpaslan attempted to classify contemporary threats and crises, which is presented in Table 1. The classification of threats to enterprises, presented by the authors, resulted from the conducted analysis of crises. The authors found that in the 1980s crises were mainly caused by the occurrence of typical hazards, while in the 1990s crises caused by atypical and natural hazards dominated (Mitroff at al, 2003).

From the above discussion, it is clear that both opportunities and threats are the result of an event or combination of events that occurred at a particular point in time (Meadows et al, 2022).

Change, triggered in the case studied mainly by the variability of the environment, also creates opportunities. Thus, the attitude of enterprise managers to the implementation of the change project, as a multifaceted determinant of enterprise management, appears as a significant challenge in the process of managing a modern enterprise. Businesses in times of pandemic are forced to develop skills, systems and processes to quickly exploit and anticipate sudden environmental volatility and recognize the dangers and opportunities presented by chaos.

The concept based on the implementation of a project of changes adapting the company's resources to the environment characterized by constant change, was also presented by J. Schumpeter. This author noted that the innovation process is, on the one hand, the renewal of the economy, and on the other, "creative destruction" (Hartung, 2011). The essence of creative destruction is the continuous internal revolutionization of economic structures and existing technologies and production methods, the continuous destruction of the old ones and the continuous creation of new, more effective ones (Caballero et al, 2010). The change projects implemented by companies, which consist of innovations primarily in the area of distribution, intensify the processes of changeability of the environment. This process results in some enterprises that are not able to manage the change project effectively and do not have the ability to survive in the changing environment (Stephen et al, 2012).

In the turbulent environment caused by the COVID-19 epidemic, stores, including retail chains, using multiple distribution channels, including retailers who have so far managed to build integrated systems known as omnichannel, have found a favorable situation. An omnichannel system, as opposed to multichannel (multiple non-integrated sales channels), is characterized by the harmonization of activities regarding the product and how to deliver the shopping experience to the customer regardless of which channel they choose.

In conclusion, it is worth noting that the process of implementing change projects requires that the managers of the enterprise have comprehensive knowledge of the events affecting the volatility of the environment. The process of aging of production methods and product distribution channels is now faster than it was a few dozen or even a few years ago. Moreover, the turbulence of the environment affects the enterprise, requiring decision makers to be able to manage change in order to plan, organize, motivate and control change processes, as well as neutralize emerging threats and take advantage of emerging opportunities. The literature extensively describes the change processes induced by a turbulent environment. However, there is a lack of linkages of

environmental change to the COVID-19 pandemic and in particular to change project management. The problem has been described in the medical sciences, but there is a lack of studies in the management science literature on the impact of the COVID-19 outbreak on corporate change project management processes (Carracedo et al., 2021), especially in relation to change management in product distribution channels.

4. Research methodology

The method of literature analysis and criticism as well as descriptive analysis methods were used to achieve the intended research goal. The method of literature analysis and criticism was used as the first part of scientific cognition. The essence of the method of analysis and criticism of the literature is to indicate the relevance, discoverability and new approach to the indicated purpose of the study. With the use of this research method, the previous scientific achievements in the discussed field are presented, at the same time indicating the existing free research space in the studied area. The method of analyzing and critiquing the literature allowed for the presentation of the complexity and core of the problem described (Coombs et al, 2009). The used research method also allows to indicate the topicality and novelty of the approach to the problem in relation to the current state of knowledge in the studied area. The applied research method made it possible to signal both differences and existing relationships as well as significant features in previous scientific inquiries.

The second method used in the study is descriptive analysis, which came down to a description of the research methodology used in the research conducted (Gibbert et al, 2008). A descriptive function was used as a premise to characterize the methodology used. The descriptive analysis method was used to characterize the sequence of actions, norms and rigors that contributed to the formulation of conclusions.

Analytical research in management science is used to indicate the structure and the relationships contained in it. Therefore, the paper uses descriptive analysis to solve the research problem. The use of the descriptive analysis method to achieve the research objective made it possible to formulate conclusions from the conducted research. The formulation of conclusions was realized on the basis of observation, abstraction and generalization of the observed relationships. This method made it possible to detect both dependencies and gaps in the existing perception of the problem studied.

The research methods used have a limitation related to empirical verification. However, in the case of the undertaken research goal, which is: identification and assessment of the impact of knowledge dynamics processes on the effectiveness of the project implementation of changes in product distribution channels in the conditions of the COVID-19 pandemic, are justified. The premise leading to this conclusion is the fact that, therefore, empirical verification requires time, which is necessary to carry out the observation, measurement, and, consequently, to apply the proposed solutions by the company. Therefore, at a later stage of the research procedure, the case study method used allows for the presentation of a detailed description of the phenomena and relationships under investigation. A significant advantage of the research process being carried out is the pursuit of identification, quantification, and, consequently, the development of the concept of the studied phenomenon and a deeper interpretation (Gibbert et al, 2008).

Problems in management science should be solved using scientific quantitative or qualitative methods. Especially when faced with exploratory and descriptive problems, quantitative methods may not be sufficient to explain their nature, conditions and causes of occurrence or course. In this case, qualitative research methods are used. One of the qualitative research methods used in this article is the case study. In relation to management science, a case study is a detailed description of a real economic phenomenon in order to formulate conclusions about the causes and results of its course. This method is empirical in nature because it analyzes and evaluates phenomena occurring in reality. Case study is used especially for descriptive research topics (Zainal et al, 2007). At the same time, this method uses multiple techniques and tools for data collection and analysis. The article uses the sources of the database of entities to which the examined unit realized the sale of products. On the basis of the collected information, the case study method enabled an in-depth analysis of the studied problem, presenting its specificity, interaction with other elements of its environment.

In addition, for the full implementation of the adopted goal, participant observations were conducted, in which the researcher participated in the implementation of the project which was the subject of observation in the examined enterprise during the research period. The quantitative study was carried out on the basis of data

from the IT system of the surveyed company. The selection of the sample for the research was purposeful, which was dictated by the purpose of the study.

5. Characteristics of the entity examined

The research results presented in the article are based on a manufacturing company, which is located in Poland and belongs to the medium-sized enterprise sector. The study covered the years 2018 - 2020. During the period under review, the company realised its sales via international distribution channels.

The company's area of operation covers the whole of Poland, as well as to a large extent Lithuania, Latvia, Russia, Hungary, the Czech Republic, Romania and Germany. The company employed approximately 90 people during the years under examination. The enterprise produces a wide range of accessories for window decoration such as curtain rods, blinds, pleats. In 2004 the company obtained ISO 9001:2001 certificate and in 2009 and 2010 it was awarded the Customer Laurel by the votes of consumers. In 2009, the organizational and legal form of the company was changed from a general partnership to a limited partnership, which reflected in the organizational structure the scope of duties performed by separate units.

6. Findings – descriptive analysis

The purpose of the study is to learn and evaluate the impact of knowledge dynamics processes on the effectiveness of the project implementation of changes in product distribution channels under conditions of the COVID-19 pandemic. As a result of the observations, it was noted that in 2018 the company started to develop the e-commerce distribution channel, however in the initial period it did not bring the company the expected results. That is why, the company distinguished in its production and sales structure three production and product distribution channels through which it executed its production and sales processes in the period under review. The basis for separating the production and sales channels was the knowledge of managers, concerning the subjective scope of service logistics of production and distribution of products. The supported distribution channels are divided into the following sectors:

- e-commerce channel (Internet) - serving the individual customer market in Germany,
- network customer channel - serving customers in Poland and Ukraine,
- other clients - serving small and medium-sized enterprises who are clients of the audited entity, both in Poland and abroad.

The e-commerce channel serves individual customers who place orders via e-commerce platforms (eBay, Amazon). It is characterized by a significant fragmentation of both orders, types of products, forms of payment as well as the method of delivering the product to the final customer. As mentioned above, this channel serves customers in Germany.

The network customer channel includes customers with significant order volumes, similar to each other in terms of important product parameters, such as: size, color, type of fabric. Orders received from customers from this channel are characterized by repeatability in the production process and mass sales in terms of logistics.

The remaining customers, to which small and medium-sized enterprises are classified, differ in the volume of sales in relation to individual customers (it is greater than them) while not accounting for the number of network customers that can be served in the channel (too low repeatability of orders). Customers from this distribution channel are located both in Poland and abroad, which additionally affects the logistics processes of deliveries made to customers from this channel. The selection of the research subject was made on the basis of the identified distribution channels for products before the pandemic period. The entity had identified three distribution channels (e-commerce, network customers and others) which made it possible to identify and describe the research goal on the basis of the selected entity.

The scope of realized revenues in the identified distribution channels in the studied company, considering the subject scope of product distribution logistics service and the scope of administrative and office service is shown in Figure 2.

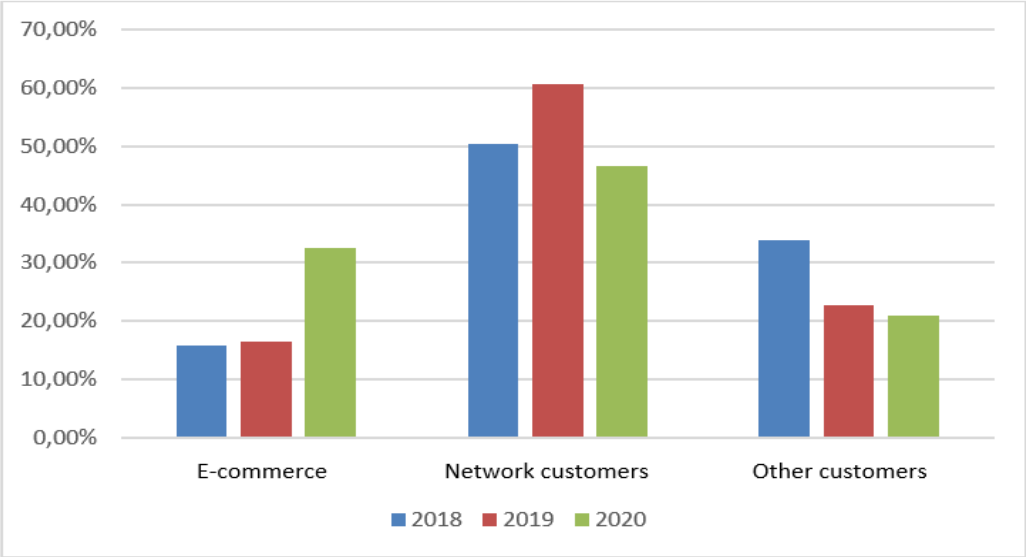


Figure 2: Characteristics of distribution channels in 2018-2020

Source: own elaboration

Figure 2 indicates that the share in sales of e-commerce channel customers located in Germany amounted to 15. 86% of total sales, to exceed 32% share in total sales of the entity in 2020. The product distribution channel to network customers, accounted for 50. 34% of total sales in 2018. In 2020, it was 46.52%, relying mainly on network customers from Ukraine and Romania. Share of sales to other customers decreased from 33. 8% in 2018 to 20. 94% in 2020.

7. Conclusions from the research

The presented data shows that increase in knowledge gained from the observations and analyses made has influenced the effectiveness of the project of implementing changes in product distribution channels. The implementation of a change management project in the area of the supported product distribution channels allowed the entity to maintain its sales and production processes in 2020, a year in which significant turbulence in the business environment was observed, compared to the two previous years under review.

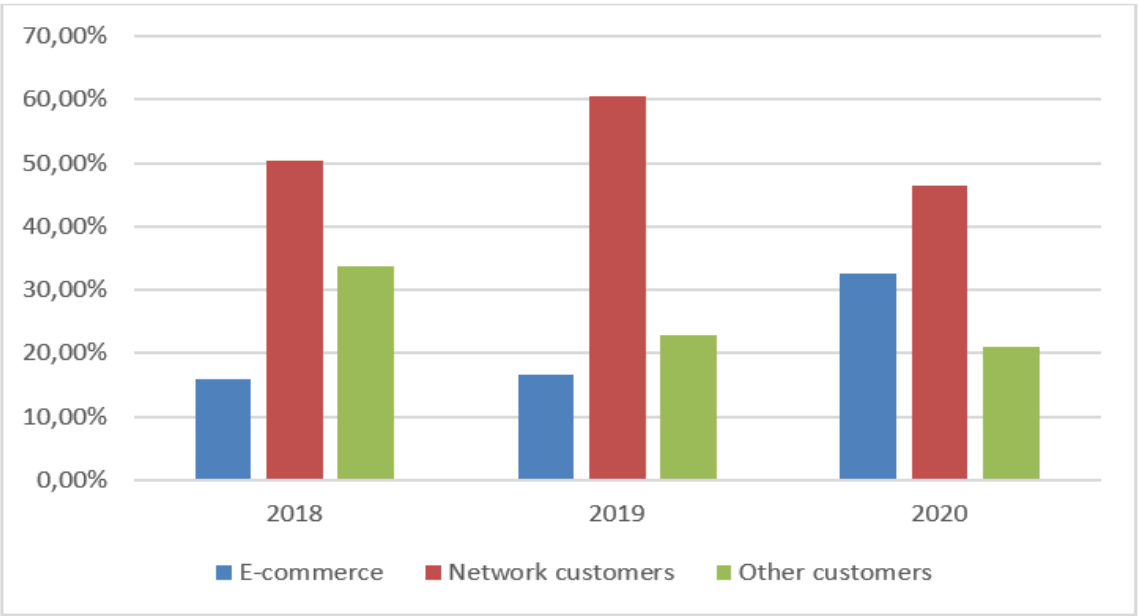


Figure 3: Changes in the share of sales by identified distribution channels

Source: own elaboration.

When examining the project of changes in the area of product distribution channels the following conclusions emerge:

- the company has implemented a project to actively seek and develop distribution channels that, despite the enforced lockdown caused by the pandemic in 2020, were able to ensure the sale of products manufactured by the company,
- the entity, within the framework of the implemented project, separated in the management structure the branches (visible especially in the production and sales department) responsible for separated (indicated by the author) and serviced distribution channels, which, due to their specificity, provided the entity with a high level of order fulfillment,
- the company was significantly affected by pandemic-related restrictions, which translated into a significant drop in demand from small and medium-sized customer entities,
- distribution channels have been identified as part of the ongoing change management project; e-commerce, network clients and other entities,
- the entity has observed a change in operating conditions resulting from external circumstances and, by implementing a change management project, has adapted its production, sales and accounting processes to handle, and thus develop, a product distribution channel identified as e-commerce.

The proof of this argumentation is the separation of three channels in the structure of the examined enterprise, i.e. production, distribution and sale of products.

The method of order processing presented in Figure 4 is referred to as traditional or sequential, where individual actions occur one after another, in series, rather than simultaneously. Unfortunately, this type of order handling in the growing e-commerce market, has proven to be ineffective.



Figure 4: The current phases of the contract

Source: own elaboration.

Until the implementation of the change management project, the company under study was executing the order in its various phases (as indicated in Figure 4). The company has implemented a change management project by, among other things, implementing a dynamic order handling model (Figure 5) in which phases 1 and 2 (indicated by arrows) are implemented in parallel with phase 3, followed by phase 4. In addition, the Company implemented solutions allowing for grouping orders for picking purposes, while maintaining their unit handling (phase 3).

The implication from the research is the concept of change management project implemented based on knowledge, identification, measurement and quantification of product distribution and production channels, allowing to observe the studied phenomena and acquire new knowledge to manage the change resulting from the business environment. This change is the result of external circumstances related to the occurrence of the COVID-19 pandemic. It constitutes a source of knowledge of both threats and opportunities, but the speed of identifying changes is undoubtedly a challenge for the managers of the company under study.

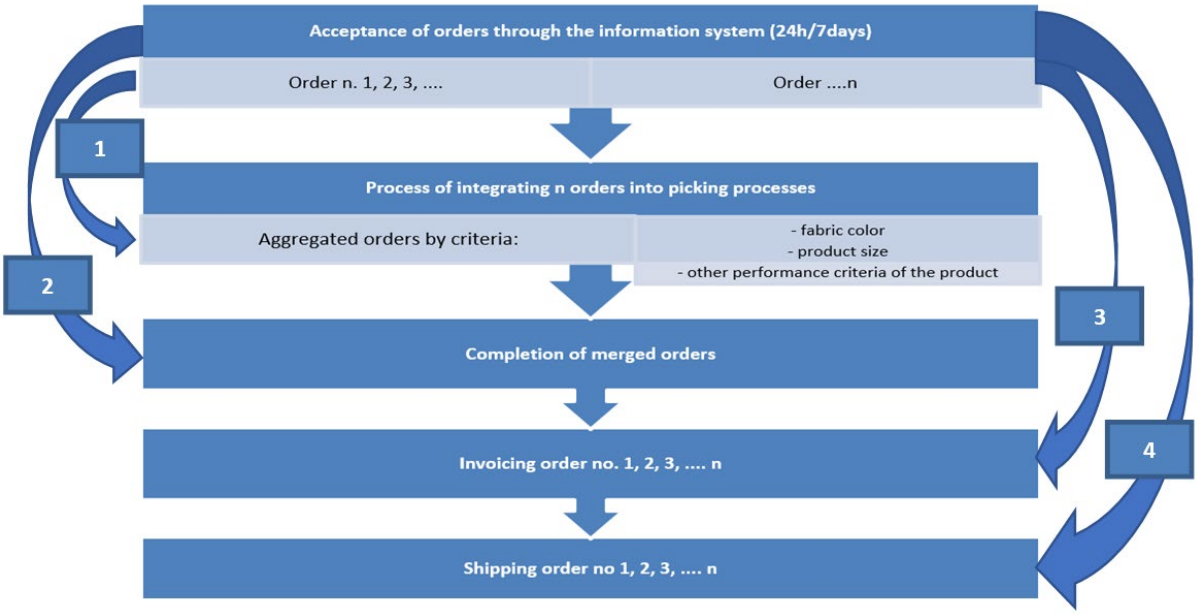


Figure 5: Order processing phases after the expansion of distribution channels

Source: own elaboration.

8. Conclusion

The purpose of the study is to find out and evaluate the impact of the project of changing the distribution channels of the products realized sales under the conditions of COVID-19 pandemic. In light of the considerations presented in the study, it can be indicated that the management sciences have observed and described the changes in the environment, pointing to the rationale for emerging threats and opportunities in the company's environment, but not in the conditions of the COVID-19 pandemic, for which there is a research gap.

The analysis of the literature shows that there is a need to make visible the changes in the environment, which, in addition to emerging threats, is also a cause for opportunities, especially with regard to the impact of the COVID-19 pandemic on business management.

The case study was based on a manufacturing company, indicating separate distribution channels both at home and abroad. The research showed that the knowledge gained through observation and analysis has a significant impact on the ongoing project of changing sales in different distribution channels under conditions shaped by the COVID-19 pandemic. It can be assumed that the increase in knowledge effectively affects the management of the project of changing distribution channels during the pandemic period, especially with the e-commerce channel, significantly affects the effectiveness of enterprise management in a turbulent environment.

The presented considerations are important and up-to-date because of the growing role of observing and identifying threats and opportunities in a turbulent environment. Contribution to the management sciences is the project concept of identification and measurement of supported product distribution channels, in order to search for market advantages of the company. One of the important areas of creating competitive advantage, may be the implementation of the project to identify, quantify and subject to a process of verification of the existing product distribution channels which is an expression of effective management of the project of change in the company, caused mainly by external factors.

References

Bontis N. et al (1999). The knowledge toolbox: *A review of the tools available to measure and manage intangible resources,* European management journal 17.4, pp 391-402.

Bratianu, C. (2007) *Thinking patterns and knowledge dynamics*, In Proceedings of the 8th European conference on knowledge management (Vol. 1, pp 152-157).

Brown, C. et al (2008) *Economic Turbulence*, University of Chicago Press.

Caballero R.J. (2010) *Creative destruction,* In: Economic Growth. Palgrave Macmillan, London, pp 24-29.

Carracedo P. et al (2021) *Research lines on the impact of the COVID-19 pandemic on business*, Journal of Business Research, Volume 132, pp 586-593.
Christopher M. (1996) *Distribution management strategy*, Placet, Warszawa.
Coombs W.T. and Holladay S.J. (2009) *Further Explorations of Post-Crisis Communication: Effect of Media and Response Strategies on Perceptions and Intentions*, Public Relations Review, 35.
Cowan, R. et al (2004) *Knowledge dynamics in a network industry*, Technological forecasting and social change, 71(5), pp 469-484.
Gibbert M. et al (2008), *What Passes as a Rigorous Case Study?*, "Strategic Management Journal", Vol. 29, nr 13.
Hartung A. (2011) *Predict, change, guide the future*, Wyd. Wolters Kluwer, Warszawa.
Heckmann N. et al (2016) *Organizational Capacity for Change, Change Experience, and Change Project Performance*, "Journal of Business Research", Vol. 69.
Henderson R. and Clark K. (1990) *Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms, Administrative Science Quarterly*, 35(1), 9–30.
Henderson, R. and Cockburn, I. (1994). Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal*, 15(Winter Special Issue), 63–84.
Judge W.Q. and Douglas T. (2009) *Organizational Change Capacity: The Systematic Development of a Scale*, "Journal of Organizational Change Management", Vol. 22.
Kagaya T. (2013) *How Do Investors Evaluate Business Continuity Management (BCM) Disclosures in Emergency Situations? Evidence From the Great East Japan Earthquake*, Journal of Modern Accounting and Auditing, Vol. 9, No. 3.
Kerzner H. (2021) *Project Management case studies*, John Wiley & Sons, Inc., Hoboken, New Jersey.
Kok R.A.W. and Driessen P.H. (2012) *Antecedents of Market Orientation in Semi-Public Service Organizations: A Study of Dutch Housing Associations*, "Service Industries Journal", Vol. 32.
Łęgowik-Świącik, S. (2021) *How Intellectual Capital Shapes the Business Model in Strategic Areas of Enterprise Management* [in:] Garcia-Perez A. and Simkin L. (red.) Proceedings of the 22nd European Conference on Knowledge Management, pp 492-500.
Leybourne, S.A. and Sainter P. (2012) *Advancing project management: Authenticating the shift from process to "nuanced" project-based management in the ambidextrous organization*, Project Management Journal 43.6, pp 5-15.
Meadows, M. et al (2022) *Tension in the data environment: How organisations can meet the challenge*, Technological Forecasting and Social Change, 175, 121315.
Meyer C.B. and Stensaker I.G. (2006) *Developing Capacity for Change*, "Journal of Change Management", Vol. 6.
Mitroff I.I. and Alpaslan M.C. (2003) *Preparing for Evil*, Harvard Business Review, No. 81.
North K. and Kumta G. (2018) Knowledge Management: *Value Creation Through Organizational Learning*, Second Edition. Springer.
Otola I. (2013), *Business management processes and competitiveness in an infected market*, Wydawnictwo Politechniki Częstochowskiej, Częstochowa.
Prahalad C.V. and Hamel G. (1990) *The core competence of the corporation,* Harvard Business Review, 68, 79–91.
Rike B. (2003), *Prepared or Not … That is the Vital Question*, The Information Management Journal, Vol. 37, No. 6.
Takagi N. and Varajao J. (2019) *Integration of success management into project management guides and methodologies - position paper*, Procedia Computer Science 164.
Teece D.J. (2007) *Explicating Dynamic Capabilities: The Nature and Microfoundations of (Sustainable) Enterprise Performance*, „Strategic Management Journal", Vol. 28.
Tiganas C. (2011) *Economic Instability - A Conceptual Approach*, International Journal of Communication Research, March, Vol. 1.
Venczel T.B. et al (2021) *Project Management Success Factors, Journal of Physics*, Conference Series , Volume 1935 , 5th Agria Conference on Innovative Vehicle Technologies and Automation Solutions InnoVeTAS 2021 13 maja 2021, Eger, Hungary.
Wang C. L. and Ahmed P. K. (2007) *Dynamic capabilities: A review and research agenda,* International journal of management reviews, *9*(1), 31-51.
World Economic Outlook (2020), https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020, date of access 20.02.2022.
Zaidah (2007) *Case study as a research method*, Jurnal kemanusiaan 9, pp 1-6.
Zollo M. and Winter S.G. (1999) *From organizational routines to dynamic capabilities*, INSEAD, 1999. Eisenhardt K.M. and Martin J.A. (2000) *Dynamic capabilities: what are they?*, Strategic Management Journal, 21, 1105–1121.

Knowledge Management for Managing Crisis in Tourism: Theoretical insights

Ewa Stolarek-Muszyńska[1*] and Malgorzata Zieba[2*]
[1]PhD student of the Doctoral School, Gdansk University of Technology, Poland
[2]Division of Management, Gdansk University of Technology, Gdansk, Poland
ewa.stolarek-muszynska@pg.edu.pl
mz@zie.pg.gda.pl

Abstract: Purpose: COVID-19 has caused an unprecedented crisis affecting the entire tourism industry. Accommodation, food, and travel sectors have been affected by the decreased number of visitors, which had a ripple effect on the financial situation of the whole industry. The purpose of this work is a better understanding of the role of knowledge management in terms of mitigating the crisis in the tourism sector, as well as a development of the framework that appropriately addresses the relevance of KM in crisis situations. Methodology: This study is based on the literature review of selected papers devoted to crisis management and knowledge management in the time of crisis. The research output is presented in the form of a new framework. This study focuses on the potential support of KM practices on the crisis management within a tourism industry. This work delivers the insights regarding the potential knowledge management application in tourism sector in terms of coping with high-volume crisis. Findings: The proposed framework shows that knowledge management practices can be potentially helpful in the time of crisis and may be integrated into a kind of framework for crisis management. Those practices need to be carefully adjusted to the particular situation and to the possibilities of their implementation, as well as to the type of crisis situation and its severity. Additionally, the importance of knowledge as a mean of support for tourism organizations in their decision-making process has been confirmed. Research limitations: Research output is limited to the theoretical contribution originating from the framework. This limitation is to be overcome in the future when the pilot study testing this framework is conducted. Practical implications: Findings of this study provides useful insights not only for the academic society and researchers, but also for tourism organizations striving for further development and improvement of its' internal processes and handling a crisis situation. Originality/value: This paper improves the overall understanding about the role of knowledge management during a crisis in tourism sector. Theoretical findings provided in this study can constitute the inspirational benchmark for the tourism organizations helping them to catch on the impact of KM practices on the crisis management.

Keywords: knowledge management, crisis management, tourism, theoretical framework

1. Introduction

A crisis situation is often associated with negative outcomes for organizations. Therefore, organizations try to prevent and avoid them and their consequences. However, this is not always possible. Although there are several studies investigating crisis management as a way to enhance resilience in tourism (Filimonau & De Coteau, 2020; Lew, 2014; Prayag, 2018), the new character of the COVID-19 pandemic has brought many attention of researchers and practitioners (Sigala, 2020; Škare et al, 2021; Yang et al, 2021). This crisis has lasted for quite a long time, with some better and worse scenarios for particular sectors, regions and countries.

As the COVID-19 pandemic has proved, tourism is one of the most vulnerable sectors to crisis impacts. According to UNWTO (2021), COVID-19 has caused severe damage to international tourism: an estimated loss of over US$ 2 trillion in global GDP, loss of US$ 1.3 trillion in export revenues from international tourism and unprecedented fall of international tourist arrivals by 73,9%. The crisis caused by the COVID-19 pandemic is seen as an event on a much larger scale than any previous crises (Higgins-Desbiolles, 2020). At the same time, it is already clear that the consequences of the COVID-19 will be serious and long-term; they will also require new measures and tools to help organizations overcome them (Zieba and Bongiovanni, 2022). Therefore, crisis management is becoming a key factor to minimize the impact of negative events and "is no longer an extra, but rather a principal and crucial function for tourism destinations and organizations" (Berbekova et al, 2021).

Taking the above into account, there is a need to provide organizations operating in this sector with some tools and techniques to handle not only this crisis, but also the ones appearing in the future. From the analysis conducted by the authors, it is clear that there are just few frameworks devoted to crisis management in the tourism industry (Faulkner, 2001; Ritchie, 2004; Paraskevas and Arendell, 2007; Zhang et al, 2011). According to the best knowledge of the authors, there is just one comprehensive framework for Knowledge-Based Crisis Management proposed by Racherla & Hu (2009). It can therefore be clearly stated that there is a gap on how knowledge management can be applied for the sake of crisis management in tourism organizations and there is

a need to develop a theoretical framework encompassing crisis management and knowledge management, taking into account the characteristics of the tourism sector.

To fill this knowledge gap, starting from the framework of Racherla & Hu (2009), we have developed a framework for Knowledge-oriented Crisis Management in the tourism industry, providing more insights on how KM can be integrated in it.

The paper develops as follows. First, the importance of KM in COVID-19 crisis and similar crises is discussed. Second, theoretical review of the crisis management frameworks is presented, followed by the proposal of the framework integrating KM and crisis management. Third, discussion and conclusions are elaborated and finally, the limitations and future research avenues are described.

2. Importance of KM in COVID-19 crisis and similar crises

The COVID-19 pandemic has brought many challenges in various areas of organizational functioning, including the way organizations manage their knowledge (Cegarra-Navarro et al, 2021; Bratianu and Bejinaru, 2021). At the same time, this crisis has appeared to require new methods and approaches to fight it, as this crisis is a crisis about knowledge (Tomé et al, 2021). At the beginning of the pandemic, individuals, organizations, whole countries and even global communities needed to learn how to act in such a situation and knowledge management has appeared to be crucial in this case as the one aiming to actively save lives (Ammirato et al, 2021). Knowledge in crisis management has several functions, as it may enhance defense mechanisms, limit potential damages, or even empower the return to the normal situation faster (Kir Kuščer et al, 2021).

According to Ng et al (2022), knowledge management in this crisis situation has contributed to many areas, such as: supporting organizations and its members to overcome initial problems coming with the crisis, helping in the application of the lessons learnt, supporting of the development of new knowledge, making a better link with the customers, obtaining new skills and becoming aware, as well as considering the future of organizations, also after the crisis (Ng et al, 2022). Additionally, KM may also support change management (so crucial in the face of a changing environment), optimization of operations, or creating innovations through organizational learning. It may also help in protecting the workplace and providing employees' safety (Schiuma et al, 2021).

Knowledge management can be implemented in organizations a variety of ways. Among the classifications of knowledge processes there is the one proposed by Probst et al. (2000), which includes knowledge localizing, knowledge acquisition, knowledge development, knowledge sharing and dissemination, knowledge exploitation and knowledge preservation. Those processes related to knowledge should be performed in a vicious cycle in organizations to make sure that the new and useful knowledge is constantly delivered to and applied by the organization. As far as types of knowledge are concerned, there are also many classifications available. Organizations might for example use the taxonomy by Lundvall and Johnson (1994) to analyze different types of knowledge important from their organizational perspective. According to these authors, knowledge can be of the following types: know-what, know-why, know-how, and know-who (Lundvall and Johnson, 1994). This taxonomy is useful in a crisis when organizations need to quickly identify key knowledge that is necessary for them to overcome this crisis.

3. Theoretical review of the crisis management frameworks

There is no single universally accepted definition of crisis in the literature due to several reasons, like different types of crises or different sectors where crises may appear. For example, a crisis in tourism can be defined as "any occurrence which can threaten the normal operation and conduct of tourism related businesses; damage a tourist destination's overall reputation for safety, attractiveness and comfort by negatively affecting visitors' perceptions of that destination" (Sönmez et al, 1994). Crises in tourism can be dangerous for the entire industry as they may cause a (temporary) suspension of operations, significant difficulties in traveling, and decrease of the tourist traffic for fear of safety or financial stability (Hopkins, 2021).

In a process of thorough literature review Huang, Tseng and Petrick (2007) identified 11 crisis management models (constructed by researchers in 1986 and 2006) – of which only 4 relate to the natural disaster type of crises. Ritchie and Jiang (2019) and Berbekova, Uysal and Assaf (2021) extend slightly this list and provide the examples of tourism crisis management models based on specific crisis context (i.e. malevolence-based crisis,

terrorism) and models integrating additional research domains (i.e. strategic planning, knowledge management, organizational learning).

Following the above studies, it can be stated that the 2000s witnessed a gradual surge in crisis management frameworks dealing with the tourism industry. In this paper, the number of analysed frameworks was limited, and the focus was made on four tourism-specific models (two of which go beyond the defined lists), namely framework by Faulkner (2001), Ritchie (2004), Zhang et al (2011) and Racherla et al (2009). These models were chosen due to their coverage of the broad tourism context and different types of crises they address. Thus, they constitute a substantive starting point in creating a new, comprehensive framework proposal.

Faulkner (2001) developed the first tourism-specific crisis management framework. Based on the previous crisis management-related literature and models by Fink (1986) and Roberts (1994), Faulkner identified six phases in crisis / disaster process:

1. pre-event: when action can be taken to prevent or potential disaster,
2. prodromal: when the disaster is imminent,
3. emergency: when action is necessary as disaster is felt,
4. intermediate: when focus is on restoring services and community to normal,
5. long-term (recovery): when recovery continues,
6. resolution: when a new improved state is established.

Along with the crisis lifecycle, Faulkner (2001) created a set of strategies for each phase to help industry prepare and respond to crises. In his tourism disaster framework, the author highlighted the importance of long-term disaster preparedness as the vital component in terms of responding to similar crises in the future. An important element of this model is the integration of tourist organizations with the local community in order to efficiently manage the crisis (Faulkner, 2001).

The crisis management framework by Ritchie (2004) follows the anatomy of crisis/disaster by Faulkner (2001) applied in the tourism sector. The model proposed by Ritchie simplifies the crisis lifecycle and introduces a 3-step framework (prevention & planning, strategic implementation, and resolution, evaluation & feedback) which includes the concepts from strategic planning and management. The framework provides an integrated and holistic approach when dealing with crises and disasters. Ritchie (2004) believes that proactive management is required while managing the crisis, especially the proactive planning and strategy formulation.

The crisis management for the tourism industry was later inspected by Zhang, He and Xue (2011). The authors developed the model for tourism destination crisis management based on Fink's (1986) stages of the crisis lifecycle. The model consists of 3 stages of activities for effective crisis management: pre-warning management, response management and mitigation management, and recovery management. It emphasizes the importance of the effective pre- and warning system, as well as media communication.

Table 1 outlines the frameworks for tourism crisis management described above. For the consistency and clarity of the analysis, these models were assigned to a crisis lifecycle proposed by Faulkner (2001).

Table 1: Frameworks for tourism crisis management

Phase in crisis/disaster process after Faulkner (2001)	**Faulkner's (2001) model**	**Ritchie's (2004) model**	**Zhang's et al. (2011) model**
Pre-event When action can be taken to prevent or mitigate the effects of potential disasters	*Precursors* Disaster management team appointment, education of industry, development of disaster management strategy	*Crisis / Disaster prevention and planning* Proactive planning and strategy formulation, scanning to planning	
Prodromal When it is apparent that disaster is imminent	*Mobilisation* Warning systems, secure facilities		*Pre-warning management* Establishing the sense of crisis, making crisis management plan and

Phase in crisis/disaster process after Faulkner (2001)	Faulkner's (2001) model	Ritchie's (2004) model	Zhang's et al. (2011) model
			developing crisis pre-warning system
Emergency The effect of the disaster is felt and action is necessary to protect people and property	*Action* Rescue procedures, monitoring and communication systems	*Strategic implementation* Strategy evaluation, crisis communication, resource management, collaborating with stakeholders	*Response management and mitigation management* Developing a rapid reaction mechanism, handling public relations, communication
Intermediate A point where short-term needs of people have been addressed and the main focus of the activity is to restore services and the community to normal	*Recovery* Clean-up and restoration, media communication strategy		
Long-term (recovery) Continuation of previous phase, but items that could not be attended to quickly are attended to at this stage. Post-mortem, self-analysis, healing	*Reconstruction and reassessment* Restoration of business and development of investment plans, debriefing to promote input to revisions of disaster strategies		
Resolution Routine restored or new improved state establishment	*Review*	*Resolution, evolution and feedback* Resolution and normality, organizational learning and feedback	*Recovery management* Normal operations, process of assessing short- and long-term consequences

Source: modified after Faulkner (2001, p. 140), Ritchie (2004, p. 674), Zhang et al. (2011, p. 347)

In another study, Racherla and Hu (2009) developed a framework which applies knowledge management principles for improving crisis management efforts, namely Conceptual Framework for Knowledge-Based Crisis Management. Framework of Racherla and Hu (2011) follows the approach of Faulkner (2001), at the same time extending it by integrating the knowledge activities to the stages of the crises. The model employs the sources of knowledge (technocratic and organizational approach), KM strategies and knowledge integration factors into the crisis management lifecycle Racherla and Hu (2009).

Table 2 summarizes the assumptions of the framework by Racherla and Hu (2009). Among all the models, this framework is the only one that distinctly addresses the area of knowledge management.

Table 2: Conceptual Framework for Knowledge-Based Crisis Management by Racherla & Hu (2009)

Crisis Management Phases	**Crisis Prevention & Planning**	**Strategic Implementation**	**Resolution, Evaluation & Feedback**
Crisis Timeline	Pre-Crisis (Pre-event, Prodromal)	During Crisis (Emergency, Intermediate)	Post-Crisis (Long-Term, Resolution & Feedback)
Knowledge Management Strategies	Knowledge Acquisition, Creation & Storage	Knowledge Retrieval, Dissemination & Application	Knowledge Internalization & Feedback

Crisis Management Phases	Crisis Prevention & Planning	Strategic Implementation	Resolution, Evaluation & Feedback
KM Approach's Emphasis	Technocratic	Technocratic & Organizational	Organizational

Source: modified after Racherla et al (2009, p. 567)

As it can be seen in Table 2, according to Racherla at al. (2009), there are several knowledge management strategies that can be useful in particular stages of a crisis situation, namely knowledge acquisition, creation and storage, knowledge retrieval, dissemination and application, and knowledge internalization and feedback.

4. Framework proposal

By integrating the elements of approaches delivered by Faulkner (2001), Ritchie (2004), Lundvall & Johnson (1994) and Probst et al (2000) described in this paper, a Strategic Knowledge-oriented Crisis Management Framework (Figure 1) has been developed. This conceptual model is a starting point for knowledge-based activities that are recommended to undertake at different phases of a crisis. It provides guidance to tourism organizations on how to effectively manage a crisis using the KM approach.

The proposed framework is based on the circular process flow composed of 3 main stages: Prevention & planning, Strategic implementation and Resolution, evaluation & feedback (after: Ritchie, 2004). Each of these stages is assigned to the crisis phase (after: Faulkner, 2001), the type of knowledge (after: Lundvall & Johnson, 1994) and the KM process (after: Probst et al, 2000). The key component of the entire model is the Organizational Learning approach, which is essential for the development of effective tourism crisis strategies (Blackman and Ritchie, 2008).

4.1 Prevention & planning

It is a preparatory stage in which the organization collects and analyzes information regarding possible crisis events. This stage refers to 2 crisis phases (pre-event and prodromal), in which it is possible to take actions to anticipate the crisis itself and stop or limit its possible impacts (Ritchie, 2004).

The prevention & planning stage is a proactive process of scanning the environment, preparing forecasts, strategies, and possible action scenarios (also using modeling and simulation), as well as hazard mapping (Ritchie, 2004). This should be undertaken considering the available resources and the interests of stakeholders.

At this stage, organization also tries to obtain different types of knowledge, namely know-what, know-why, know-how, and know-who (Lundvall and Johnson, 1994), by answering the following questions: what can happen? why it can happen? how can we prepare for what is about to happen? and who can help us to prepare and to handle the crisis when it happens? There are also some KM processes that should be applied here, namely knowledge localizing and knowledge acquisition (Probst et al, 2000).

4.2 Strategic implementation

As soon as a crisis becomes apparent, immediate action is required. It is fundamental to evaluate the possible strategies and select the one that fits best (Ritchie, 2004). The COVID-10 crisis has clearly shown that the high dynamics of changes and the difficulty of predicting them are an inherent part of the crisis event. Therefore, quick decisions, full flexibility in operation, continual monitoring, and the ongoing data acquisition from within the organization and external sources are a must (Ritchie, 2004).

During the crisis event, it is vital to ensure the fluent information flow and crisis communication with the media as they play a critical role in crisis situations (Faulkner, 2001). Effective communication also applies to internal and external stakeholders. The implementation of a crisis communication strategy and understanding and collaborating with groups of stakeholders (employees, decision makers, tourism industry, representatives of local governments, tourists, media) are crucial in planning and managing a crisis in the tourism industry (Ritchie, 2004).

At this stage, the tourism organization goes through 3 phases of the crisis: emergency, intermediate and long-term (recovery), in which it takes actions to address the short-term needs of people and the company itself (Faulkner, 2001).

At this stage also organization tries to obtain different types of knowledge (Lundvall and Johnson, 1994), by answering the following questions: what do we do at each stage of the crisis? why we should behave in a certain way? how can we overcome the challenges faced? who is needed for each activity? do we have the resources? do we need to hire some staff/purchase certain resources? The KM processes most useful here are knowledge development, knowledge application, knowledge sharing and dissemination (Probst et al, 2000).

4.3 Resolution, evaluation & feedback

Ritchie (2004) points out that the main goal of the organization in the crisis management process is to take control over the crisis or to stop it completely. The resolution, evaluation & feedback stage is the moment of regaining such control. At this stage, the activities of the organization are restored to their normal or improved state (Faulkner, 2001).

An important step in the process of overcoming the crisis is a retrospective evaluation of the effectiveness of prior actions. Assessment of strategies and responses, revision of resources, as well as learning from crisis experience enable decision makers to introduce essential changes and adapt strategies to the future crisis situations (Ritchie, 2004). Crises seen as "agents of change" (Ritchie, 2004) stimulate the implementation of changes in the organization environment and making the corrections of its standard activities, thus preparing the company for potential crisis events in the future.

At this stage also organization tries to obtain different types of knowledge (Lundvall and Johnson, 1994), by answering the following questions: what has worked and what has not? what activities should be undertaken for the future? why this happened? how this affected our company? how the new solutions can be integrated with our regular activities? who is responsible for it? Organization should try to implement the KM processes such as knowledge exploitation and knowledge preservation (Probst et al, 2000).

4.4 Organizational learning

Organizational learning is “the process of creating, retaining, and transferring knowledge within an organization” (Rao et al, 2018), therefore it is a key context at every stage within the Strategic Knowledge-oriented Crisis Management Framework. It aims at creating new knowledge to assist future tourism crisis strategies (Blackman and Ritchie, 2008). This emergent knowledge enables the revision of actions taken and can be used by the organization as an incentive to change (Blackman and Ritchie, 2008).

Tourism organizations lead up to acquire new knowledge in crisis situations (Ghaderi et al, 2014), and so systematic learning processes and ongoing evaluation of actions play a significant role. Questioning the existing approaches, reflecting on the current knowledge stock, and continual collecting data (Blackman and Ritchie, 2008) are tools that can be used by organizations at every stage of the crisis and that support organizational learning.

In a proposed framework the organizational learning is understood as a process occurring before, during, and after a crisis. It shapes the way a crisis is experienced and how an organization changes its routine and adapts strategies to avoid repeating the same mistakes in the future.

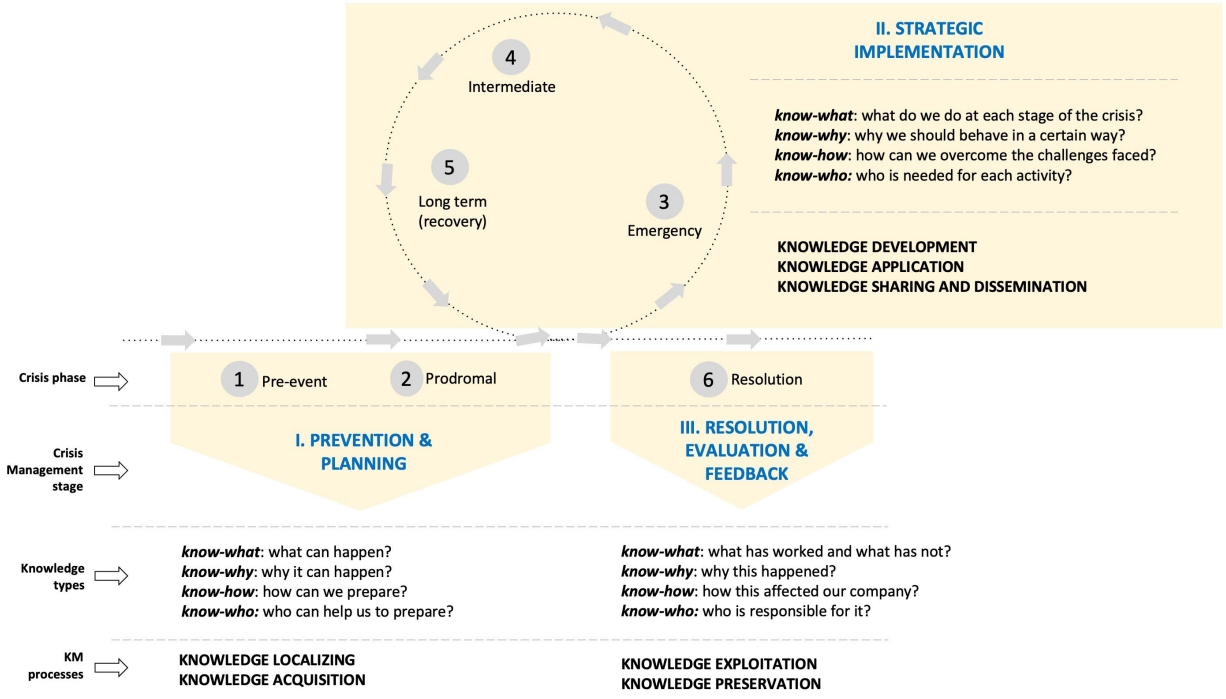


Figure 1: Strategic Knowledge-oriented Crisis Management Framework

Sources: Own elaboration, on the basis of Probst et al (2000), Lundvall & Johnson (1994), Faulkner (2001) and Ritchie (2004).

5. Discussion and conclusions

The proposed framework integrates the Crisis Management approach with Knowledge Management and Organizational Learning. The recent and severe crises such as the COVID-19 crisis or the war in Ukraine have shown that organizations need to be prepared for sudden and unfavorable events and their long-term impact. The framework proposed in this paper is an attempt to provide a tool for organizations not only to handle the crisis situation when it has already occurred, but also to get prepared for such an instance before. Organizations will need in the future more tools and support of the academia in handling their operations in the VUCA world, characterized with volatility, uncertainty, complexity and ambiguity (Mack, 2015 et al.). The proposed framework is an example of such a tool, which can help them in handling some of this uncertainty, complexity and ambiguity of any crisis they will face.

On the basis of the analyzed publications, it can also be stated that Knowledge Management plays a significant role while managing the crisis in tourism industry and constitutes a mean of support for tourism organizations in their decision-making processes. KM is a helpful tool in a crisis situation and for example during the pandemics, Knowledge Management appeared to be crucial to prevent infections and deaths (Ammirato et al, 2021). Also, the role of organizational learning has been understated so far, for example the framework offered by Racherla and Hu (2009) addresses this area only at a general level. At the same time, it is a potentially useful element in the process of crisis handling and preventing (Blackman & Ritchie, 2008). It also should be noted that the stages of the crisis and its management presented in this framework may be blurred and integrated in time – this makes handling the crisis situation even more complex. All in all, the proposed framework is an outcome of the literature analysis and an attempt to integrate the inputs from various fields (namely crisis management and knowledge management) into a tool helping organizations to deal with crisis situation before, during and after the crisis.

6. Limitations and future research areas

This study naturally has several limitations. First of all, the presented framework is of a conceptual character and needs to be empirically validated. Second, the analysis performed had not been based on a systematic literature review, but on a structured one. Therefore, some potential further developments are possible in due course.

Finally, the crisis used as the background of this framework is the COVID-19 pandemic and it is possible that other crises might be of different character.

Among the further research areas there is definitely the development of this framework for the sake of other sectors. Although the framework seems to be of a universal character, it is based on the literature devoted to the tourism sector. Therefore, for its better universality, literature devoted to other sectors should be analyzed and somehow integrated into the framework.

Acknowledgements

Ewa Stolarek-Muszyńska appreciates the support for young researchers of the Faculty of Management and Economics of Gdańsk Tech. Małgorzata Zięba acknowledges the support from the research grant from the National Science Centre (Poland) in the context of a research project "Knowledge risks in modern organizations" (No. 2019/33/B/HS4/02250).

References

Ammirato, S., Linzalone, R., and Felicetti, A. M. (2021) "Knowledge management in pandemics. A critical literature review", *Knowledge Management Research & Practice*, 19(4), 415–426.

Berbekova, A., Uysal, M., and Assaf, A. G. (2021) "A thematic analysis of crisis management in tourism: A theoretical perspective", *Tourism Management*, *86*, 104342.

Blackman, D., and Ritchie, B. W. (2008) "Tourism Crisis Management and Organizational Learning", *Journal of Travel & Tourism Marketing*, *23*(2–4), 45–57.

Bratianu, C., and Bejinaru, R. (2021) "COVID-19 induced emergent knowledge strategies", *Knowledge and Process Management*, *28*(1), 11–17.

Cegarra-Navarro, J. G., Vătămănescu, E. M., and Martínez-Martínez, A. (2021) "A context-driven approach on coping with COVID-19: From hiding knowledge toward citizen engagement", *Knowledge and Process Management*, *28*(2), 134–140.

Faulkner, B. (2001) "Towards a framework for tourism disaster management", *Tourism Management*, *22*(2), 135–147.

Filimonau, V., & de Coteau, D. (2020) "Tourism resilience in the context of integrated destination and disaster management (DM2)", *International Journal of Tourism Research*, 22(2), 202–222.

Fink, S. (1986) *Crisis Management: planning for the inevitable*, New York: American Management Association.

Ghaderi, Z., Mat Som, A. P., and Wang, J. (2014) "Organizational Learning in Tourism Crisis Management: An Experience From Malaysia", *Journal of Travel & Tourism Marketing*, *31*(5), 627–648.

Higgins-Desbiolles, F. (2020) "Socialising tourism for social and ecological justice after COVID-19", *Tourism Geographies*, 22(3), 610–623.

Hopkins, D. (2021) "Crises and tourism mobilities", *Journal of Sustainable Tourism*, *29*(9), 1423–1435.

Huang, Y. C., Tseng, Y. P., and Petrick, J. F. (2007) "Crisis management planning to restore tourism after disasters: A case study from Taiwan", *Journal of Travel and Tourism Marketing*, 23(2–4), 203–221.

Kir Kuščer, S. E. M. P. (2021) "Tourism organizations' responses to the COVID-19 pandemic: an investigation of the lockdown period", *Current Issues in Tourism*, *25*(2), 247–260.

Lew, A. A. (2014) "Scale, change and resilience in community tourism planning", *Tourism Geographies*, 16(1), 14–22.

Lundvall, B.Å. and Johnson, B. (1994) "The Learning Economy", *Journal Of Industry Studies*, Vol. 1 No. 2, pp. 23–42.

Mack, O., Khare, A., Krämer, A., & Burgartz, T. (Eds.) (2015) *Managing in a VUCA World*, Springer.

Ng, D. W. L., Duarte Alonso, A., Bressan, A., and Vu, O. T. K. (2022) "Impacts, lessons learnt and envisioning the future of firms under COVID-19 – implications for knowledge management", *Journal of Knowledge Management*.

Paraskevas, A., & Arendell, B. (2007) "A strategic framework for terrorism prevention and mitigation in tourism destinations", *Tourism Management*, 28, 1560–1573.

Paraskevas, A., Altinay, L., McLean, J., and Cooper, C. (2013) "Crisis Knowledge in Tourism: types, flows and governance", *Annals of Tourism Research*, *41*, 130–152.

Prayag, G. (2018) "Symbiotic relationship or not? Understanding resilience and crisis management in tourism", *Tourism Management Perspectives*, 25, 133–135.

Probst, G., Romhardt, K. and Raub, S. (2000) *Managing Knowledge: Building Blocks for Success*, Wiley.

Racherla, P., & Hu, C. (2009) "A Framework for Knowledge-Based Crisis Management in the Hospitality and Tourism Industry", *Cornell Hospitality Quarterly*, *50*(4), 561–577.

Rao, Y., Yang, M., and Yang, Y. (2018) "Knowledge Sharing, Organizational Learning and Service Innovation in Tourism", *Journal of Service Science and Management*, *11*(5), 510–526.

Ritchie, B. W. (2004) "Chaos, crises and disasters: a strategic approach to crisis management in the tourism industry", *Tourism Management*, *25*(6), 669–683.

Ritchie, B. W., and Jiang, Y. (2019) "A review of research on tourism risk, crisis and disaster management: Launching the annals of tourism research curated collection on tourism risk, crisis and disaster management", *Annals of Tourism Research*, *79.*

Roberts, V. (1994) "Flood Management: Bradford Paper", *Disaster Prevention and Management: An International Journal*, 3(2), 44–60.

Schiuma, G., Jackson, T., and Lönnqvist, A. (2021) "Managing knowledge to navigate the coronavirus crisis", *Knowledge Management Research & Practice*, *19*(4), 409–414.

Sigala, M. (2020) "Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research", *Journal of Business Research*, 117, 312–321.

Škare, M., Soriano, D. R., & Porada-Rochoń, M. (2021) „Impact of COVID-19 on the travel and tourism industry", *Technological Forecasting and Social Change*, 163.

Sönmez, S. F., Backman, S. J., and Allen, L. (1994) *Managing tourism crises: A guidebook*, Department of Parks, Recreation and Tourism Management, Clemson University.

Tomé, E., Gromova, E., and Hatch, A. (2021) "Knowledge management and COVID-19: Technology, people and processes", *Knowledge and Process Management*, 1–9.

UNWTO (2021) "COVID-19 and Tourism | 2020: A year in review", data accessed on 15 March 2022 from: https://www.unwto.org/covid-19-and-tourism-2020

Yang, Y., Altschuler, B., Liang, Z., & Li, X. (Robert). (2021) "Monitoring the global COVID-19 impact on tourism: The COVID19tourism index", *Annals of Tourism Research*, 90.

Zhang Xiu-hua, He Zhi-yong, and Xue Lu-qi. (2011) "Tourism destination crisis management study - Based on the crisis life-cycle" *Proceedings of International Conference on Information Systems for Crisis Response and Management, ISCRAM 2011*.

Zieba, M. and Bongiovanni, I. (2022) "Knowledge management and knowledge security — Building an integrated framework in the light of COVID-19", *Knowledge and Process Management*, pp. 1–11.

Digitalization of Knowledge Development in the Media Industry

Fred Strønen, Karl Joachim Breunig, Ross Ellefsen and Tor Arne Vikingstad
Oslo School of Business, Oslo Metropolitan University, Oslo, Norway
Fredst@OsloMet.no

Abstract: Disruption in the global media and publishing industry is prevalent due to digitalization and new business models. The Scandinavian media market have already for a decade experienced disruptive technology and digital changes. The old highly profitable two-sided business model of both selling newspapers and adds has evaporated. Remaining is a freemium or even worse – a free content and a small margin from selling online advertisements. To compensate for revenue reduction the media organizations digitalize, and consequently have made a lot of media workers redundant. To create competitive advantage in this digital landscape, the players in the media industry needs to utilize big data analytics to make better decisions and to learn. It requires media organizations to gather, process, and act on a lot of information by combining digital multisided platforms. To know customer preferences and behavior there is a strong need to analyze, learn and explore rich information sources. They also need to be better at knowledge management to transform insight from data to organizational changes. To date there is limited empirical research detailing this learning process involving big data analytics and knowledge management. We offer insight from a case study of one of Norway's larger publishing houses, with ownership in several newspapers and online media platforms. The case study was conducted during 2021 and is based on 10 different interviews with newspaper editors, journalists, commercial managers, and business analysts. Learning is an essential part of developing dynamic capabilities and this study is built on frameworks developed on knowledge development by applying the 4I organizational learning framework as an analytical lens. Our findings reveal important triggers and barriers for use of digital analytical tools and organizational learning processes. Especially intuiting, by providing more granularity to this dimension of the 4I framework corresponding better to the contemporary digitalized organizational reality. From this in-depth study of big data we gain insight into organizational learning from the intuition process. What triggers information retrieval can be categorized in three different areas: Strategic, Development and Cooperative aspects. In terms of strategic, availability of analytical tools is a crucial factor for a data-driven publishing business. From a development perspective, hypothesis-testing, developing new business models and new services is the core of big data analytics. The last dimension identified is cooperation as it is easier to find a common ground and direction for the organization. Big data analytics creates a coordination element in the organization. Although big data is a frequent business concept, relatively few articles address the challenges of using business analytical tools for understanding how organizations convert knowledge and learn and from big data.

Keywords: knowledge management, big data, learning, media industry

1. Introduction

The Scandinavian media market have already for a decade experienced disruptive digital technology. The old highly profitable two-sided business model of both selling newspapers and adds has evaporated. Remaining is a freemium or even worse – a free content and a small margin from selling online advertisements. To compensate for revenue reduction the media organizations digitalize, and consequently have made a lot of media workers redundant. To create competitive advantage in this digital landscape, the players in the media industry needs to utilize big data analytics to make better decisions and to learn. Media organizations must gather, process, and act on a lot of information by combining digital multisided platforms. They also need to be better at knowledge management to transform insight from big data to organizational changes. Although big data has now become a frequent business concept, relatively few articles address the challenges of using business analytical tools or explore the possibilities for new theory around big data (George et al., 2014; Vaio et al 2021). Therefore, several researchers in recent years have emphasized the importance of a deep dive into even softer aspects of business analysis (Constantiou & Kallinikos, 2015; Markus, 2015; Mikalef et al., 2018, p. 548). This is justified by the fact that it can help organizations better understand customers' behavior, abilities, and preferences in relation to the organization's own capabilities (Pappas et al., 2018).

Knowledge management places focus on knowledge as a key resource for the company, and how the distribution of knowledge can lead to a competitive advantage (Grant, 1996; Tsoukas, 1996; Crossan et al., 2011). Several researchers point to knowledge sharing and learning in organizations as an important source of innovation, and that routines and processes for creating, sharing, and using knowledge can create the basis for a potential non-replicable resource base. Therefore, the last decade's investment in big data and data analysis points to a need to better understand how these data sources and information can promote learning by individuals that subsequently foster organizational learning processes. Crossan et al. (1999) explained this multileveled learning process as achieved through 4 stages: Intuiting, Interpreting, Integrating and Institutionalizing. With respect to

increased need for improved understanding of the relation between organizational learning and big data analysis there is especially a need further investigation into what triggers intuition (Laney & Buytendijk, 2013; Jenkin, 2013, p. 97). In 2011, Vera, Crossan and Apaydin linked the various fields of theory together in an integrated framework. In the framework, Crossan et al. (2011) both the similarities between the different concepts, and the themes that are specific to the different concepts. In the middle, the researchers have chosen to emphasize "learning processes that form the basis for routines and resources". We have added technology as a fourth field of theory in the framework, which forms the context and background for the study.

Currently many organizations across several industries experience how digitalization (Vial, 2019) affect collaboration patterns and learning processes within their organizations. Our investigation into the Norwegian media corporations' transfer from business models based on advertising to user-based subscriptions – gathering, processing, and disseminating user-generated data has become an important part of editorial value creation and business development. We lean towards a comprehensive theoretical basis, with support in the 4I-model (Crossan et al., 1999). The model conceptualizes organizational learning as a multi-level dynamic process, spanning the individual, group, and organizational levels, including intuiting, interpreting, integrating and institutionalizing processes, as well as feedforward and feedback processes.

Our research question is: What is the role of digital analytical tools in knowledge management and how does it affect organizational learning?

We apply the 4I framework to identify, categorize and analyse which role analytic tools have in individual and collective learning, and its significance in terms of organizational learning processes through in-depth understanding of these how these learning processes unfold in the case of a large Norwegian media house. We determined three triggering mechanisms for information handling: 1) strategic, 2) development and 3) cooperative.

Theoretically this paper contributes with insight on how one of the largest Scandinavian media firms utilize big data analytics and how they handle information and search for new knowledge and learning. Based on this empirical case study we learn about how big data contributes to knowledge development. The study's empirical findings are based on ten interviews with editorial managers, journalists, commercial managers, and business developers of a Norwegian media group. The paper is divided in the following sections: Theoretical background, methodology, presentation of the findings and concluding discussion.

2. Theoretical background

Recent research has documented that there is no unambiguous definition of knowledge and knowledge management in an organizational context (Bibi et al, 2021; Serenko, 2022). Common to the various paradigms is that knowledge is broadly defined as either explicit or tacit (Nonaka & Takeuchi, 1995). The objectivist view of knowledge considers information and data as a discrete object that exists separately from humans, which in turn acquires knowledge and puts knowledge to life. Explicit knowledge can be easily formulated, disseminated, and therefore also made available. This perspective often conceptualizes knowledge sharing in a classical transmitter-receiver model, assume that explicit knowledge can be relatively easily applied in a new context (Hislop et al., 2013, p. 152). Critics of this view believe that codifying and storing knowledge in ICT-based repositories will not provide useful knowledge, as it depends on the person and organization using it. Therefore, practice-based perspective emphasizes that the sharing of knowledge requires that one actively derives and constructs meaning behind data from an interaction process. Collaborative tools, collective knowledge sharing, and networks are therefore central to practice-based ICT systems, which facilitate the distribution, sharing and active use of knowledge in an organization (Hislop et al., 2013, p. 166). The concept of tacit knowledge was introduced by Polanyi (1967), who argues that people often know more than they can easily express.

While some have argued that knowledge can only exist in individuals, several researchers highlight knowledge as a collective phenomenon in the form of shared routines, assumptions, perspectives, and values (Collins, 2007; Ebbers & Winjberg, 2009; Hecker, 2012; Razmerita et al., 2014; Hislop et al., 2013, p. 21). Spender (1996) is among those who early classified a collective level of knowledge on an equal footing with the individual (Hislop et al., 2013, p. 21). In his matrix, he divides knowledge into four generic types of knowledge: objective, collective, automatic and conscious. Objective knowledge represents explicit knowledge in groups, such as formal organizational routines or rules. Collective knowledge represents tacit knowledge in groups, such as informal

organizational routines or established norms. Automatic knowledge is silent, individual knowledge based on pure intuition, and is more challenging to formulate, explain and learn from. Conscious knowledge, on the other hand, is more explicitly individual knowledge that is easier to formulate and explain, and therefore also easier to acquire and share with others (Spender 1996; Hislop et al., 2013). This division allows us to better understand the collective mechanisms that occur in knowledge and learning processes between individuals in organizations. Knowledge sharing in organizations is a key research area as it can potentially contribute to a non-replicable resource and knowledge base (Carlile, 2004), an effect that has been strengthened in terms of digital development. Several key authors have argued for a more knowledge-based organizational theory that explains organizational competitive advantages (Ghoshal & Moran, 1996; Grant, 1996; Kogut & Zander, 1992; Crossan et al., 2011, p. 156).

3. Methodology

This research was constructed as an embedded case study, and aims at theoretical replication whereby different results are likely for theoretical reasons (Ridder, 2012). The case study was conducted during 2021 in Norway of one major player in the Norwegian media industry. Data from the interviews were coded and analyzed according to the major themes emerged in the interviews, and the material was analyzed within each theoretical area before cross-comparisons were undertaken to identify similarities and differences among the firms' initiatives. All the quotes from the interviews have been approved by the individuals interviewed, and quality checked, and additional information was added when necessary. Data collection and preliminary structuring were conducted by the two last authors during the spring 2021. We have divided our findings into three sections – according to the major themes that emerged in the interviews. They were all recruited by using the "Snow-ball" (Heckatorn, 2011) method, searching for reliable sources with appropriate expertise within their companies. This study is based on the 'Gioia methodology' (Gioia, Corley & Hamilton, 2013) developing first-order concepts from the interviews and extracting the most important insights from the first order insights to second-order insights. We have used a deductive orientation for interpreting data and grouped together information in second-order concepts.

We have conducted ten interviews with journalists, editors, business developers and analysts at both employee and management level in a Norwegian group company within media, technology, and digital growth, hereinafter referred to as the group. We have limited the study to the group's media investment at three respective media houses owned by the group, as well as some respondents with the group as employer. In our research phase, the informant presented the challenge of including more individuals and subject orientations in the work around digital business analysis in the organization. Regarding the group management's desire to anonymize the group - as well as competition considerations and considerations for the participants in the project - we have anonymized both the group, the media houses, and the respondents. The group management has not had access to the data material or the content of the study.

3.1 The research context

In the last 20 years, the group has experienced a strong shift from physical newspaper sales to digital cash flows - and extensive changes in competition conditions. Based on this, media houses have invested in business analytical tools and digital platforms with the aim of making analysis and presentation of user and market-based data available and simplified. The technology includes storage, processes, and sensors, and quantifies all data in contact with the company's digital business models across the organization's business units. The goal of the analysis tools is to turn data into insight, which in turn drives action based on a robust and understandable data set. Interactive dashboards, storytelling and insight sharing functions will thus help knowledge organizations' decisions and processes to become more data-driven (Tableau, 2020). The group has a pronounced focus on knowledge sharing and has also invested in digital tools that include communication, accounting, coordination, external statistics, decision making and business analysis. The company also has a goal that more individuals will be able to perceive, analyze and present data material in the development of new business models and digital cash flows. This applies not only to managers or group employees, but to a greater extent to editorial staff with areas of responsibility that do not necessarily involve analytical positions or responsibility for major strategic decisions. This vertical and horizontal knowledge and learning process will then form the basis for more and varied competence to be involved in further development and implementation of the company's strategy.

4. Empirical Findings

To answer the research question: What is the role of digital analytical tools in knowledge management and how does it affect organizational learning? We focus on analysis tools with focus on the intuition process in the 4I model presented by Crossan et al. (1999) at the individual level. A major challenge associated with analyzing learning processes on an intuitive level is its preverbal nature. To examine this process among the respondents, we asked respondents about their digital routines, routines related to information retrieval, motivational factors, and attitudes to various analysis tools. The findings presented below are identified based on the two dimensions Jenkin (2013) describes as triggers of information gathering; intention and mechanism.

4.1 Organizational learning with a focus on intuition processes

A key research question has been to further understand users' intuitive encounter with digital analysis tools in their search for new information and insights. This is done with the assumption that strategic decisions are made on an informative and up-to-date information basis, and that analysis tools today are an important tool for storing, retrieving, and presenting data as well as communicating and distributing an information need to several individuals.

4.1.1 Triggering factors for information retrieval

In the data material, we have identified three triggering factors that explain how the respondents intuitively seek out and use business analytical tools for information gathering: 1) strategic 2) development and 3) cooperative aspects. Here we will present some of the data material we base this claim on.

4.1.2 Strategic

The respondents seek out digital analysis tools mainly to learn more about the status of different target groups, user preferences and results related to various business initiatives to increase digital user revenue. One respondent describes that analysis tools are deeply integrated into work and learning routines, and that reaping learning from analysis tools is central to being able to pursue projects, initiatives, and processes further:

> *"It flows right into getting to learn and deciding a further path and what activities we are going to plan. It goes hand in hand with the work tasks (...). We need to see if we hit the target audience, the target, and generally look at whether our content is engaging" (R10).*

Insight is described as an important reference point in the form of target figures, current status and analysis of measures and projects. This finding is reflected by other respondents, who also highlight digital analysis tools as a key source of learning, and an important starting point in product development and new business initiatives. Another editorial respondent who works as a journalist and group leader justifies this in a firm and stated strategy.

> *"For the editorial staff, it is very much related to this strategy for digital subscribers. A clear goal has been set for all houses to be digitally sustainable during 2021. So, it is tangible, both for us and for [the group]" (R7).*

Availability of analysis tools and insights is a crucial factor for a data-driven development of editorial products and services. An editorial manager believes that number and data-driven assessments based on real-time data can contribute to creating added value for the customer and loyal subscriptions, through quantitative measures such as sales, customer dropout, coverage percentage, age distribution and gender distribution:

> *"SAS (airline) can provide "fast track" and "lounge", but what can we do to make them want to be with us? This is really what I use digital analysis for, and I immerse myself in it every single day" (R9).*

However, this finding can be seen in contrast to respondents who are journalists, who state the scope of available tools and the possibilities as overwhelming. Although analysis tools have been made available with a call for active use and exploration, editorial respondents report lower use of analysis tools compared to editorial managers and commercial respondents. A respondent who works as a journalist state early in the interview that analysis tools are not a big part of everyday work:

> *"There are so many tools, so I do not keep up. We have switched to something called [analysis tool] now. I have not started with that at all, I must admit" (R8).*

When asked what the respondent perceives as the underlying reasons for this, the answer is that the respondent does not experience clear guidelines on use and expectations related to his work tasks. At the same time, the respondent states that analysis tools are indirectly a larger part of everyday work through daily discourse:

> *"It is used when we go through the numbers at the morning meetings or in our group, where we often talk about how much sales we have (...). So, it's not like we're not dealing with this at all. But I as an individual probably use it very little in everyday life" (R8).*

4.1.3 Development

While most of the respondents emphasize the opportunity to explore and find data and insights, several of the respondents also emphasize that product and concept development is an important intention for actively seeking new information. This largely applies to so-called hypothesis testing, where several of the group's digital products both originate from and are developed using tests using extensive data and analysis tools. One respondent elaborates that testing hypotheses can give an indication of potential in a development project, and is central to the development of new products and services:

> *"My working day consists very much of having a long portfolio of ideas and hypotheses on things we believe can create value, and then there are finding ways and strategies to validate these ideas and put them into action" (R1).*

Another respondent (R4) with a background as a business developer also states the tools as an intuitive way to seek out already established hypotheses. At the same time, the respondent outlines a high threshold for implementing changes in the media houses' product portfolio. The strategy of data and insight as a distributor of decision-making authority is described as an important driver for innovation and business development:

> *"These are important changes that we are working on today, and we must prove hypotheses, changes, and sales processes in, for example, a regular article or our daily sales. If we make changes, it should be based on tests of tests. We must have data that supports the decisions we make" (R4).*

An editor highlights a clear development related to individuals' everyday work considering the implementation of the data-driven strategy. In the past, decisions were often based on subjective strategic assessments, as opposed to numerical and data-driven assessments based on real-time and analytical data. When asked how organizations and individuals have related to analysis over time, the respondent talks about a clear development in line with the organization's strategy to become more data-driven:

> *"Before, we had several theories, and we got some confirmed as well. But it was often from the way we made paper newspapers; that the famous desk sat and decided what should be in print, what should be big and what should be small. Many of them had quite good "fingerspitzgefühl", but it was not analysis" (R9).*

4.1.4 Cooperation

The latter identified intention, cooperatively, is reflected with greater consensus across subject orientations in the data material in comparison with strategic and development. Several respondents state that they use analysis tools to be able to communicate and collaborate across based on a common understanding. Analysis and insight have a central cooperative and collaborative role, as analytical tools and insight are a central source of learning and reference. When asked about a respondent's use of analysis tools, the respondent points out insights as an important means of gaining a foothold in various ideas and initiatives:

> *"I would say that they are the most convincing arguments, you cannot get anywhere without numbers. It is to get a breakthrough" (R1).*

On the same question, an editorial respondent has a slightly different view of analysis tools considering common discourse and collaboration. The respondent describes the focus on numbers as occasionally alienating and as a learning barrier for parts of the editorial staff. The respondent believes that qualitative assessments and an editorial value base to a greater extent appeal to editorial staff:

> *"I have observed new managers who are very concerned about numbers, that it does something with the "standing" they get in parts of the editorial office. They may lose some people they could have brought with them if they had had another line of argument" (R7).*

While analysts and business developers more often focus on parameters such as sales, distribution, and customer dropout, several of the editorial respondents emphasize more qualitative parameters such as societal relevance and impact. A respondent with an editorial background further describes both positive and negative aspects of basing editorial production on number-driven insights. The respondent states that a balance is needed between the use of quantitative and qualitative decision bases:

> *"We do not live in a bubble; we must be up to date on what people are interested in. Then I think it is good to follow, and it gives us good insight into what catches people. There is also the danger that you drop important cases, precisely because there are things that you think will generate higher numbers than by another parameter" (R8).*

To the same question about intuitive use of analysis tools, another editorial respondent answers that there is great diversity in the arsenal of tools and the introduction of new digital aids. The respondent emphasizes that efforts to acquire new digital knowledge are extremely important, to be able to use the tools in line with their purpose:

> *"New tools are coming all the time. Both tools that can simplify the workflow and everyday work, but which can also be used to convey our content. Acquiring new digital knowledge continuously is extremely important, in the part of the organization that I am at least" (R2).*

5. Discussion

To answer the research questions: "What is the role of digital analytical tools in knowledge management and how does it affect organizational learning?", we have applied as an analytical lens the 4I model of Crossan et al. (1999). Based on Jenkin's (2013) recommendation to examine information gathering and digital tools in the light of the framework, we see that analysis tools have a prominent and varied role in the group, with both follow-up relationships and falsifications in organizational learning processes and level differences. Our findings related to the role of analysis tools in different parts of the 4I model support the recommendation to look further at an extension of the 4I model. We find findings in all learning processes that support the fact that information gathering, and analysis tools play a significant and increasingly important role in the group.

From this in-depth study in learning from big data systems we gain insight into organizational learning from the intuition process. What triggers information retrieval can be categorized in three different areas: Strategic, Development and Cooperative aspects. In terms of strategic, availability of analytical tools is a crucial factor for a data-driven publishing business. Both for editorial and business development recognizes the importance of having big data analytics available in their everyday work. From a development perspective, hypothesis-testing, developing new business models and new services is the core of big data analytics. The reliance on data is essential for making better business decisions. The last dimension identified is cooperation. Big data is a tool for greater consensus, as it is easier to find a common ground and direction for the organization. Big data analytics creates a coordination element in the organization.

6. Conclusion and future work

Our study contributes to a categorization and conceptualization of the role of analysis tools in organizational learning processes, and the individual's seeking role in organizational learning processes. By drawing on the significance that the tools have had on individuals' intuition and search process, collective discourse and strategic implications, the problem bridges the gap between digital exploration and organizational learning with the intention of forming a more thorough conceptual framework to understand both the role of analytical tools and their practical significance. Analytical tools have received a greater focus in the last decade, and several companies have realized that the data they own - and not least the way they use it - can contribute to competitive advantages (Pappas et al., 2018). As we explore the use of big data analytics within an organizational learning framework and include technology as a key factor and by highlighting the intuiting aspect – with focus at the individual level and their ability to comprehend the big data information and collaborate with technology. This has consequences for the Intuiting stage of the 4I framework. Further research should seek to identify organizational learning processes related to digital tool also at the other 3 stages of the 4I organizational learnings process, and in general seek to identify good organizational learning practices involving man-machine collaboration.

References

Bibi, G., Mousumi P., & Dash, S. S. (2021) Theoretical necessity for rethinking knowledge in knowledge management literature." *Knowledge management research & practice* 19, (3) pp. s396-407.

Carlile, P. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries. *Organization Science,* 15(5), 555-568.

Collins, H. (2007). Bicycling on the Moon: Collective Tacit Knowledge and Somatic-Limit Tacit Knowledge. *Organization Studies*, 28(2), 257-62.

Constantiou, I. D. & Kallinikos, J. (2015). New games, new rules: big data and the changing context of strategy. *Journal of Information Technology,* 30(1), 44–57.

Crossan, M., Apaydin, M. & Vera, D. (2011). *A Framework for Integrating Organizational Learning, Knowledge, Capabilities, and Absorptive Capacity.* John Wiley & Sons.

Crossan, M., Lane, H. & White, R. (1999). An Organizational Learning Framework: From Intuition to Institution. *The Academy of Management Review,* 24(3), 522-537.

Ebbers, J. & Wijnberg, M. (2009). Organizational Memory: From Expectations Memory to Procedural Memory. *British Journal of Management,* 20, 478-90.

George, G., Haas, M.R. & Pentland, A. (2014). Big data and management. *Academy of Management Journal,* 57(2), 321-326.

Ghoshal, S. & Moran, P. (1996). Bad for practice: A critique of the transaction cost theory. *Academy of Management Review*, 21, 13–47.

Grant, R. M. (1996). Toward A Knowledge-Based Theory of the Firm. *Strategic Management Journal,* 17(2), (109-122).

Heckathorn, D.D., 2011. Comment: Snowball versus respondent-driven sampling. *Sociological methodology*, *41*(1), pp.355-366.

Hecker, A. (2012). *Knowledge Beyond the Individual? Making Sense of a Notion of Collective Knowledge in Organization Theory. Organization Studies*, 33(3): 423-45.

Hislop, D., Bosua, R. & Helms, R. (2013). Knowledge Management in Organizations - a critical introduction. (4. Utg). Oxford University Press.

Kogut, B. & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science,* 3, 383–397.

Laney, D. & Buytendijk, F. (2013). *Invest in Information and Analytics to Benefit from Big Data*. Gartner.

Markus, M. L. (2015). New games, new rules, new scoreboards: the potential consequences of big data. *Journal of Information Technology,* 30(1), 58–59.

Mikalef, P., Pappas, I., Krogstie, J. & Giannakos, M. (2018). Big data analytics capabilities: a systematic literature review and research agenda*. Information Systems and e-Business Management*, 16, 547-578

Nonaka, I. & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation.* Oxford University Press.

Pappas, I., Mikalef, P., Giannakos, M., Krogstie, J. & Lekakos, G. (2018). Big data and business analytics ecosystems: paving the way towards digital transformation and sustainable societies*. Information Systems and e-Business Management*, 16, 479-491.

Polanyi, M. (1967). *The Tacit Dimension.* Routledge.

Razmerita, L., Kirchner, K. & Nabeth, T. (2014). Social Media in Organizations: Leveraging Personal and Collective Knowledge Processes. *Journal of Organizational Computing and Electronic Commerce*, 24, 74-93.

Ridder, H.G., 2017. The theory contribution of case study research designs. *Business Research*, *10*(2), pp.281-305.

Serenko, A., 2021. A structured literature review of scientometric research of the knowledge management discipline: A 2021 update. *Journal of Knowledge Management*.

Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal*, 17, 45-62.

Tableau. (2020). *What is Tableau*. Tableau. https://www.tableau.com/why-tableau/what-is-tableau

Vaio, A. D., Palladino, R., Pezzi, A & Kalisz, D. E. (2021). The role of digital innovation in knowledge management systems: A systematic literature review. Journal of Business Research, 123, pp 220-231.

Yin, R. K. (2011). *Case Study Research: Design and Method* (3. Utg). Sage Publications.

Intellectual Capital and Performance: A Case Study of Construction Companies

André Sucena[1], Florinda Matos[2] and António Nunes[1]
[1]NECE- Research Center for Business Sciences, Department of Management and Economics, University of Beira Interior (UBI), Covilhã, Portugal
[2]DINÂMIA'CET-IUL - Centre for Socioeconomic Change and Territorial Studies, Iscte - University Institute of Lisbon, Lisboa, Portugal
andre.sucena@ubi.pt
florinda.matos@iscte-iul.pt
anunes@ubi.pt

Abstract: Intellectual Capital Management is a key element for a company's development and value creation in achieving sustainable competitive advantage. Since intellectual capital is unique in the marketplace, companies retaining and transferring internally generated knowledge can face the external environment with more agility. Due to the importance of civil construction in the Portuguese economy, this exploratory research uses a case study methodology applied to construction companies in Portugal. The findings of this research evidenced that intellectual capital management influences the performance of construction companies. By recognising the importance of intellectual capital management and how it influences the performance of companies, it is possible to trigger a set of investments in human capital that will become structural capital through the transfer of their competencies and, finally, relational capital. Therefore, higher performances are achieved without losing the knowledge acquired over the years. This research can help to understand the importance of investing in intellectual capital management competencies in civil construction companies to leverage their competitive strategic development.

Keywords: Intellectual Capital Management, Human Capital, Construction Companies, Performance

1. Introduction

Several authors have demonstrated the importance of intangible asset management, particularly Intellectual Capital management, as a factor in the competitiveness and sustainability of companies (Matos et al., 2018). Without applying intellectual capital management policies, companies' future is threatened, even more so nowadays, when workers have significant volatility regarding the search for new jobs and consequent exchange between companies.

On the other hand, the human capital, as one of the components of the intellectual capital, must be retained in the companies (Edvinson, 1997). It is necessary to implement measures to prevent the workers' discomfort in the surroundings of their companies, a space where most of the time the worker spends more time than at home. Otherwise, the worker's well-being in the company is compromised, making it clear that the company did not foresee or implement the necessary policies to retain the human capital. The company's investment in its worker and all his knowledge about the company is at risk. The added value that was added to the company, in the short term, is no longer reflected in the medium-long term because the knowledge created ends up not being retained, nor is there a concern to transfer it to other members of the company (Matos & Lopes, 2009).

It appears that many the SMEs (Small and Medium Enterprises) have difficulty retaining this human capital, largely due to the lack of career plans, the lack of communication, the devaluation of the worker's abilities, the lack of organizational climate, the poor environment of work that is felt and the fact that the responsibilities do not correspond to the worker's remuneration and prospects for growth (European Commission, 2018).

This exploratory research uses a convenience sample to analyze companies in the civil construction sector, whose weight in the Portuguese economy is very relevant. According to INE – Statistics Portugal data in 2019, the civil construction sector had a 4.2% share of the Portuguese GDP. It is possible to say that over the years, civil construction has been revealed to be one of the most critical sectors in the country.

This sector suffered a crisis from 2008 to 2011, which meant the closure of numerous companies and the mass displacement of workers in the area towards unemployment.

This research's main objective is to understand how intellectual capital management influences the performance of SMEs.

Based on these objectives and the problems already identified, some questions are raised that will serve as a starting point for this investigation:

1. What is the capacity of companies to implement intellectual capital management policies that facilitate the retention and transmission of knowledge created and accumulated?
2. Will it be possible to associate companies' increased success and competitiveness with applying intellectual capital management policies?

In this paper, when referring to the concept of performance, we refer to the evaluation of the efficiency and effectiveness of a company in carrying out the economic activity because, according to Dumay (2016), measuring the performance of a company is a way to quantify the efficiency and effectiveness with which it carries out its business activities.

2. Literature Review

2.1 Intellectual Capital

The lack of consensus regarding the definition of Intellectual Capital is one of the themes that has been dragging along over time and has led countless authors and scholars to come up with various hypotheses. However, everyone recognizes Intellectual Capital as an important resource supporting companies' performance. Recognition was mainly acquired after the work developed by Sveiby (1990) and later by Edvinsson and Malone (1997), among others.

Intellectual Capital begins by being defined as an asset of each individual, a characteristic generated through a genetic combination with education, life and business experience (Hudson, 1993). Other authors, such as Nahapiet (1998), reject a more personal definition of Intellectual Capital and prefer associating the term with each person's knowledge, social and collective capacity. On the other hand, Matos and Lopes (2009) and Korsakiene et al. (2017) reiterate that a good perception of the importance of Intellectual Capital by companies and consequent good management of it can boost their competitive capacity.

Thus, it becomes possible to divide Intellectual Capital into two types of economic value. The first intangible asset of companies, Structural Capital, essentially encompasses everything that is owned by a company but is not measurable, such as administrative systems, computer systems and patents. Second, Human Capital, which includes all internal and external human resources (Edvinsson & Malone 1997).

Daryaee et al. (2011) and Burstien and Zyngier (2012) consider Intellectual Capital as the difference between book value and non-financial capital, arguing that good management of Intellectual Capital is critical for companies to achieve success.

The authors who best provide a more perfect and timely definition to achieve the objectives of this paper are Guthrie and Petty (2000) and Wiig (1997), for whom the correct implementation of intellectual capital not only provides a great knowledge advantage. Additionally, these authors reiterate that knowledge, and the consequent Intellectual Capital, can accelerate the innovation capacity of companies if a dialogue is promoted that encourages the learning of all those involved in the company (Guthrie & Petty, 2000; Wiig, 1997).

From the definitions attributed by these authors, it is possible to verify some common characteristics of the definition of Intellectual Capital: a) as it is intangible and therefore difficult to measure, it is not possible to find this asset reflected in the statements financial; b) it is a dynamic process that requires, in a collective way, the practice of several people and; c) companies are only given a competitive advantage when Intellectual Capital is well implemented (Guthrie & Petty, 2000).

It is possible to conclude that a consensus has not yet been reached for a correct method to measure Intellectual Capital because of all the methods presented, none can cover the most varied aspects of Intellectual Capital. However, Intellectual Capital is still an of the key elements for the success of any company in today's economy (Matos et al., 2020).

2.2 Intellectual Capital in SMEs

SMEs can use Intellectual Capital to create internal awareness and promote a financial boost (Khalique, 2014) and sustainable growth (Rastogi, 2003).

For SMEs this means greater availability to make investments of greater magnitude in Intellectual Capital which, in addition to improving the performance of SMEs, directly affects their development strategy, indirectly influencing its financial and non-financial components (Orlitzky et al., 2003). This type of investment allows for the creation of internal learning, where it is possible to acquire, create and transfer knowledge among all those involved in the company (Garvin et al., 2008).

Therefore, Intellectual Capital affects the ability to transmit and retain knowledge within SMEs, particularly human capacity and social and organizational capital (Corvelho & Migliarese, 2014). Several authors support the theory that Intellectual Capital is a fundamental pillar for SMEs because it supports their ability to innovate and provide better solutions to their customers (Matos et al., 2020). Intellectual Capital is one of the pillars that allow companies to have a competitive advantage over their direct competitors and consequently improve their performance in the market.

2.3 Research Support Intellectual Capital Management Model

Matos and Lopes (2009) developed the ICM - Intellectual Capital Management Model to study intellectual capital management in SMEs. Later, in 2013, this model was developed, and an updated version of the model was presented (Matos, 2013). The various studies referred to by these authors demonstrate the operationalization of the model to audit the intellectual capital management in SMEs in the Portuguese context (Matos & Lopes, 2009; Matos et al., 2011, Matos, 2013). These authors believe that, compared to other models, the ICM - Intellectual Capital Management model has a greater capacity to deal with the complexity of factors that constitute intellectual capital and organizational knowledge (Matos, 2013).

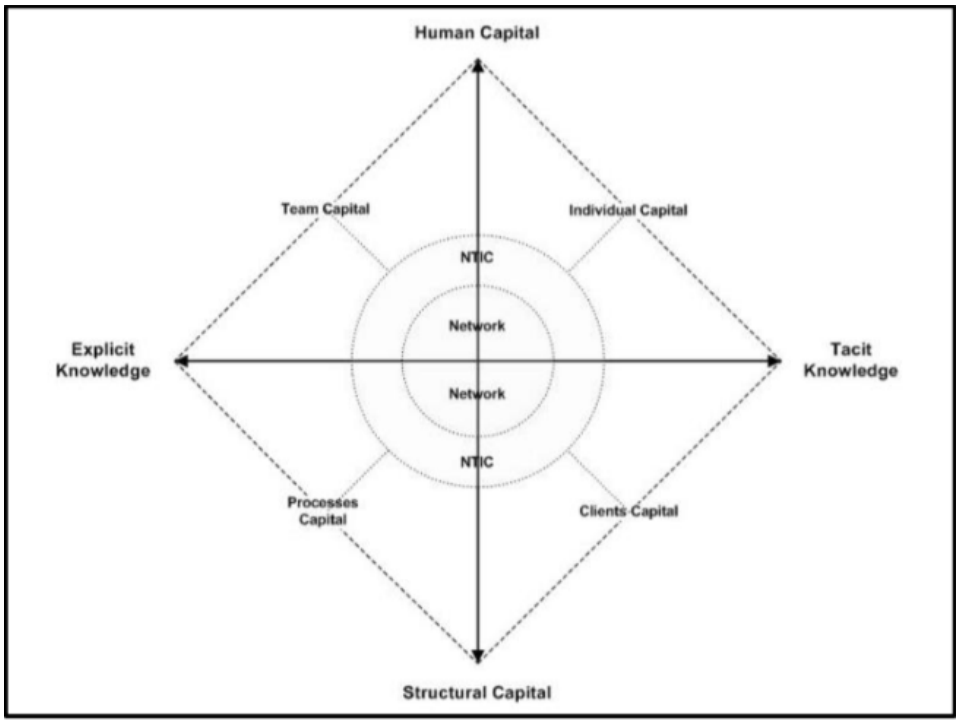


Figure 1: ICM - Intellectual Capital Model (Matos, 2013, p. 343)

The model in Figure 1 focuses on the analysis of more detailed information about the company's internal management, not disregarding the development quadrants and parameters so that it is possible to determine the complexity of organizational knowledge factors (Matos, 2013) and, in general, all components of Intellectual Capital Management.

According to Matos (2013), this is divided into four quadrants, each of which has its own set of analysis parameters: Personal Capital, Team Capital, Process Capital and Customer Capital. The network and new

information and communication technologies are also part of this model and are common to all quadrants (Matos, 2013).

Here, the knowledge generated from the company's workers stands out, that is, the company's source of value, which is obtained through the talents and abilities demonstrated by each worker (Matos, 2013).

In the Team Capital quadrant, the combination of skills and talents of workers in each company is reinforced when performing a task assigned to them. By fulfilling this objective, they are adding value to the company and creating links among themselves; when there is teamwork in each company, it becomes easier to create value, produce and share tacit knowledge that, later, when operationalized, makes it into explicit knowledge. Matos (2013) reiterates that when explicit knowledge is formalized in a company's regulated system, it is easier to acquire value for the company and consequently for the knowledge of workers.

On the other hand, Process Capital focuses on organizational knowledge, which can be understood as the organizational memory of companies, that is, the recording of information within the scope of the economic activity of companies and may be similar to the transformation process of business.

Finally, Client Capital is directly related to the interaction between workers and clients, or if we consider the interaction between the research object and its audience. It is important to understand how the provision of services and products are presented to customers and how the issues raised by them are resolved. This knowledge and concerns often arise from the way the market is analyzed, and the response that is given regarding the investment that should be made so that innovation helps to improve customer satisfaction (Matos, 2013). Since the main objective is to maintain a healthy relationship with customers, customer satisfaction is essential, as it is through them that the company's image is reflected.

As for the two shared quadrants, namely new information and communication technologies and networks, it can be assumed that they can establish a relationship between the four main quadrants. Its main role is to support as many management positions as possible to help resolve issues. In addition, it appears that this is an asset for the company, as it promotes worker productivity and service quality (Matos, 2013).

Through the literature review, it was impossible to identify a model that would best apply to Portuguese SMEs and more specifically to the civil construction area, even though several models have emerged, suggested by numerous authors over the years. Thus, the model ICM - Intellectual Capital Management (Matos, 2013) is the model that best fits, as it is an audit model of intellectual capital management that has already been adapted to the reality of Portuguese SMEs.

3. Methodology

3.1 Data Collection and Analysis Methods

Through the application of the ICM – Intellectual Capital Management model developed by Matos (2013), the objective of this investigation is to understand how Intellectual Capital Management influences the development of companies in the civil construction area and how it reflects, whether positively or negatively, relative to its most direct competitors.

Considering the scope of this investigation and the proposed objectives, complemented by the starting questions for this investigation, the instrument best suited for data collection is the interview survey (Bardin, 1977).

All interviews were conducted through a script preliminarily structured and tested in companies operating in the civil construction area, acting as a coordinating axis for them and reflecting on the literature review exposed above. In the last step, the transcription and content analysis of the collected responses was performed.

3.2 Sample

In this research, three companies in the civil construction sector will be analysed. These companies have in common the fact that they work as clients and suppliers among themselves, creating a kind of unofficial consortium.

3.3 Interview Survey

The preparation of the guide for the interview survey was based on several sources with similar research related to Intellectual Capital and its influence on companies. Once elaborated, the script was tested and revised based on an interview conducted with a small civil construction company with characteristics similar to those in the case study.

To fulfil the research objectives, a set of questions were constructed and organised in a script, which served as the basis for the interviews carried out with the three managing partners of the three companies in the sample. By the end of May 2021, the interviews and gathering of all the information necessary to carry out this investigation were established.

The questions asked in the survey used in the interviews contemplate the reality of companies in a time frame from 2019 to 2020 and the projection for the following two years (2021 to 2022). The questions focus on the decisions taken by companies and how they are reflected in their activity. There is also a set of issues to define its workers and the direct relationship they have with the increase in the competitive capacity of companies.

3.4 Data Analysis Method

According to Bardin (1977), one of the interview analysis techniques is content analysis, where a systematic and objective process is developed to describe the content of one of the transmitted information; content analysis is a technique used for analysing the data.

4. Analysis of Results

4.1 Presentation of Companies

The companies that participated in the study comprise the following criteria:

1. Companies whose economic activity is aimed at civil construction;
2. Headquartered nationwide and with a turnover above €50 000.00;
3. High level of specialization in its areas of intervention;
4. High aptitude and growth prospect of companies.

Founded in 2015, Reprototais Remodelações Unipessoal, Lda gave continuity to other companies founded by the current managing partner during the 1990s. Reprototais is one of the companies with the greatest presence in the construction and remodelling market in Lisbon, establishing several private partnerships.

Baratino – Indústria de Móveis e Restauro, Lda, also founded in the last decades of the 20th century, presented itself in the market as one of the most specialized carpenters in Lisbon. Over the last few years, Baratino has been consolidating its position in the market. The current carpenter manager by profession is responsible for the growth of the family project started by his father, to whom he succeeded as managing partner.

António GB Monteiro Equipamentos Elétricos, Lda is a sole proprietorship company founded by its current managing partner during the 1990s. António GB Monteiro Equipamentos Elétricos, Lda, presents itself in the market as one of the most specialized companies in the area of electrical installations carrying out numerous works in mainland Portugal.

4.2 Case Study Results Synthesis

For the preparation of this case study, the researcher developed a questionnaire based on the ICM model (Matos 2013) to try to understand the level of intellectual capital management of the three companies that participated in the study the case studies and at what times they privilege Intellectual Capital Management. In addition, the questionnaire aims to obtain these three companies' strategic positions concerning Intellectual Capital.

The investigation will be conducted through a qualitative method. Data were obtained through an interview, lasting approximately thirty minutes, carried out with the managing partners of the three participating companies. To facilitate the content analysis, the results of these interviews were summarized in the table below (Table 1) and commented quadrant by quadrant according to the ICM – Intellectual Capital Management model developed by Matos (2013).

A colour-based answer classification system will be used. This graphic is intended to facilitate the reader's understanding when analyzing this research.

Table 1: Results of the treatment of interviews conducted with the Managing Partners of the three companies

Question	Interviewee 1: Reprototais	Interviewee 2: Antonio Monteiro	Interviewee 3: Baratino
Does the company carry out the intellectual capital management?			
Were there hirings in the period 2019 and 2020?			
Question	**Interviewee 1: Reprototais**	**Interviewee 2: Antonio Monteiro**	**Interviewee 3: Baratino**
Did you carry out redundancies in the period 2019 and 2020?			
Is it valued and facilitated the acquisition of knowledge by workers?			
Do talented workers be valued and compensated?			
Is vocational training recognized as an instrument for acquiring new skills?			
Are workers encouraged to share their individual knowledge and knowledge?			
Are there rewards for employees who share their individual knowledge?			
Are workers encouraged to be innovative?			
Are workers who are innovative/creative rewarded?			
Are there innovations related to internal organization processes?			
Are there innovations at the organizational level?			
Does the company have more certifications in addition to those imposed for carrying out the activity?			
Are workers dedicated to the work they do?			
Are workers creative or spontaneous?			
Are the senses of team elevated on the part of the workers?			
Is all the knowledge acquired by workers passed on to new colleagues?			
Is the development of teamwork skills privileged in the company?			
Does the company use new technologies to record and systematize all internal and external organization processes?			
Are new technologies a tool to improve the quality of internal organization processes?			
Are employees' important knowledge computerized?			
Are employees' important knowledge saved in paper format?			
Are employees' important knowledge stored in each employee's individual memory and not recorded?			
Does the company have a certification system? If yes, which one?			
Have partnerships been developed in this company with other companies or institutions at national level?			
Have partnerships been developed in this company with other companies or institutions at an international level?			
Have the developed partnerships been creating more value for the company and consequently improving internal dynamics?			
Have the developed partnerships been improving economic results?			
Does the company carry out market studies? If yes, how often?			
Question	**Interviewee 1: Reprototais**	**Interviewee 2: Antonio Monteiro**	**Interviewee 3: Baratino**
Are the innovations developed mainly the result of customer needs?			
Are the developed innovations mostly the result of workers' ideas about the market?			
Are team ideas a source of innovation to bring new solutions to the market?			
Does the company favor the relationship with customers?			

Source: Self elaboration.

Subtitle:

Negative answer	Positive response	Not applicable

4.3 Intellectual Capital Management Graphics Synthesis

Analyzing Figure 2 it possible to observe which quadrants have the most significant weight in any of the three companies.

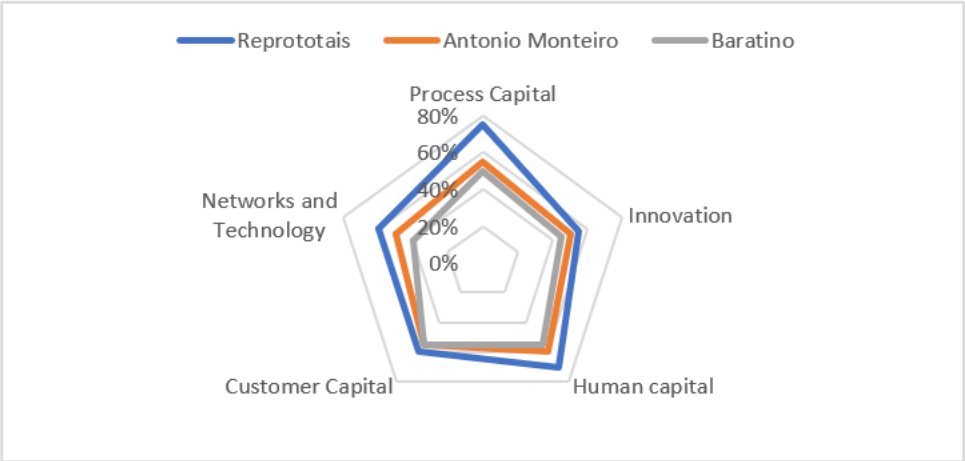


Figure 2: Graphical Synthesis of GCI in the three companies surveyed

Source: Self elaboration.

In the case of Reprototais, the Human Capital and Process Capital quadrants are the quadrants with the most significant weight in the company, followed later by the Networks and Technology quadrant, which, like the Innovation quadrant, requires greater investment.

The remaining two companies follow the same investment pattern in the five quadrants but do so with less intensity than Reprototais.

It should be noted that Baratino presents a higher investment grade than António Monteiro in all quadrants, except for the Customer Capital quadrant, which is at a very similar level for both companies.

The Customer Capital, Innovation and Networks and Technology quadrants most need greater investment on the part of the three companies, which can mark the growth of these SMEs, thus directing them towards more sustainable development, a more significant competitive capacity and consequently better results.

4.4 Trend analysis of responses to the Quadrants of the ICM Model

To facilitate the interpretation of the data obtained through the interviews carried out with the companies, all of them represented by their managing partners, individual analysis of the responses obtained in the three interviews was carried out for each of the five quadrants that constitute the ICM model used in this case study and an analysis of the relationship between all quadrants according to the responses obtained.

4.4.1 Individual Capital Quadrant

By analyzing the same set of questions, it is proven that, for the three companies, their employees are a source of concern and, consequently, investment, the sharing of knowledge, the acquisition of knowledge and/or new skills are encouraged by the company.

However, two of the three companies say they do not reward employees who share their own knowledge. Baratino also adds that professional training is not a fundamental element for acquiring new knowledge and reiterates that by working daily in the art, much more skills are acquired, accompanied by experience.

4.4.2 Team Capital Quadrant

The second quadrant forces us to focus on the collective, putting the individual aside, and on the consequent internal relationships among all workers.

In this quadrant, the expectation of answers is much higher than in the previous quadrant since the research focuses on one of the economic sectors where the percentage of teamwork is much higher than individual work, a fact supported by the human inability to carry out such large projects scale in an individualized way.

Through the respondents' answers, it was noticed that all workers were dedicated and creative in the projects in which they were inserted. They follow the ideals of work defended and put into practice daily by the three companies surveyed.

4.4.3 Process Capital Quadrant

The development of the companies' internal organization enables their teams, made up of their workers, to put into practice processes aimed at formalizing the companies' knowledge. In this quadrant, civil construction and most companies related to the area (subcontracts) find it very difficult to formalize any type of knowledge. The best and most effective way to combat this problem is to pass on the testimony, that is, the commitment to teamwork, which enables the learning of the newest elements of the companies that end up having as mentors workers with countless years of experience.

Through the analysis of the answers obtained through the interviews, it is easy to verify that, in most companies, the processes they used at the beginning of them and during their growth are the same; companies with about thirty years of experience in the market, they have never changed their processes, nor have they invested in certification beyond what is required by law. Reprototais is the only company that made drastic changes in its processes and implemented some innovations, evidenced by the current difference in invoicing and the different growth expectations.

4.4.4 Customer Capital Quadrant

The relationship established between customers, workers and the company is one of the ways that companies can improve their services and/or products since, objectively, they intend to present themselves better and better in the market and surpass the customer expectations, thus increasing their satisfaction. Most companies that participated in this investigation carry out market studies throughout the year; only the company with a lower turnover says, through its managing partner, that it does not carry out any market study. The company that stands out with the highest turnover is also the one that seeks not only to meet the needs of its customers but also to provide them with the most innovative solutions possible. Most companies also declare that the greatest innovations come from the market's needs and not from the workers' proposals

4.4.5 New Technologies and Networks Quadrant

This last quadrant is characterized as a quadrant that interferes with all other quadrants because it manages to establish a relationship between them. By facilitating numerous functions and accelerating various internal and external processes of the company, it allows the level of productivity to increase without changing the variables number of workers and hours worked.

Analyzing the sample surveyed, it is noticed that the investment clearly influences certain factors in new technologies and networks. Except for the non-existence of certifications other than the mandatory ones, all companies in this study try to record the important knowledge of employees, whether in paper or electronic format. There is a full awareness on the part of all those involved that, unfortunately, there is information that remains only with the workers, and sometimes it is not even passed on to the youngest or registered in the company.

It should be noted that Reprototais is the only company in the sample that has entered into any partnership. In this specific case, numerous private partnerships were established at the national level and continue to be created. The existence of these partnerships is a very important milestone for this company since, since they were created (about a year and a half ago), they have projected the company's net results to another level and expanded the chances of launching the company to another level in a very near future.

5. Conclusion and Limitations

The three companies that participated in the study were aware of and concerned about their role in the market. By favouring the acquisition of new knowledge by their workers, companies seek to respond to the challenges that the market poses to them, whether innovative challenges or challenges posed by their customers, who, in some cases, have a particular vision of the result they want for their projects.

The company Reprototais stands out from the other companies present in this case study for constantly seeking to be at the forefront of innovations instead of just taking on challenges at the time of customer requests. The great advantage here is the carrying out of market studies which, despite not being carried out as often as desired, are enough for this company to stand out in the market as a company that pays attention to its customers, a reality proven through the results shown in the Customer Capital quadrant (Monciardini & Zambon, 2015).

It confirms, unanimously, the will of these three companies to grow, albeit at different rates, through creating new jobs, maintaining current jobs and realising advantageous partnerships. Then comes the attempt to create greater value for companies where, once again, Reprototais stands out for vigorously applying Intellectual Capital Management policies, this time very present in the quadrant of new technologies and networks. Despite only carrying out partnerships at the national level, Reprototais managed to assert itself through its ability to become completely financially independent and with very inviting prospects, which indicate both economic and financial growth and human capital in the short-medium deadline (Dumay, 2016).

The Process Capital quadrant is the most prominent quadrant of the ICM model in the universe of these three companies. The daily reality of these companies is living proof of their ability to promote teamwork and knowledge-sharing among workers. One of the techniques most used by companies in this field is the realisation of mixed teams. These teams combine more experienced and less experienced workers, where teamwork forces the creation, development and transfer of knowledge that, despite often not being registered, ends up not getting lost completely (Matos et al., 2020).

In short, despite the model developed by Matos (2013) being more than a decade old, it is possible to prove its ability to resist time and adapt to different economic scenarios. As a result of the case study on the influence of Intellectual Capital Management in the development of companies, it was proved that the ICM model is suitable for application in companies in the construction industry. Although there are quadrants that are more relevant to the reality registered in the day-to-day of these companies (such as the Team Capital, Process Capital, and the Capital of New Technologies and Networks quadrant), this does not mean that the other quadrants are not similar applied and put into practice by these companies.

During the investigation period, some limitations emerged. First, taking into account the economic activity performed by the three companies scheduling and conducting the interviews were difficult. Authorisation for the application of the questionnaires and processing data collected during the interviews proved to be a setback that the researcher did not expect.

The second limitation concerns the low education level of everyone involved in the interview process. The incomprehension of the questions asked sometimes caused embarrassment during the interviews that were only overcome by the meticulous and occasionally repetitive explanation of the concepts.

Finally, the reduced number of interviews since the adherence and availability of companies in the construction industry are reduced. In view of these limitations, this research can only be seen as exploratory, and the conclusions cannot be extrapolated. This exploratory research is a test for future research. To reduce the limitations, in future research, we will directly involve an association representing the sector with greater institutional weight in the mobilization of companies. A detailed interview guide will also be prepared with explanations of each concept, thus facilitating the understanding of concepts and reducing subjectivity.

References

Bardin, L. (1977) Análise de conteúdo, Edições 70, Lisboa.

Daryaei, A., Pakdel, A., Easapour, K. and Khalaflu, M.M. (2011) "Intellectual capital, corporate value and corporate governance, Evidence from Tehran Stock Exchange (TSE)", Australian Journal of Basic and Applied Sciences, Vol 5, No.12 pp 821-826.

Dumay, J. (2016). "A critical reflection on the future of intellectual capital: from reporting to disclosure", Journal of Intellectual Capital, Vol 17, No.1, 168–184.

Edvinson, L. and Malone M.S. (1997) Intellectual Capital, Harper Collins Publishers Inc, New York.

European, Commission (2018), Annual Report on European SMEs, EU Publications.

Garvin, D.A., Edmondson, A.C. and Gino, F. (2008) "Is yours a learning organization?", Harvard business review, Vol *86, No.*3, pp 109-116.

Guthrie, J. and Petty R. (2000) "Intellectual capital literature review: Measurement, reporting and management", Journal of Intellectual Capital, Vol 1, No.2, pp 155-176.
Hudson, W. J. (1993) Intellectual capital: How to build it, enchance it, use it, Wiley, New York.
Khalique, M., Isa, A., Bin Shaari, J. and Hassan, M. (2014) "Constructing an index of entrepreneurial competencies and intellectual capital for ICT SMEs in Malaysia", In The 6th International Borneo Business Conference, Kuching, Sarawak, Malaysia.
Korsakiene, R., Raisiene A. and Buzavaite M. (2017) "Work Engagement of Older Employees: do Employee and Work-Related Factors Matter?", Economics and sociology, Vol 10, No.4, pp 151-161.
Matos, F. and Lopes, A. (2009) "Intellectual capital management–SMEs accreditation methodology" In European Conference on Intellectual Capital, Vol. 9, pp. 28-29.
Matos, F., Lopes, A., Suciu, M. and Ghitiu, A. (2011) "Intellectual Capital Management: Case Study Portugal versus Romania" In ECIC2011-Proceedings of the 3rd European Conference on on Intellectual Capital: ECIC, p. 240, Academic Conferences Limited.
Matos, F., Vairinhos, V., and Godina, R. (2020) "Reporting of intellectual capital management using a scoring model", Sustainability, Vol 12, No. 19, pp 2810-2812.
Matos, F., Vairinhos, V., Selig, P. and Edvinsson, L. (2019) "Intellectual capital management as a driver of sustainability" Perspectives for Organizations and Society, Springer International Publishing, Cham and Berlin.
Matos, F. (2013) "A Theoretical Model for the Report of Intellectual Capital", Electronic Journal of Knowledge Management, Vol 11, No. 4, pp 339-360.
Migliarese, P. and Corvello, V. (2014) "The dynamics of intellectual capital flows in the context of change processes of small and medium-sized enterprises" International Journal of Intelligent Enterprise, Vol 2, No.2/3, 104.
Monciardini, D. and Zambon, S. (2015) "Intellectual Capital and Innovation, A Guideline for Future Research", Journal of Innovation Economics & Management, Vol 2, No. 17, pp 13-26.
Nahapiet, J and Sumantra G. (1998) "Social capital, intellectual capital and the organizational", Academy of Management Review, Vol 23, No. 2, pp 242-266.
Orlitzky, M., Rynes, S. and Schmidt, F. (2003) "Corporate Social and Financial Performance. A meta-analysis", Organization studies, Vol 24, No. 3, pp 403-441.
Rastogi, P. (2003) "The nature and role of IC: Rethinking the process of value creation and sustained enterprise growth", Journal of Intellectual Capital, Vol 4, No. 2, pp 187-194.
Sveiby, K. (1990) Knowledge Management, Estocolmo.
Wiig, K. (1997) "Knowledge Management: An Introduction and Perspective", Journal of Knowledge Management, , Vol 1, No. 1, pp 6-14.
Zyngier, S. and Burstein, F. (2012) "Knowledge management governance: the road to continuous benefits realization", J Inf Technol Vol 27, No. 2, pp 140–155.

Collaborative Practical Wisdom. Challenges and Opportunities in a Dynamic World

Marta – Christina Suciu[1, 2], Alexandru Stativă[1, 2], Ana – Maria Bocăneală[1, 2], Mircea Ovidiu Mitucă[1, 2] and Decebal Dumitrescu[1, 2]
[1]Bucharest University of Economic Studies, Romanian Academy - Group of Interdisciplinary Research, Academy of Romanian Scientists – Commission 9 for Law, Economics and Sociology, Bucharest, Romania
[2]Bucharest University of Economic Studies, Bucharest, Romania
Christina.suciu@economie.ase.ro
Alexstativa95@gmail.com
Anamaria.bocaneala@gmail.com
Mircea.mituca@gmail.com
Decebal.dumitrescu@gmail.com

Abstract: Change is the single constant of our world. We have to face challenging, dynamic and turbulent times. The complexity and dynamics of our world requires a paradigmatic holistic vision that needs collaboration. Collaborative economics focus on trust and team building, established based on a complementary set of core competences where creative, talented and gifted people are mostly valued. Online collaborative platforms and digitalization had been widely developed. We consider that, under the broader umbrella of cultural and creative economy, people have to focus more on non-traditional organizational structures that are better functioning on local and regional levels. Cultural and creative cities facilitate constructive dialogue and interactions, stimulating intercultural sensitivity applying practical wisdom such as to better interact and develop professional and personal networking. Collaborative economics focuses on proving people care more about other human beings and thus they develop new organizational structures based on compassion, empathy, emotional intelligence that ask for an important mentality shift from social networking (such as Facebook) based on sharing information, data and knowledge towards more spiritual oriented organizations within which practical wise, creative and innovative solutions that focus on wisdom have to be facilitated. In the last decades human civilization had shifted step by step from an information-based society towards knowledge, creative and innovation based one. It is high time to be wise and to shift to practical wisdom based on ethical, moral and spiritual values.

Keywords: Collaborative Practical Wisdom, Collaborative economics, Cultural and Creative Cities, Interdisciplinary approach

1. Introduction

The main goal of this paper is to share a new approach regarding how practical wisdom might be applied for leadership development, mostly in the case of cultural and creative communities and cities, based on the principles of practical wisdom and collaborative economics. The paper focus on a human-centred leadership who pursues: virtues of wisdom, collaboration, compassion, empathy, emotional intelligence, all stimulating gifted and talented people to be also wise and to prove concern about ethics and moral values. This paper is based on a step by step approach: *Firstly*, it seeks to highlight the role of virtues (in particular of *practical wisdom*) mostly in leadership studies. *Secondly*, it aims to illustrate how we may apply the virtue of practical wisdom in collaborative economics, with a special relevance fir local cultural and creative communities and cities. This paper looks also for extending the list of the key competencies required for a modern successful transformational and innovative leadership including the practical wisdom within this list. One key issue of practical wisdom (PW) is connected with the concept of knowledge management (KM), mostly with the human-centred and conversational leadership vision. We looked to identify how certain variables may influence practical wisdom within organizations and local cultural and creative communities such as to better highlight some of the potential benefits providing sustainable sources for competitive advantage (in terms of smart, sustainable and green development of circular, creative and innovative cities).

We included a brief conceptualization of the concept of wisdom, that we consider might be then applied to implement concretely the vision of human-centred leadership and practical wisdom within different organizations.

We had provided a broader approach of practical wisdom, including special references to responsibility and collaboration that relies on articulating values and establishing emotional connections to place and people/

communities such as to encourage collaborative actions towards a caring end. Practical wisdom applied within specific forms of collaborative economics, such as cultural and creative local communities explains the main drivers of a community oriented behaviour more open up for multidimensional pluralistic, diverse and interdisciplinary interpretations.

The paper is looking to better understand the roles of practical wisdom and human-centred leadership in the context of the creative-innovative and collaborative economics. Practical wisdom is like a prerequisite room for creativity, innovation and collaboration. The complex and diverse effects of the recent crisis might be successfully mitigated by leveraging *collective wisdom and the knowledge of the local communities* (mostly in the case of creative cities) focusing on *a collective human oriented leadership*. We strongly believe that the only way to get out of the complex snow ball interconnected crisis (affecting not only economics, but also the whole society in terms of moral values, education, health and not only) is to join hands for collaborations and collectively to find more and better creative and innovative solutions based on *practical wisdom human-centred people* for solving the issues plaguing humanity today more than ever.

2. Literature review

According to classical Greek philosophy "*The beginning of wisdom is the definition of terms"*. Thus we also start our research by defining the term of wisdom. *Wisdom* is an extremely complex concept. Its various conceptualizations are based on quite different definitions. *The Dictionary of Cambridge*, on its 2022 edition considers that wisdom is the ability to use knowledge and experience in order to take good decisions. Cambridge Dictionary highlights also that wisdom reflects the ability to undertake good judgments based on the knowledge, experience and different levels of understanding that provides this ability.

In a broader social context, wisdom is defined like a complex system able to allow an individual to listen to others, to evaluate what they say, and then to offer them good advice (University of Pennsylvania, 2022).

According to SAWS (*Self-Assessed Wisdom Scale*) there are five components of wisdom: openness, emotions, humor, critical life experience, reminiscence and reflectiveness. Wisdom is generally concerned with desirable and moral outcomes, universal values and the common good. Usually the so called *wise people* recognize that their knowledge, judgment and advice and that arising from others is influenced by personal and subjective relative values. Wisdom requires a multidimensional quality approach (figure 1).



Figure 1. A multidimensional quality approach of wisdom

Source: McKenna, Bernard, Ali Intezari, The Nature of Wisdom in Post-graduate students: An Implicit Theory, Conference paper, 2016

Practical Wisdom had also been studied by Paul Baltes and his colleagues at *the Max Planck Institute for Human Development* in Berlin and by Robert Sternberg and his team at *the Yale University*. According to their theory, *a wise person* seems to know what is mostly important in life and how someone can get it. Wise people hold the ability to the extent that they use their intelligence in order to seek a common good. Professor of psychology, Robert J. Sternberg defines wisdom as the capability to properly use intelligence, creativity, common sense, and knowledge (mediated by a coherent set of positive ethical values) in order to achieve the so-called common good. Common good requires a harmonization between intrapersonal, interpersonal, and extra personal interests, such as to achieve a balance among adaptation to environments, shaping of environments, and selection of new environments. Intrapersonal dimension only touch the individual (Sternberg, 1998) and it may include the desire for self-actualization, prestige, popularity, status, strength, prosperity or self-pleasure.

Interpersonal interests implicate also other people, since they are related to the relationships with others. *Extra personal interests* are those that affect an organization, a local community or, correspondingly a whole country. "*A large part of wisdom is in finding a truly common good and in persuading others of its suitability."* (Sternberg, 2003, p.9). Common good is closely linked to the collaborative economy. One of the most important principles of the collaborative economy is the sharing of goods and services for the common good of the community.

3. Building harmony based on collaboration in diverse types of societies: insights from practical wisdom

Practical wisdom is arising from an integration of knowledge and skills through awareness, and has to promote peaceful coexistence in diverse types of societies and local regional communities (Sternberg, 2003).

Practical wisdom is a dynamic and key influencing factor in human relations considered to be critical for building and developing social harmony. It involves many dimensions such as: learning how to learn, how to cope and how to be and how to live and behave by interacting with others. Wisdom enables individuals to reliably take good decisions in order to live virtuously and peacefully.

Practical wisdom leads people to use to act in ways that adequately express their religious and ethical commitments. People become wise by developing practical knowledge, by cognitively managing knowledge while being aware of its limitations (Ekmekçi et al., 2014).

When some leaders fail in the pursuit of their duties, it is more likely to be for lack of wisdom than for lack of analytical intelligence. In particular, leaders who experienced failing use to manifest an unrealistic optimism, many times accompanied by egocentrism (even narcissism), false omniscience, false omnipotence, false invulnerability, and ethical disengagement in their thinking and decision making. In other words, they fail not for a lack of conventional intelligence, but rather for a lack of wisdom.

Thus, there may arise more episodes of instability in human relationship, based on misunderstanding of the principles of practical wisdom. These unbalances generate many and different types of dissatisfaction among individuals and social groups. Wise "leaders" exercise their judgment by proving they are open to dialogue and to understand the different points of views and emotions of others, collected through everyday verbal and non-verbal communication, with an emphasis on identifying with others (Nonaka et al., 2014).

To be wise means to be able to manage and to handle in a wise way a situation that is confusing or that is uncertain in ways that allow us to make some kind of judgment, not only about the nature of the experience, but also about how to properly respond to the situation in question. In traditional management sciences but mostly within modern approaches such as *Knowledge Management (KM)* it is very important to judge situations in a variety of ways such as to provide everyone opportunities to manifest and to demonstrate their value. Wise people will not only feel emotions, but will also identify the source of them and then prove to be able to use the power of emotion in order to address injustice with passion and commitment such as to bring greater good to the whole community. Wise people respect others and are willing to apply the spirit of team, partnership and collaboration, being able to shift from sharing to carrying and to action respecting the interests of the whole community, mostly in the case of cultural and creative communities.

4. Connections between Knowledge Management (KM) and wisdom

Starting from the broader definition of wisdom, in terms of desire, active effort and ability to discover and achieve what is mostly valued in life, both for oneself and for others (which brings about flourishing in you as a human being), modern approaches of the Management sciences such as Knowledge Management (KM) involve also the "*Wisdom*" of knowing and understanding, resulting in achieving what is valuable, the ability to see what is valuable, to keep what is valuable, and to experience the capability to reach more value added.

It seems that in actual managerial practices wisdom is one of the least understood issues even we consider it is perhaps one of its mostly important dimensions.

Wisdom offers the potential for a more open and balanced form of leadership; through a cultivated predisposition to act in the best interests of greater good (Nonaka et al., 2014). In traditional managerial practices, being able to prove a good rational judgment, taking good decisions and acting well does not happen automatically. Wisdom is the quality that models action in ways that can bring about good judgment, good decisions and good actions based on more than rationality defined in a traditional sense (Rooney et al., 2010). *Boundary rationality* and modern visions that arise from more complex interdisciplinary approaches such as those from neurosciences asks for more than managing information, data and knowledge. Even though we live in a knowledge-based global economy, having certain knowledge is not enough to work more effectively and efficiently reaching good results in traditional sense. We consider that focusing just on knowledge without wisdom might be a danger to humanity. The recent COVID-19 pandemic global crisis proves this. People had the knowledge to generate different pandemic in laboratories and even to look for different vaccinations alternatives next. Is this really wise? From our team of co-authors point of view no!

Wisdom management (WM) calls for a blend of rationality, judgment, compassion, ethics, imagination and intuition concretely applied in management and mostly human oriented leadership practices. Wisdom can be seen as a strategic key tool necessary for taking complex decisions, applying knowledge and creative-innovative solutions such as to result in actions based on ethics, compassion and collaboration.

Wisdom means the ability to combine knowledge gained from experience and information with an understanding of the relevant issues, acquired through careful listening and deep thought, to find creative-innovative solutions or answers to a problem or life situation (Rowley & Slack, 2009).

Knowledge is a valuable asset that can be leveraged when managed and shared within organizations. On one hand, knowledge management allows organizational actors to learn important lessons from experiences. In particular, learning from experiences helps organizations save money and time through avoiding repeating mistakes and repeating successes. On the other hand, since a large amount of organizational knowledge is undocumented, organizations may lose valuable knowledge because of employees' mobility. Finally, there is a growing call to manage customer knowledge which is an important part of organizational knowledge that helps organizations understand their customers and better satisfy their needs. Therefore, organizations should manage knowledge through collecting it, storing it, and making it accessible to all organizational actors whenever they need it and wherever they are. (Zouari & Dakhli, 2018)

Knowledge is considered a valuable resource, which provides meaning to most enterprises' and different organizations' operations. When experts evaluate the value of the market of a public enterprise, it is considered that usually five to ten times knowledge and intangible assets such as intellectual capital are contributing more than the traditional business assets within the balance sheet.

Knowledge Management (KM) might be easier used to create a more practical methodology for educations programs, mostly on the Master level. Education is purposed to create learning; however, it does not indicate the manner in which learning operates. Knowledge management is useful in creating alternative education schemes by providing similar learning opportunities to users. (Schaefer & Makatsaria, 2021)

Ackoff offered an interesting benchmarking where at the top of hierarchy is wisdom, followed by understanding, knowledge, information, and data. Furthermore, he estimated that "*on average about forty percent of the human mind consists of data, thirty percent information, twenty percent knowledge, ten percent understanding, and virtually no wisdom*" (Ackoff, 1989)

Wisdom might be also operationalized based on the integration of cognitive, reflective, and compassionate personality characteristics (Ardelt, 2003). *The cognitive dimension* describes a wise person's desire to know a deeper truth and the ability to thoroughly understand the intrapersonal and interpersonal aspects of life (including an understanding and acceptance of the limits of knowledge, the positive and negative aspects of human nature, and life's unpredictability and uncertainties). *The reflective dimension* refers to a wise person's ability to perceive phenomena and events from multiple perspectives and to avoid subjectivity, which requires self-examination, self-awareness, and self-insight and a reduction in self-centeredness. Diminished self-centeredness, in turn, is likely to result in greater understanding of life in general and other people in particular, leading to greater tolerance and sympathetic and compassionate love for others, which represents the compassionate dimension of wisdom. Although wisdom is defined as the integration of the three dimensions, greater insight into the overall association between age and wisdom might be gained by analyzing the relation between age and the three dimensions separately.

Wisdom, like knowledge, can be conceived not only in personal terms, but also in institutional or social terms: to help us develop wiser ways of living, for example the practice of collaborative economics, to learn wiser social habits and relationships.

We live in an economy defined by diverse terminology such as knowledge-based or even cultural and creative economy.

We consider the recent complex crisis and challenges (such as COVID-19 global pandemic or climate changes) prove humankind is on a turning point and wisdom would have to become a first priority from our point of view. It's high time to be wise ! *Wise–based society* have to look mostly into the future, observing the impact of our actions on the future, on the environment, on other people and finally on humanity as a whole. Applied to Economics, *practical wisdom* involves applying ethical principles, so that the focus is on social, human values, innovations looking also on their consequences, good or not so good. We consider that, in order to shift from a knowledge-based to *a wisdom-based economy and society* we need wise people and mostly wise and human-oriented leaders. Knowledge management (KM) is about achieving more based on rationality, while *wisdom management (WM)* is about connecting mind, heart and intuition. (Jakubik &Muursepp, 2021). Boston College (Boston College, 2022) performed a cross disciplinary research on four countries belonging to four different cultural backgrounds by applying the modern vision of *the three H (Head-Heart-Hands*).

Information and knowledge are the sources of social practices, managerial actions and practices of individuals as members of communities, specific to an information and knowledge-based society. Wisdom is the guiding principle of human practices and human-oriented leadership, specific to *a wise based society*. KM is about achieving success based on our intellectual capacity, WM is about maintaining harmony and sustainability not only based on rationality, but also taking into account emotions, values, inspirations. (Jakubik & Muursepp, 2021). Flourishing towards wisdom involves looking at people by taking into account also their hearts and souls as those who are able to learn from their mistakes and to correct them one by one, without expecting just efficiency and effectiveness such as in traditional economics profit maximizing models. WM involves the accumulation of knowledge, experience and expertise about how relationships between people are formed and developed based on how we all interact such as to ensure the Common Good and sustainability of human civilization.

5. Time to be wise! Wisdom of local cultural and creative cities as an example of applying practical wisdom

Since the international data basis are not yet including many of the complex dimensions of wisdom (that are not so easy to be estimated and measured) we decided to present just some issues highlighting the issue of cultural and creative communities that requires to realize how important is to be wise also on the local communities level. Some authors belonging to the traditional schools of *Management* and *Economics* tend to consider that, if one concept or vision cannot be measured and quantified precisely yet, it means either it does not exist in reality, either it does not have any relevant importance. Similar, even in other context, to what young generations, mostly the digital one, believe about people that do not yet have yet a Facebook account.

Research on wisdom moves more on the territory and regional studies. Interdisciplinary research on wisdom invites entering the in-between of groups and communities, their local cultures, organizations, institutions, regional realities and societies, natural environment and ecologies.

In order to express how we might apply practical wisdom on the local communities level we took into account *the complex cultural and creative cities performances evaluated by the City Monitor 2019.* Practical wisdom comes in sensitivity to how we relate to what is right or wrong, good or bad (Nonaka et al., 2014). Of course, this aspect will be the subject of many cross disciplinary further research and studies. The complexity of our lives requires more collaboration, and to achieve collaboration people need to have a set of wisdom principles. The Creative and Collaborative Economy, with its core principle of practical wisdom, can be a means of facilitating constructive interactions, cross-cultural awareness and dialogue between people. Practical wisdom helps people, mostly on the local communities level, to become more sensitive to the importance of collaboration (from sharing to caring) (European Cooperation in Science and technology, 2021). The social nature of online collaborative communities provides a framework for collaborative learning. Social networking platforms might better support collaborative structures on the local cultural and creative cities level.

Collaborative learning is a valuable approach to improve knowledge co-generation, helping crowd members to confront situations, where participants express ideas, voice opinions, and share experiences. People need to demonstrate that they care more about others, that they have the wisdom to build, maintain and develop relationships. Another important point to mention is that in the collaborative economy it is absolutely necessary to have a human-centered leader who, with practical wisdom, manages to perform.

Practical wisdom improves managerial reasoning, decision-making and concomitant action (Jakubik & Muursepp, 2021). A considerable level of wisdom may be necessary for a leader to engage in transformational leadership. Collaborative or shared leadership has frequently been advocated as an alternative to vertical or top-down leadership. These people appreciate that they don't have all the answers and, as a result, actively seek input from others as a means of overcoming their individual limitations.

Simply put, they show acceptance, but also determination: acceptance of personal strengths and limitations, along with a willingness to ask for and use the help of others. (*Bringing humility to leadership: Antecedents and consequences of leader Humility*). The authors of the article "*Wisdom and narcissism as predictors of transformational leadership"* mention that the wise people have extraordinary insight, knowledge and skills regarding the meaning and lead of life and are able to judge and advise on difficult and ambiguous issues of life (Greaves et al., 2014). Practical wisdom requires an awareness of the true means and purposes of human activity that guides leaders to make better decisions based on a better understanding of their values, priorities and goals. Wise people consider different life roles (e.g. family and work) when motivating their followers and giving advice. These qualities should help them act as positive, creative and transformational models for others. We consider that mostly in the case of cultural and creative cities to build social harmony based on compassion, respect, appreciation, trust is an important goal, because of the contemporary challenges such as climate changes, different conflicts, complex crisis. The wise view of reality helps individuals to react wisely in any situation by integrating cognitive, reflective and affective personality traits engaged in strategic awareness through the wise adoption of technology (Huda et al., 2020).

Based on a cross-disciplinary and interdisciplinary conceptualization of practical wisdom, we should make distinctions between data, information, knowledge, and wisdom-based decision making (Küpers & Pauleen, 2013). While data, analytics, information and knowledge can assist decision-makers to better deal with complex and wicked problems, one may argue that data-based systems cannot replace optimized human decision-making capabilities. These capabilities include a range of qualities and characteristics inherent in philosophical, psychological and organizational conceptions of practical wisdom (Kramer & Crespy, 2011). *Practical wisdom* allows for a better equipped and more experiential and reflexive journey and fosters the art of mindful travelling, beyond a reactive, moralizing behaviour.

One reasonable approach is to accept that a deliberative and political conception of practical wisdom in organizations and local communities, with a focus on cultural and creative cities might be seen as part of an all-embracing responsibility. This then in turn calls for a proactive concept of societal involvement embedded in democratic mechanisms of a conversational leadership, communicative discourse, governance transparency and accountability. Furthermore, practical wisdom calls for reinventing or reforming civic institutions like

enterprises, universities, think tanks, research labs and so on, in ways in which these can develop and make informed and inclusive decisions, leading to deliberative action.

People with practical wisdom have the moral will to do the right thing and the moral skill to figure out what the right thing is in any particular situation, although they may be well intentioned rules and incentives that might actually erode wisdom (Schwartz, 2011).

Excessive reliance on rationality and rules deprives people of the opportunity to develop moral skill, and excessive reliance on incentives undermines moral will. Rules and incentives demoralize activities and the people who engage in them. Wisdom is an indicator of personality growth and development, which requires openness to experiences and a questioning attitude toward societal norms rather than conforming and adjusting to the prevailing societal standards. Therefore, a higher level of education facilitates personality growth and development, while a lower education encourages personality adjustment, particularly through work requirements. Hence, a positive association between age and wisdom might be more likely among highly educated individuals than among individuals with a lower education. Yet, those differences and especially nonlinear differences by educational attainment might not be visible in small samples with participants from diverse educational backgrounds (Pridgen, Ardelt, & Nutter-Pridgen, 2018)

6. Methodology

In relation to the main goal of the paper, the authors called for *a multilevel approach.* First of all, it was necessary to identify within the specialised literature the main significant works on the subject. Moreover, the authors applied a non-parametric Spearman correlation in order to identify the most relevant connection between the three dimensions of *the Cultural and Creative Cities Index (C3)* as an example of best practice for applying practical wisdom and wisdom management principles.

6.1 Main Data basis used

In 2019, the second edition of *the Cultural and Creative Cities Monitor* was launched.

The Cultural and Creative Cities Index (C3) is a composite aggregate index that measures cultural and creative performance within 190 cities from 30 European countries.

The quantitative information includes *29 indicators*, relevant for *9 dimensions* that been structured on *three main components,* connected with practical wisdom, namely: *cultural vibration; creative economy* and *favourable environment*. Table 1 illustrates the three components of *the Cultural and Creative Cities Index (C3).*

Table 1: Cultural and Creative Cities Index (C3) components

C3 Index – Cultural and Creative Cities Index								
1. Cultural Vibrancy		**2. Creative Economy**			**3. Enabling Environment**			
D1.1 Cultural Venues & Facilities	D1.2 Cultural Participation & Attractiveness	D2.1 Creative & Knowledge-based Jobs	D2.2 Intellectual Property & Innovation	D2.3 New Jobs in Creative Sectors	D3.1 Human Capital & Education	D3.2 Openness, Tolerance & Trust	D3.3 Local & International Connections	D3.4 Quality of Governance

Source: designed by authors based on the information from the "*Cultural and Creative Cities Monitor", 2019*

The structure of C3 and its three dimensions includes key variables we consider to be relevant for practical wisdom and wisdom management and wisdom decision making. The 190 selected cities were divided into clusters, regarding the number of their inhabitants (table 2).

Table 2: Classification of cities according to the number of inhabitants

Cluster name	Population (inhabitants)
Cluster S	50 000 – 100 000
Cluster M	100 000 – 250 000
Cluster L	250 000 – 500 000
Cluster XL	500 000 – 1 000 000
Cluster XXL	> 1 000 000

Source: designed by authors based on the information from the "*Cultural and Creative Cities Monitor*", 2019

We consider that C3 index is a useful tool for decision makers interested to apply *practical wisdom* principles helping them to design, apply and monitor different cultural strategies and policies (Montalto et. Al., 2019). In order to identify the importance of creative economy within the aggregate C3 *index* we applied *a non – parametric correlation Spearman index* that transforms the original values into ranks using the following formula.

$$\rho = 1 - \frac{6 \times \sum d^2}{n(n^2 - 1)}$$

Where:
d - represents the difference between the ranks of the values measured in a subject
n – represents the number of subjects taken into account.

The Spearman correlation coefficient is a correlation coefficient, which might take values between ***-1*** (which means the existence of a negative connection) and **+1** (which indicates the existence of a positive one).

7. Main results and discussions

There had been identified five clusters based on C3. For this paper we analysed the cities included within *the XXL cluster* (with over 1,000,000 inhabitants). There are included 20 cities most of them European capitals (figure 2).

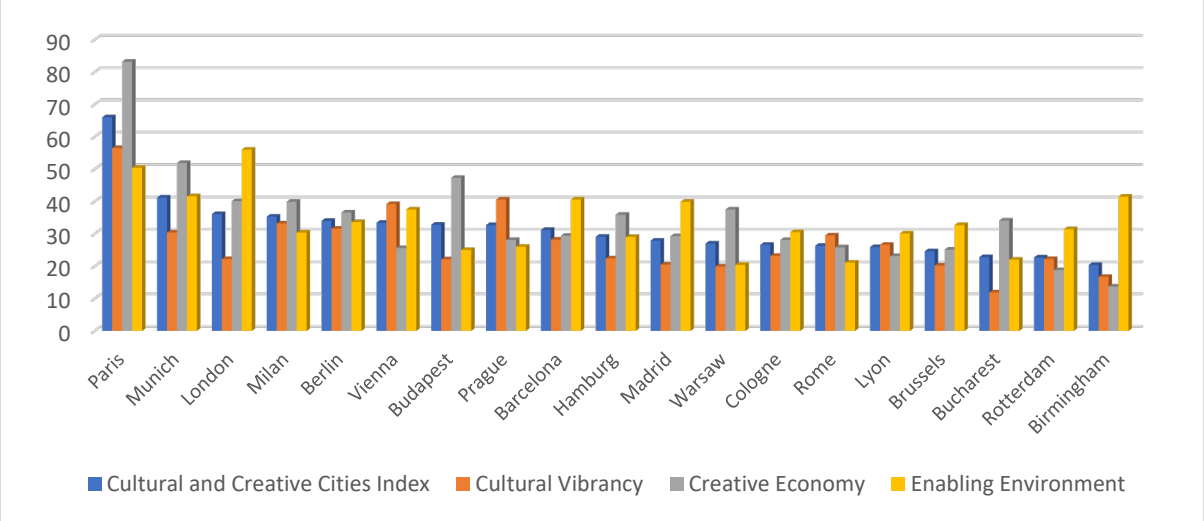


Figure 2: Cities included within the XXL cluster

Source: Designed by authors based on the data from "Cultural and Creative Cities Monitor", 2019

The first dimension is ***the cultural vibration*** measures the cultural intensity of a city in terms of participation in culture and cultural infrastructure.

The second dimension is ***the creative economy*** analyses the contribution of cultural and creative sectors to the city's economy.

The third dimension is ***the environment*** analyses the tangible and intangible elements that contribute to attract creative class, talented people.

The top three cities in XXL cluster are: *Paris* (C3-66), *Munich* (C3-41), and *London* (C3-36). On the bottoming part of C3 are: *Sofia* (C3-20), *Birmingham* (C3-20) and *Rotterdam* (C3 -23). C3 index and its components are important for designing public and local policies. Based on the results highlighted by C3, decision makers benefit on additional tools to design strategies and local policies and to take different actions and to monitor their progress (table 3).

Table 3: The benchmarking of cities included within the XXL cluster, depending on C3 and it's dimensions

No.	City	C3 index ranking	Cultural Vibration Ranking	Creative Economy ranking	Enabling Environment ranking
1	Paris	1	1	1	2
2	Munich	2	6	2	3
3	London	3	5	4	1
4	Milano	4	4	5	12
5	Berlin	5	5	7	8
6	Vienna	6	3	16	7
7	Budapest	7	14	3	16
8	Prague	8	2	13,5	15
9	Barcelona	9	8	11	5
10	Hamburg	10	11	8,5	14
11	Madrid	11	15	12	6
12	Warsaw	12	17	6	19
13	Köln	13	10	13,5	11
14	Roma	14	7	15	18
15	Lyon	15	9	18	13
16	Brussels	16	16	17	9
17	Bucharest	17	19	10	17
18	Rotterdam	18	12	19	10
19	Birmingham	19	18	20	4
20	Sofia	20	20	8,5	20

Source: Designed by authors based on the data from the "*Cultural and Creative Cities Monitor*", 2019

According to data included within table 3, Paris ranks first in the city benchmarking from the XXL cluster. For Romania Bucharest ranks on the 17th position within the XXL cluster, with a value of 22.8 of the C3 index. Corresponding to *the "cultural vibrancy" dimension*, Bucharest ranks on the 19th position and, according to the sub-indicators "*cultural places & facilities*" it occupies the 20th position. Regarding the "*cultural participation & attractiveness*", Bucharest occupies the 19th position. With respect to *the "creative economy" dimension*, Bucharest occupies position 10, and for the component sub-indicators, *"creative & knowledge-based jobs*" occupy position 16. For *"intellectual property & innovation"* Bucharest occupies position 19, and for *"new jobs in the creative sectors"* it occupies position 4. Within in the *"enabling environment" dimension*, Bucharest ranks on the 17th position. According to "*human capital & education*" Bucharest ranks on the 18th position. With respect to *"openness, tolerance and trust*" Bucharest ranks on the 10th position. Regarding the *"local & international connections*" Bucharest ranks on the 20th position. With respect to *the "quality of government*", the city ranks on the 19th position.

In order to analyse the connection between the aggregate index C3 and its second dimension (creative economy sub-index) authors applied Spearman correlation index obtaining a value of 0.70 that illustrates a strong connection between the C3 aggregate index and the creative economy. The value obtained is statistically significant being higher than the significance threshold of 10% (0.380), the significance threshold of 5% (0.447), the significance threshold of 2% (0.520) and the significance threshold of 1% (0.570). According to the value obtained and the fact that this value is statistically representative, the authors manage to highlight that creative economy has a strong influence on the C3 aggregate index (figure 3).

As illustrated in figure 3 this strong connection highlights the importance of creative economy and implicitly of applying practical wisdom on creative cities level for the local socio-cultural and economic development, at least in the case of the cities included within XXL cluster.

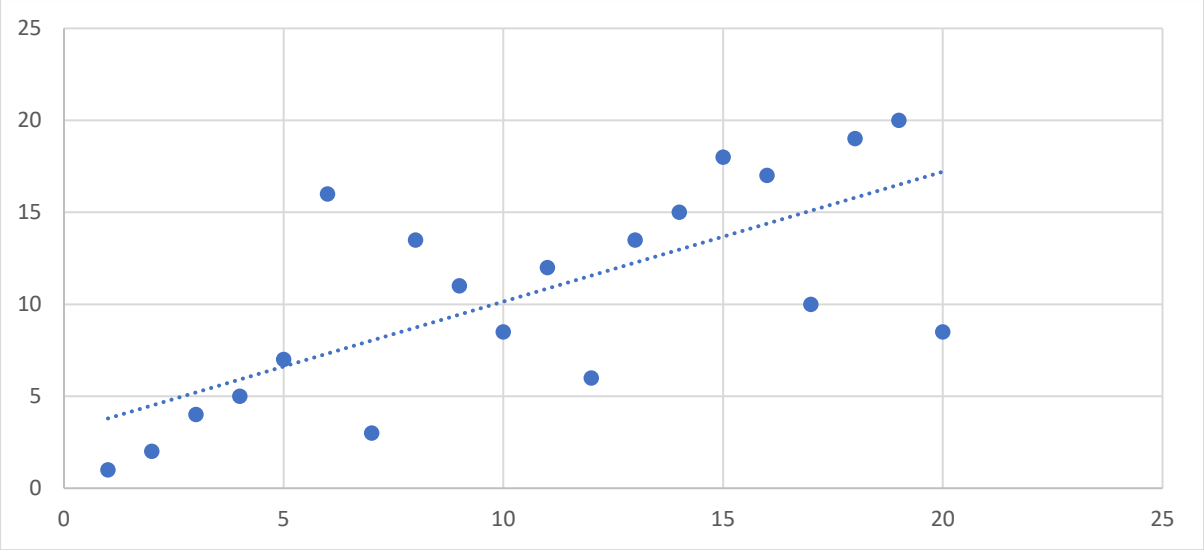


Figure 3: The relationship between the C3 aggregate index and the "*creative economy*" dimension

Source: Designed by authors based on the data from "Cultural and Creative Cities Monitor", 2019

8. Main Conclusions

For a genuine transformation towards practical wisdom in organization and leadership to take place, a radical re-orientation of meanings, values and practices have to occur at the micro, mezzo and macroeconomics levels.

Theoretical developments of wisdom research continue to emerge and empirical studies are required and request a wider variety of wisdom. We consider further research has to focus more into practical wisdom that needs to be further developed and empirically studied in order not only for offering a more comprehensive understanding but also to be applied in practice (Schwartz, 2011)

The world is constantly evolving. In the last decades the role of creative and cultural economy for local development is essential (ADAGP. 2021).

Cultural and creative cities are making the difference for local development as highlighted within our paper by the high value of the Spearman coefficient. This paper suggests also the importance of applying practical wisdom in the cases of the local decision makers.

The main limitation of our research is that the data are from 2019. We did not manage to identify recent data, which could capture the evolution of cities during the last years connected also with multi dimensions crisis due to global COVID pandemic 19.

Our team intends to continue this research by extending the research to all the clusters and correspondingly to its connection with the other two dimensions, namely: the cultural vibration and the favourable environment, as parts of the C3 index.

References

ADAGP. 2021. "EY Study: Rebuilding Europe through Culture." January 26, 2021. https:// www.adagp.fr/en/actuality/ey-studyrebuilding-europe-through-culture

Ardelt, M., Pridgen, S., Nutter-Pridgen, K. L., (2018), *The Relation Between Age and Three-Dimensional Wisdom: Variations by Wisdom Dimensions and Education*, Journals of Gerontology: Psychological Sciences, J Gerontol B Psychol Sci Soc Sci, 2018, Vol. 73, No. 8, 1339–1349

Boston Consulting Group. (2021). *Human-oriented leaders are the future of leadership.* Retrieved from https://web-assets.bcg.com/b4/67/551c4d9340a78a15ad08db02cf15/bcg-humancenteredleadersarethefutureofleadership-20210204-vf.pdf

European Cooperation in Science and technology, (2021), COST Action CA16121, From Sharing to Caring: Examining Socio-Technical Aspects of the Collaborative Economy. - https://sharingandcaring.eu/about-sharing-and-caring

Ekmekçi, A. K., Teraman, S. B. S., Acar, P., (2014), *Wisdom and management: a conceptual study on wisdom management*, 10th International Strategic Management Conference, Procedia - Social and Behavioral Sciences 150 (2014) 1199 – 1204

Greaves, E., C., Zacher, H., McKenna, B. and Rooney, D. (2014), "Wisdom and narcissism as predictors of transformational leadership", Leadership & Organization Development Journal, Vol. 35 No. 4, pp. 335-358. https://doi.org/10.1108/LODJ-07-2012-0092

Huda, M., Nor Muhamad, N.H., Isyanto, P., Muhamat, R., Marni, N., Ahmad Kilani, M. and Safar, J. (2020), "Building harmony in diverse society: insights from practical wisdom", International Journal of Ethics and Systems, Vol. 36 No. 2, pp. 149-165.

Kramer, M., & Crespy, D. (2011). Communicating collaborative leadership. The Leadership Quarterly, 1024-1037.

Küpers, W., & Pauleen, D. (2013). A Handbook of Practical Wisdom - Leadership, Organization and Integral Business Practice.

McKenna, B., Ali Intezari, The Nature of Wisdom in Post-graduate students: An Implicit Theory, Conference paper, 2016

Montalto, V.; Moura, CJT; Alberti, V.; Panella, F.; Saisana, M. *The Cultural and Creative Cities Monitor* , ed. 2019; Oficiul pentru Publicații al Uniunii Europene: Luxemburg, 2019.

Nonaka, I., Chia, R., Holt, R., Peltokorpi, V., (2014), Wisdom, management and Organization, Management Learning 2014, Vol. 45(4) 365–376

Rowley, J., Slack, F. (2009), Conceptions of wisdom, Journal of Information Science, 35 (1) , pp. 110–119, CILIP, DOI: 10.1177/0165551508092269

Schwartz, B. (2011). Practical wisdom and organizations. Research in Organizational Behavior, 3-23.

Sternberg, R.J. (1998) A balance theory of wisdom. Review of General Psychology, 2, 347-365.

Sternberg, R. J. (2003). Wisdom, intelligence, and creativity synthesized. New York: Cambridge University Press.

Sternberg, R. J., (2003), Wisdom and education, Gifted Education Intemational, Vol 17, pp 233-248

University of Pennsylvania, [online] https://www.authentichappiness.sas.upenn.edu/newsletters/authentichappinesscoaching/wisdom

Sustainable Competitive Advantage through Embedding Intellectual Capital in the Business Plan and Strategy

Slavica Trajkovska[1], Angelina Taneva-Veshoska[1], Srecko Trajkovski[2] and Vlatko Ivanov[2]
[1]Institute for Research in Environment, Civil Engineering and Energy, N. Macedonia
[2]Civil Engineering Institute MACEDONIA, JSC Skopje, N. Macedonia
slavica.trajkovska@iege.edu.mk
angelina@iege.edu.mk
srecko.trajkovski@gim.mk
vlatko.ivanov@gim.mk

Abstract: Purpose: The purpose of this paper is to present a comprehensive model of embedding intellectual capital in the business plan and strategy. The model aims to increase the sustainable performance of companies and ensure their competitive advantage, suggesting a methodology for managing intellectual capital. A case study of a Macedonian company, where the model is piloted, is presented. Design/methodology/approach: Qualitative research in a form of interviews among managers and a case study of a Macedonian company was used to obtain data about the effects of the piloted model. The transformational process from a traditional to a learning organization started in 2014, with measurement intellectual capital, followed in the next years with measures and activities for managing intellectual capital and integrating it with the business strategy and plan. Findings: The findings confirmed the positive effects of intellectual capital on the company's performance. In the period of 2014-2022 a number of strategic decisions, innovative actions and structural measures have been developed and implemented. For each capital (human, organisational, structural, relational, process and innovation) activities and indicators were specially designed matching the strategic goals, the organisational structure and the available resources. Research limitations/implications: This comprehensive model of embedding intellectual capital in the business strategy for sustainable competitive advantage explored in this paper is piloted for the first time. More examples and studies like this are needed to follow the effects in different companies. Our recommendation is to replicate the research and compare the analyses with different companies, preferably in other countries as well. Practical implications: This study is expected to increase the motivation of other companies to manage intellectual capital and increase their business sustainability and competitive advantage. Originality/value: The presented model has double value – contributing to research and practice in the field of intellectual capital and sustainability management.

Keywords: Sustainable Management, Intellectual Capital, Competitive Advantage, Organisational Development, Business Strategy

1. Introduction

In recent years, the concept of sustainable development has been increasingly addressed by the business sector (Hahn and Scheermesser, 2006).

In the current business environment, more and more organisations see the need to look beyond the traditional concerns of running a business for immediate profit and to begin to deal with factors in the greater world that impinge on their medium to long-term success (Fairfield et al., 2011). Companies must change their strategy from a workforce-based business to a knowledge-based business. The reason for this is the recognition that knowledge is essential component of the business and seen as sustainable strategic resource to gain and maintain a competitive advantage (Muslih et al., 2021). Nowadays, it is widely recognised that organisations need to act in a socially responsible way in order to contribute to the social well-being and competitiveness as well as the financial success of the firm (Moneva and Ortas, 2010).

One of the most used criteria to evaluate the successful functioning of an organisation is its effectiveness. Effectiveness, which involves doing the right things, at the right time, with the right quality etc., can be defined as the ratio between actual output and expected output (Sink, et al., 1989).

Efficiency, however, refers to productivity ratio and reflects how well the resources are utilised to accomplish the result (Sumanth, 1994). Organisational effectiveness is discussed by Zheng et al, (2010) in combination with strategy and knowledge management (KM), where they use the definition the degree to which an organisation realizes its goals. 'Performance' is the umbrella term of excellence and includes profitability and productivity as well as other non-cost factors such as quality, speed, delivery and flexibility (Tangen, 2005).

The concept of organisational performance in literature refers normally to financial aspects such as profit, return on assets, return on equity, and economic value added (Kaplan, 1983). While financial measures of performance are among the most widely used by businesses, many researchers have criticized the short-term thinking and emphasize the importance of the non-financial components of performance measurement (Otley, 1999). Consequently, as a response to a relatively narrow point of view of performance measuring, a more balanced approaches of performance measurement systems to include financial and non-financial performance measures, as well as explaining cause-and-effect relationships between the various measures, and providing better insight in terms of links between performance measurement systems and organisation's strategy have been proposed (Neely and Adams, 2000).

Sustainability-oriented performance and the competitive advantage of an organisation is gained when an organisation has human resources that cannot be imitated or replaced by its market rivals. In order to survive and fight for competitive advantage, every organisation needs to use methods that are different from those of their competition; therefore, any organisation should find rare resources that are impossible to imitate, copy, or replace. McElroy (2006) states that organisations that strive to be sustainable need two things: knowledge of its impacts on the world and the capacity to learn and innovate.

The global transformation of the economy, driven by digital transformation and sustainability challenges, is placing its focus on the evaluation of companies' intangible assets. Thus, if the report of those intangible assets, namely intellectual capital (IC) management, is endowed with credible metrics, recognised, and accepted, it can work as a guarantee, ensuring the reliability and sustainability of an organisation (Matos et al., 2011). Organisations are positioning to incorporate different performance measures integrating them in their organisational goals and strategy. This also implies a change in their business models and management systems. Nowadays, the trend is toward holistic sustainability management systems, methods and tools.

2. Literature review

2.1 Knowledge Management and Intellectual Capital in Companies

Hadders (2017) argues that knowledge is among the key elements in making a business perform in a more sustainable way. To perform sustainably, organisations need the knowledge "how" to pursue this desire. Therefore, it is necessary to develop and implement knowledge management systems and sustainable business models. According to the knowledge-based view (Grant, 1996), the knowledge located in various places within the firms, such as employees, organisational culture, routines, policies, systems, and documents (Alegre et al., 2013), is the main asset used to reach and sustain competitive advantages, since it is unique and hard to replicate and replace. Consequently, the enterprise must implement knowledge management practices able to value and develop the knowledge resource (Beijerse, 2000; Donate and Pablo, 2015). This makes it easier to understand how to manage people and processes, how to achieve growth and competitive processes, and how to organise new products and technologies (West and Noel, 2009; Cardoni et al., 2020).

Intellectual capital and knowledge management are the basic building blocks (cornerstones) of an effective 21st-century management model. The ability of an organization to effectively nurture, capture, leverage, and share its knowledge resources become the key that provides an enterprise with its strategic power advantage in the world. When an organsation develops its ability to build, access and leverage its knowledge resources it is creating its knowledge advantage. In an era of knowledge economics, KM and IC have emerged as major issues that managers must deal with, if the organizations want maintain their competitive advantage (Cabrita, Cruz-Machado and Matos, 2015). With proper management of intellectual property and knowledge, companies will be able to act intelligently, achieving sustainable competitiveness. Designing and articulating a successful competitive strategy is a never-ending task. In this context, the IC management plays an important role in influencing the heterogeneity of companies and their sustainable competitive advantage. (Matos et al., 2020)

Knowledge management and intellectual capital are believed to influence each other, and the relationship between the two constructs is of vital importance to organisational effectiveness and efficiency (Seleim and Khalil, 2011). Intellectual capital is a major player and a foundation for sustainable competitiveness and efficiency. Human capital, structural capital, and relational capital can all be explored in the light of sustainability (Januškaitė and Užienė, 2018).

More than a half-century ago, Penrose (1959) argued that knowledge could be used to explain firm's performance and growth. The role of knowledge (as compared with natural resources, physical capital and low skill labour has taken on greater importance in knowledge-based economies (Taneva-Veshoska et al., 2015). Investments in knowledge and innovation are very important for productivity growth. These investments lead to creating new knowledge, new technologies, new products and services, ensuring more jobs and contributing to increased welfare (Taneva-Veshoska et al., 2015). An effective and efficient use of the unique tangible and intangible assets within firms are important sources of competitive advantage (Peteraf, 1993; Doz, 1996). Knowledge management is a relatively young discipline that is considered an effective source for determining the strategic direction of and developing competitive advantages within a company (Gaviria-Marin et al., 2019).

The knowledge-based organisation paradigm emphasizes that the differences in firms' performances are attributed to differences in the rules of creating, developing, distributing, and using knowledge. Firms need to be able to adapt instantly and accurately by exploiting existing knowledge in order to enhance their competitive advantage (Anand and Walsh, 2020).

The transition from traditional management models towards sustainable management models that not simply measure certain business components, but incorporate knowledge will provide organisations with an adequate tool in the process towards sustainability.

Knowledge and intellectual capital are viewed as the most important source for achieving sustainable competitive advantages (Drucker, 1993; Benevene and Cortini, 2010). When knowledge management activities are used to develop and maintain intellectual capital, it becomes a resource of sustainable competitive advantage (Seleim and Khalil, 2007). On the other hand, when intellectual capital is properly utilized and exploited, it increases the absorptive capacity of the organisation, which, in turn, facilitates its knowledge management processes.

3. Methodology

In order to understand in more depth the topic "sustainable competitive advantage" and explore the opportunities companies have for embedding intellectual capital in the business plan and strategy, case study method was used.

Qualitative research in a form of interviews among managers and a case study of a Macedonian company was used to obtain data about the effects of the piloted model. The transformational process from a traditional to a learning organization started in 2014, with measurement intellectual capital, followed in the next years with measures and activities for managing intellectual capital and integrating it with the business strategy and plan. The research aimed to find answers whether there are positive effects of intellectual capital on the company's performance.

3.1 Embedding Intellectual Capital in the Business Plan and Strategy - Case Study of Macedonian Company

The initiatives for investments in knowledge, R&D&I, especially for the business sector barely exist. N. Macedonia spends only 0.22% of its GDP on R&D which is one of the lowest percentages in Europe (where the government is the biggest contributor to total R&D expenditures). One of the few private companies that invest in knowledge, R&D&I in N. Macedonia is the Civil Engineering Institute MACEDONIA JSC SKOPJE (CEIM).

CEIM is a private company established in 1975 in Skopje, N. Macedonia, active in the construction industry. CEIM offers services in all areas of construction: planning, research, design, quality control, surveillance and construction. CEIM operates on the market in N. Macedonia, and through its subsidiaries regionally in: Serbia, B&H, Albania, Montenegro and Kosovo.

In the last 8 years CEIM successfully transformed itself into a learning organisation, by setting up system for KM and IC. This is a very unique and rare case happening in N. Macedonia, a developing country and a modest innovator (European Innovation Scoreboard, 2020).

The CEIM strategy is designed with an orientation towards sustainable development and knowledge-based economy, improving the R&D activities and gain applied knowledge and competencies. The decision in 2014 to transform the company from a traditional organisation to a learning organisation, which learns and manages its knowledge and IC was initiated by the Supervisory Board of CEIM. The decision was based on the assessed needs

and life cycle stage, as well as the challenges of the environment (political and economic) and the vision for the future.

The need for implementing all the KM/IC activities were:

- more complex working conditions and aggravating factors and risks, both in the environment and in the constitution of the company
- the trend of encouraging development, research and innovation, as the main drivers of development in the modern global economy and the main strategic commitment of the European Union
- rapid technological development, rapid obsolescence of technologies and technological skills, the need for long-term planning to upgrade knowledge, which will have a longer use value
- competitiveness in the market, based on modern ways of corporate organization, planning, management, operations and marketing
- phase of the life cycle in which the company is - reaching full maturity, which imposes the need to pursue goals and directions that will continue the upward trend of development, and will avoid stagnation and decline
- the company's tendency to expand more intensively on foreign markets

The company's vision is supported by constantly upgraded knowledge and innovation, applied for continuous improvement of services and participation in modern trends in science, technology and economy. Such a vision implies the development of the company not only as an important business actor in the economy, especially in the construction sector in the country and the region, but also in the direction of: application of the latest knowledge and technological achievements in operation, in accordance with national and European trends for sustainable development, use of many years of experience and knowledge in the service of the progress of science, economy and society.

In the period of 2014-2022 a number of strategic decisions, innovative actions, structural measures, and organisational changes have been developed and implemented, based on the adopted strategies for investment and development of the IC in CEIM.

Several aspects were observed before starting to build an innovative model for transformation toward achieving sustainable performance and KM and IC:

- Stage of the life cycle - the need to continue the trend of an upward line of development, and prevent stagnation and decline;
- Complex operating conditions and risks;
- Rapid technological development; and
- Necessity for long-term planning, upgrading the knowledge and organisational memory.

In the process of building an innovative model for transformation and development of learning organisations towards sustainable performance, through KM and IC a large number of analyses were conducted to assess the current situation in CEIM, and then a series of measures and activities were developed and implemented in order to improve resources in each capital and successfully manage knowledge toward reaching the goal of becoming learning organisation.
A number of documents (strategies, rulebooks, manuals and guidelines) have been created and adopted, that serve as a basis and support for activities and support the transformation. All implemented activities are implemented in accordance with CEIM Strategies:

- Development strategy,
- Strategy for human resources management, and
- Strategy for KM.

The summary of the strategic goals of these documents are presented in Table 1.

Table 1: CEIM Strategic documents and their objectives

Development strategy	Strategy for human resources management	Strategy for knowledge management
Building sustainable brand, maintaining reputation in the business and social spheres	Improving employee motivation and introducing new motivational techniques	Detection (mapping) of knowledge in CEIM (basic level, advanced level, specific knowledge, research potential)
Maintaining a competitive advantage in the domestic market	Performance management	
Expanding the operations in markets in other countries	Development of managerial and leadership skills of the Company's management staff	Lack or need for certain knowledge (training plan and professional development
Improving financial performance	Improving organisational culture	
Advancing existing services	Hiring experienced staff, experts in a specific field	Sharing, creating and retaining knowledge
Development of new services	Continuous development of staff	Organisational memory
Strengthening the capacities and nurturing the HR	Identification of competencies for each job position	Managing external knowledge networks and infrastructure
Continuity in investments	Talent management and career planning	

The most relevant strategic document for KM and IC is the KM strategy. The goal of the KM strategy is to create long-term value for CEIM by focusing on knowledge and building the necessary capacity to maintain its competitive advantage in the country and the region. Furthermore, the strategy supports maintaining the features of a learning organisation, adapting to the needs and challenges in its environment.

Embeding intellectual capital in the business plan and strategy meant that for each capital (human, organisational, structural, relational, process and innovation) activities and indicators were specially designed matching the strategic goals, the organisational structure and the available resources. Examples for each strategic goal and its relation to different capitals and suitable indicators are presented in Table 2.

Table 2: Embeding intellectual capital in CEIM Strategy

Development strategy	**Activities**	**Capital**	**Indicators**
Building sustainable brand, maintaining reputation in the business and social spheres	-Measuring client satisfaction and loyalty -Nurturing good relations with stakeholders -Implementing sustainability principles -Positioning and promoting the company as attractive company for young and talented engineers	Relational Organisational	-Assessed satisfaction based on service, quality, collaboration, etc. -Number of meeting, frequency and type of communication, established collaboration -CSR plan and activities developed and implemented -Presentations for students, Number of internships, Promotion of career fairs, Collaboration with universities and professors, etc.
Maintaining a competitive advantage in the domestic market	-Assessment of the quality of services offered -Market analysis offering competitive prices -Offering complex project services hard to copy -Taking initiatives for changes in the laws or policies in the civil engineering sector	Process Relational Structural Innovation	-High standards for quality and project management -Digitalisation and centralised monitoring of project management -Database for costs and comparison with prices from other companies -Number of complex, long-term projects providing strategic consultancy services -Number of initiatives and proposals submitted -Memberships and networking in Chambers and Professional Associations
Expanding the operations in markets in other countries	-Market analysis, competitors, potential investments -Choice of most suitable forms	Relational	-Detailed analysis -List of competitors -List of potential partners

Development strategy	Activities	Capital	Indicators
	of promotion, networking, finding partners		-Analysis of planned investments -Plan of promotion -Number of events and new relations established
Improving financial performance	-Financial analysis of CEIM services -Analysis of projects based on their profitability, size, complexity, etc.	Financial	-Profitability of each service offered by the Departments -Ranking projects based on revenue and profitability
Advancing existing services	-Development of unique services -Continuous improvement of the current services with training programs -Transfer of knowledge and technology	Structural Human Innovation	-Number of improved services -Investments in training -Established partnerships with universities -Number of new research projects -Number of EU funded projects
Development of new services	-Implementation of Program for technological development -Enhancing the research potential of CEIM employees -Collaboration activities with academia	Innovation Human	-Number of joint research projects -Number of employees completing MSc and PhD studies -Number of EU funded projects for research and education -Number and quality of collaboration established with universities and research institutes
Strengthening the capacities and nurturing the HR	-Strategic management of knowledge -Training program -Career development of employees -Talent management program	Human Innovation Process	-Investments done in education -Employees progressing in their career -Effective implementation of mentorship program -Digitalisation of organisational memory -Employee engagement
Continuity in investments	-Investment program in research, education, infrastructure	Process Human Innovation	-Number of research projects funded by the company -Implemented training program and improved competencies

This table presents only selection of the developed activities and indicators, and related capital. Embeding the intellectual capital and its components was done in the business plan and strategy, having in mind the organisational structure and expected outputs form each work position.

Additionally, the developed system was reflected in the digitalisation system, currently in development which will integrate all the indicators and would support the management of knowledge and intellectual capital in the company. Monitoring the progress of managing knowledge and intellectual capital in CEIM and measuring effects and benefits from this transformation process will be done during this and next year continiously using several quantitative and qualitative methods. It is planned all the components of IC to be embedded in the business plan, and the indicators to be part of the action plan and the reports done annually. With this besides the financial reports the company will start creating and publishing a non-financial report on the performance of the company.

4. Conclusion

This case study serves as proof and inspiration for companies, providing evidence of the positive effects on sustainable performance from managing intellectual capital (IC) and knowledge. The research contributes to the field by offering new findings and proposing a new model for enhancing company's sustainability-oriented performance and innovation. The survey conducted in Macedonian company contributes to the knowledge about business models and sustainable management in developing countries.

Building an innovative model for transformation and development of learning organisation is far from easy and smooth. One important notion is that this is a long-term process and the benefits from it can be observed after few years. CEIM's approach towards building a model for transformation and development of learning organisation, is reflected through their attitudes toward the employees, enabling and nurturing work environment and organisational climate which ensures employees' engagement, motivation, and pursue for professional growth.

Effects and benefits from KM and IC in CEIM are multiple:

- the company's knowledge is properly stored, visible, used, and has an added value,
- new knowledge is co-created in joint research projects with Universities with applied focus relevant to the business strategy of the company,
- knowledge is shared with the mentorship and internship program,
- investments in IC positively influence the achievement of its business goals,
- organisational services and processes are upgraded or renewed, and
- the productivity and the organisational performance is improved and sustainability-oriented.

The results from the qualitative and quantitative analysis (Scandia Navigator, VAIC, cost-benefit, correlation) confirmed the positive effects of KM and IC have on the company's performance. Results showed that this process of KM and IC is enhancing competitiveness of the company and will bring even greater results on long term.

4.1 Implications for research

This research design is quite viable in opening new directions for future research and practical implications for companies in developing countries. This specific transformation toward learning organisation and strategic management of knowledge and intellectual capital explored in this paper is not exploited often in developing countries. More examples and studies like this are needed to replicate the specific model and make strong recommendations. This study is expected to increase the motivation of other companies to invest and manage knowledge and intellectual capital activities and enable sustainability-oriented performance of their company.

4.2 Implications for practice

The implications of the findings presented are important from a practical perspective, as the information can assist managers to recognize the relevance of the topic and its importance, and support organisation development toward sustainability-oriented performance. The experience of the Macedonian company and its transformation, the effects and benefits obtained are of great importance for developing countries and industry. The positive effect for other companies is that the developed and implemented actions for managing and measuring knowledge and intellectual capital can be replicated and further used by other organisation, motivated to enhance their development and sustainability-oriented performance. This transformation model from traditional to learning organisation, proposes a set of actions and measures, has innovative approach to follow the progress, using quantitative and qualitative methods. Additionally, the investments in knowledge and intellectual capital are directly linked to increasing the potential of human capital and the competitive advantage of the organisation. It can be expected that this Macedonian company will serve as an inspiration and role model for other companies in developing countries to follow this example, replicate, and benefit from managing knowledge and intellectual capital.

This case study has a wider impact on society level as well, contributing to building knowledge-based economy, economic growth and development in developing countries. The knowledge-based economy places great importance on the diffusion and use of information and knowledge as well as its creation through developing knowledge networks. The determinants of success of enterprises, and of national economies as a whole, is ever more reliant upon their effectiveness in gathering and utilizing knowledge. This impact can be strengthened and long lasting, if government, professional bodies and associations support this process of managing knowledge and intellectual capital on micro level and create incentives for companies who work in a sustainable manner.

References

Alegre, J., Sengupta, K. and Lapiedra, R. (2013) "Knowledge management and innovation performance in a high-tech SMEs industry", International Small Business Journal, 31(4), pp.454-470.

Anand, A. and Walsh, I. (2020) "The four stages of the knowledge sharing process in SMEs", International Journal of Entrepreneurship and Innovation Management, 24(6), pp.465-481.

Benevene, P. and Cortini, M. (2010) "Interaction between structural capital and human capital in Italian NPOs: Leadership, organizational culture and human resource management", Journal of intellectual Capital.
Cabrita, M., Cruz-Machado, V., Matos, F. (2015) "Linking Knowledge Management and Intellectual Capital", International Journal of Socio technology and Knowledge Development 5(4):1-13.
Cardoni, A., Zanin, F., Corazza, G. and Paradisi, A. (2020) "Knowledge management and performance measurement systems for SMEs' economic sustainability", Sustainability, 12(7), p.2594.
Civil Engineering Institute MACEDONIA (2022) Available at: http://www.gim.com.mk/ (Accessed: 04 May 2022).
Donate, M.J. and de Pablo, J.D.S. (2015) "The role of knowledge-oriented leadership in knowledge management practices and innovation", Journal of business research, 68(2), pp.360-370.
Doz, Y.L. (1996) "The evolution of cooperation in strategic alliances: initial conditions or learning processes?" Strategic management journal, *17*(S1), pp.55-83.
Drucker, P.F. (1993) Post-Capitalist Society, Harper Business, New York.
European Innovation Scoreboard (2020) Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1150 (Accessed: 05 May 2022).
Fairfield, K.D., Harmon, J. and Behson, S.J. (2011) "Influences on the organizational implementation of sustainability: an integrative model*",* Organization Management Journal, 8(1), pp.4-20.
Gaviria-Marin, M., Merigó, J.M. and Baier-Fuentes, H. (2019) "Knowledge management: A global examination based on bibliometric analysis", Technological Forecasting and Social Change, 140, pp.194-220.
Grant, R.M. (1996) "Toward a knowledge-based theory of the firm", Strategic management journal, 17(S2), pp.109-122.
Hadders, H. (2017) "The adaptive quadruple bottom line scorecard: measuring organizational sustainability performance", Available online from the Canadian Sustainability Indicators Network: www. csin-rcid. ca/downloads/csin_conf_henk_hadders. pdf. Accessed on, 19.0.2022
Hahn, T. and Scheermesser, M. (2006) "Approaches to corporate sustainability among German companies", Corporate social responsibility and environmental management, 13(3), pp.150-165.
Januškaitė, V. and Užienė, L. (2018) "Intellectual capital as a factor of sustainable regional competitiveness", Sustainability, 10(12), p.4848.
Kaplan, R.S. (1983) "Measuring manufacturing performance: a new challenge for managerial accounting research", Readings in accounting for management controlSpringer, Boston, MA. pp. 284-306.
Matos, F., Vairinhos, V., Godina, R. (2020) "Reporting of Intellectual Capital Management Using a Scoring Model", Sustainability 12(19):2810-2811.
Matos, Florinda & Vairinhos, Valter & Godina, Radu. (2020)."Reporting of Intellectual Capital Management Using a Scoring Model", Sustainability. 12. 2810-281.
McElroy, M.W. (2006) "The sustainability code–A policy model for achieving sustainability in human social systems", Center for Sustainable Organizations, University of Groningen.
Moneva, J.M. and Ortas, E. (2010) "Corporate environmental and financial performance: a multivariate approach", Industrial Management & Data Systems.
Muslih, M., Wati, T., Agustin, R., Lestari, A. (2021) "Intellectual Capital Disclosure", International Journal of Multidisciplinary Research and Publications (IJMRAP), Volume 4, Issue 6, pp. 1-8.
Neely, A. and Adams, C. (2000) "Perspectives on performance: the performance prism", Centre for Business Performance, Cranfield School of Management, UK.
Otley, D. (1999) "Performance management: a framework for management control systems research", Management accounting research, 10(4), pp.363-382.
Penrose, E. (1959) "The Theory of the Growth of the Firm", Basil Blackwell, Oxford. Performance, European Journal of Marketing, 37, pp.476-497.
Peteraf, M.A. (1993) "The cornerstones of competitive advantage: a resource-based view", Strategic management journal, 14(3), pp.179-191.
Seleim, A. and Khalil, O. (2007) "Knowledge management and organizational performance in the Egyptian software firms", International Journal of Knowledge Management (IJKM), 3(4), pp.37-66.
Seleim, A.A. and Khalil, O.E. (2011) "Understanding the knowledge management-intellectual capital relationship: a two-way analysis", Journal of Intellectual Capital.
Sink, D.S., Tuttle, T.C. and Shin, S.I. (1989) "Planning and measurement in your organization of the future Norcross", GA: Industrial Engineering and Management Press, pp. 170-84.
Sumanth, D. (1994) "Productivity Engineering and Management", McGraw-Hill New York, NY
Taneva-Veshoska A., Trajkovska S**.,** Antic K. *(*2015*) "*Enhancing competitiveness trough collaborative innovation partnership – a case study of Macedonian company", REDETE - Researching Entrepreneurship and Economic Development in Transition Economies, Graz, Austria.
Taneva-Veshoska, A., Trajkovska, S., Drakulevski, L. and Janeska-Iliev, A. (2015) "Search for values and talent in organizations striving towards a knowledge-based economy-the case of Republic of Macedonia", International Journal Scientific and Applicative papers V9, p.82.
Tangen, S. (2005) "Demystifying productivity and performance", International Journal of Productivity and performance management.
Uit Beijerse, R.P. (2000) "Knowledge management in small and medium-sized companies: knowledge management for entrepreneurs", Journal of knowledge management, pp 162–179.

West, G.P. and Noel, T.W. (2009) “The impact of knowledge resources on new venture performance. Journal of small business management, 47(1), pp.1-22.

Zheng, W., Yang, B. and McLean, G.N. (2010) “Linking organizational culture, structure, strategy, and organizational effectiveness: Mediating role of knowledge management”, Journal of Business research, 63(7), pp.763-771.

A Systematic Literature Review of Agriculture Knowledge Management in KM and non-KM Journals.

Rebecca P. Tumwebaze, John N. Walsh and John Lannon
University of Limerick, Limerick, Ireland
Rebecca.Tumwebaze@ul.ie
John.Walsh@ul.ie
j.lannon@doras.org

Abstract: This paper discusses the contrast in approach to agriculture knowledge management (AKM) empirical research between mainstream Knowledge Management (KM) scholars and scholars from non-KM fields, and the implications of this contrast to the development of AKM scholarship. The paper uses a systematic literature review, gathering papers from both mainstream KM literature and non-KM literature. A total of 44 peer-reviewed publications were analysed. Of these, 12 publications were from the mainstream KM literature while 32 publications were from the wider non-KM literature but had an agriculture knowledge management focus. While KM scholars predominantly conducted AKM research in structured, organized settings such as agriculture organisations and agri-business enterprises, scholars from non-KM fields, mostly agriculture, conducted AKM research in less formal settings, engaging farmers and local communities in research and exploring the indigenous knowledge that arises out of such communities. This contrast shows a disconnect in the studies conducted by the two groups of scholars. The disconnect is also reflected in the fact that the scholars from the different backgrounds do not cite one another and hence AKM literature does not have any coherent development. This paper offers an overall picture of the existing knowledge of AKM, and provides pointers for future AKM research

Keywords: Knowledge; Knowledge Management; Agriculture; Agriculture Knowledge Management; Farming

1. Introduction

The agriculture sector is on the frontline of global efforts to address the world's problems of food insecurity, poverty, climate change, sustainability, and environmental degradation. The importance of leveraging agriculture knowledge therefore cannot be downplayed. The field of knowledge management (KM) has registered tremendous success and continues to evolve, which makes consideration for KM's application to strategic sectors like agriculture eminent. A systematic review of the relevant literature however found that research on agriculture knowledge management (AKM) is limited, fragmented and highly interdisciplinary. The authors have identified a limited number of 'primary' AKM studies from the mainstream KM journals and 'secondary' AKM studies from non-KM journals examining different aspects of agriculture-related research. As such, this study follows Bandara, et al. (2011) who argued that where a field is emerging and novel, researchers may also need to review what they termed as 'secondary papers' that do not specifically discuss the topic of interest, but still includes some discussion of it embedded within other topics. The purpose of this paper is three-fold: 1) to analyse the contrasting approaches to AKM empirical research between scholars from mainstream KM journals (primary literature) and scholars from non-KM journals (secondary literature).; 2) to examine the implications of these two research streams in terms of research and practice and 3) to recommend a possible research direction for AKM scholars. The paper is structured as follows: section 2 presents the methodology; section 3 presents the findings, section 4 presents the discussion of findings and recommendations for future research; while section 5 presents the conclusion.

2. Methodology

A widely accepted approach, that of a systematic literature review, was employed to ensure transparency and rigor (Thomé, et al., 2016). Like Podsakoff et al. (2005), the authors limited the systematic review to peer-reviewed journal articles omitting other sources such as books, book chapters and working article series. While AKM is also present in unpublished reports and other 'gray' literature, the authors focused on peer reviewed literature to ensure quality of evidence and consistency with accepted systematic review practices (e.g., Mariano & Awazu, 2016); Massaro, et al., 2015).

An initial search examined the top 20 journals (tiers A & B) from Serenko & Bontis' list of Knowledge Management and Intellectual Capital (KM/IC) journals (2021). The researchers carried out searches in each of the 20 journals using the keywords "knowledge* AND (agri* OR farm* OR food*)" present in the text with the asterisk (*) to facilitate unlimited truncation. An initial screening resulted in 72 peer-reviewed articles, further reduced to 58 after eliminating duplicates. Four inclusion criteria were then applied: (a) the article investigated

knowledge management in an agricultural context, (b) the article was empirical, (c) the article was in English and (d) the full text was available to the researchers through existing university library subscriptions. This resulted in only 12 eligible articles.

Given the small number of papers identified from mainstream KM journals and the need for literature reviews to be comprehensive, identifying all available articles (Aromataris & Riitano, 2014), the researchers decided to retain the search terms and inclusion criteria but expand the scope of the search to include papers from non-KM journals. The researchers conducted another manual search on 'Academic Search Complete', a multi-disciplinary database with more than 7,300 peer-reviewed journals of different fields. This search returned 311 potentially relevant papers, reduced to 206 after the elimination of duplicates. After the four inclusion criteria were applied, 32 papers from non-KM journals were identified, making a total of 44 relevant papers for the systematic literature review.

A coding matrix was developed to review the identified papers. For each article, the authors reviewed the journal in which article was published and the setting/context in which the study was conducted. Coding was carried out independently by two of the authors. Where slight differences occurred in the initial coding, the relevant papers were reviewed and discussed until consensus was reached.

3. Findings

3.1 Journal of publication

This systematic literature review examined 44 studies, 12 from KM journals and 32 from non-KM journals. Among the KM journal articles, the most popular publication outlets were the Journal of Knowledge Management (5 papers) and Knowledge Management Research and Practice (3 papers), while the remaining studies were from four different journals. There was a wider spread of journals in the 32 non-KM articles, which were published in 27 different journals, with a dominant trend being the publication of a single paper per journal. The only journals that had multiple publications were: the Journal of Ethnobiology and Ethnomedicine (3 papers), Agriculture and Human Values (3 papers) and the Sarhad Journal of Agriculture (2 papers).

The quality of the papers was examined using both Impact Factors (Clarivate) and Cite Scores (Scopus) as metrics. The quality of the KM journals was almost double the quality non-KM journals using both impact factors and cite scores. In addition, while almost all the KM journals had cite scores and 9 out of 12 had an impact factor, non-KM journals possessed less of both, with 28 out of 32 having cite scores and only 19 out of 32 having an impact factor.

Table 1: Paper quality

Journal Type	Average Impact Factor	Average Cite Score
Knowledge Management Journals	4.95 (n=9/12)	6.50 (n=11/12)
Non-Knowledge Management Journals	2.80 (n=15/32)	3.84 (n=19/32)

KM Journals n=12, Non-KM Journals n=32

3.2 The setting/context in which studies were conducted

The predominant focus of the AKM articles in KM journals was similar to typical KM areas of interest, considering how to leverage knowledge for business growth, competitive advantage, and organisational improvement, although the former articles considered agricultural organisations and agri-business enterprises. 10 out of the 12 mainstream KM studies were conducted in structured organisational settings (Chisita & Fombad 2020; Gardeazabal et al., 2021; Ahmed & Newton, 2005), across inter-organisational settings (Fait et al. 2019; Garcia-Villaverde et al. 2008; O'Connor & Kelly 2007) or in institutional settings that bear resemblances with organisations such as a cooperative (Galindo 2007), a network (De Bernardi et al. 2021) and a project (Feng et al. 2009). The operational context in such structured organisational settings allowed managers/leaders to identify areas where knowledge processes can be leveraged and identify tools and techniques that coujld be used to reinforce the application of knowledge, whether consciously or unconsciously. The organisational contexts enabled easier access to respondents by researchers. Only 2 papers from mainstream KM journals (Torres et al. 2021; Mahindarathne & Min 2019) considered research participants in non-organisational settings: both studies were conducted in farming communities and engaged individual farmers without any organisational attachments.

In sharp contrast, researchers from non-KM journals predominantly conducted AKM studies in non-organisational settings, engaging rural farming communities and individuals in AKM research. 29 out of 32 secondary studies reviewed were conducted in community settings, mainly focusing on farmers. Inherent in these studies was an acknowledgement of farmers' indigenous knowledge. These studies recognised that farmers possess a deep and rich knowledge of many aspects of agriculture such as environmental conservation (Jiao et al. 2011; Mamun 2010), sustainable natural resource management (Heijting et al. 2011; Wyckhuys & O'Neil 2007), pest management (Yematow et al. 2016; Eisenberg et al. 2009; Guimarães and Mourão 2006), soil (Asse´ and Lassoie 2011), fertilizers (Misiko et al. 2010), and plants (Thorn et al. 2020). This literature review indicates that such indigenous knowledge, held by farmers and in community, rather than organisational settings, is overlooked by mainstream KM scholars whose focus is on formal agriculture organisational and agri-business settings, where knowledge processes are facilitated by organisational managers/leaders, who may not appreciate the role, authenticity and value of indigenous knowledge. Communities in less formal contexts, provide members with opportunities for different knowledge processes without formal/organised facilitation. Only 3 of the 32 secondary studies were conducted in structured/organised settings (i.e. Imam et al. 2021; Lopez et al. 2021; Powell 2017).

One non-KM study (Barua and Rahman 2018) was unique in that the researchers recognized the agriculture sector as being composed of diverse stakeholder groups, belonging to both organisational and non-organisational contexts. The researchers used a Participatory Rural Appraisal technique to investigate the perspectives of fishers in their local community, which was supplemented with interviews with NGO personnel, researchers, private entrepreneurs, government representatives and resource users. In this study, while some research participants were from non-organisational contexts (e.g. fishers/farmers, local communities), other participants were interviewed in the context of their organisations (e.g. NGO personnel, private entrepreneurs, government representatives, researchers). Barua and Rahman (2018) explored the utilization patterns and management aspects of natural resources and economic valuation of the ecosystem services through indigenous knowledge practices in Bangladesh. Rather than focus on farmers and local communities as resource users, the researchers engaged organizational stakeholders because of the role these play in facilitating resource use in communities. Barua and Rahman (2018) observe that environmental-friendly traditional values can be enforced by effective environmental protection policies. While they acknowledge communities as key resource users and holders of valuable indigenous knowledge, they also recognize that private sector players, NGOs and government players play equally important roles in promoting ecological and economic benefits from resource use.

4. Discussion of findings and recommendations for further research

4.1 Journal of publication

There is limited research on AKM in knowledge management journals, with studies focusing on the organisational leveraging of knowledge. In contrast, AKM research has been published across a larger number of non-KM journals and examined the relevance of knowledge from a wider range of agricultural topics, such as rural development, agriculture, climate change, environment, ecology, and agronomy among others. Such a distribution of agricultural issues and KM responses means that AKM research has, to date, developed on a piecemeal basis and is currently lacking a coherent underlying theory that seeks to link key KM activities with the idiosyncrasies of the agricultural context. The scattered distribution of papers among multiple journals also shows that there is no journal that is seen by researchers to be a natural 'home' for a developing stream of AKM research.

As demonstrated in table 1, the 12 AKM papers from mainstream KM journals though limited in number have much higher citation impact than the 32 AKM papers from non-KM journals. This shows that the papers from KM journals have more reach in the scientific community, compared to the papers from the lower quality non-KM journals. There is need therefore for the higher impact KM journals to facilitate scholarly attention on AKM in order to help the evolution of AKM literature. The field of AKM is open and presents opportunities for potential scholars to explore. KM journals should facilitate specialised streams of AKM research, providing a platform for KM and non-KM scholars to collaborate in building a scholarly dialogue in the field.

5. The setting/context in which studies were conducted

The focus of current KM research is predominantly aligned to for-profit organizational settings. Consequently, KM scholars' approach to AKM research has also focused on an organisational context that is similar to existing

KM studies. Currently, KM has been successfully applied to organisations to enhance decision making (O'Çonnor & Kelly 2017), competitive advantage (García-Villaverde et al., 2018), innovation (Gardeazabal et al., 2021) and production (Torres et al. 2021). In this paper, we argue that there exists a growing need for KM scholars to go beyond organisational contexts, specifically when examining the agriculture sector.

There has been considerable reflection on KM in the public sector, including Massaro et al. (2015) who provides a helpful review of literature for knowledge management application in that context. Boyne (2002) argues that public and private sector organisations are different and require different approaches in application of management principles. In this article, we extend this argument by suggesting that the agriculture sector also has unique differences. Therefore, KM application to any sector ought to begin with a comprehensive analysis of the sector to inform suitability of available KM principles to the sector or a review and adaptation of KM principles to the sector context. This systematic literature identified three areas of uniqueness for the agriculture sector that set it apart from not only private organisations but other public sectors as well: heterogeneity of knowledge actors, heterogeneity of agriculture knowledge, and structural context.

Heterogeneity of knowledge actors: From the literature reviewed, the agriculture knowledge actors were identified as farmers, local communities, farmer associations, local governments, national governments, technical agriculture experts, researchers, international development organisations, national/local Non-Governmental Organisations (NGOs), education institutions and private sector agro-enterprises. By virtue of their different roles, these knowledge actors possess different knowledge, expertise, motivations and goals and stem across multiple epistemic boundaries. Even when the work of these diverse knowledge actors is ostensibly interdependent, agriculture researchers (Sumane et al. 2018; Lwoga et al. 2010) have acknowledged that the various groups of agriculture knowledge actors are largely disconnected from one another, due of strained relations or conflicting perspectives and goals but some may also hold mutually supporting knowledge.

Heterogeneity of knowledge: The heterogeneity of knowledge actors leads to a diverse heterogeneous knowledge base. While the benefits of heterogeneous knowledge are widely acknowledged in KM literature (Rodan 2002; Rodan & Galunic 2004; Nielsen 2002), it can also be disruptive, requiring well thought out consideration by researchers. In the agriculture sector, farmers' indigenous knowledge is often disregarded by policy makers and other actors who downplay it as inefficient, outdated or merely based on mysticism (Lopez et al. 2020; Mashavave et al. 2013). Farmers, in their turn, have also often disregarded conventional knowledge transmitted to them through government extension systems (Kamurudin et al. 2015). Agriculture researchers have lamented the lack of interest in, and adoption of, their findings by farmers and other agriculture sector players (Nain et al. 2018). Technical experts such as veterinarians continue to face marginalization by farmers and other agriculture players because they have tended to lose their monopoly over knowledge in an information age (Ruston et al 2016) with their knowledge often in conflict with farmers' indigenous knowledge (Kamurudin et al. 2015). Alternatively, government interventions and the knowledge that arises out of these interventions tends to focus on agriculture commercialization and profitability, while the typical smallholder farmer is interested in farming as a livelihood and a source of food security (Anderson, Learch and Gardner 2016). These examples indicate that the heterogeneous knowledge present in the agriculture sector may not necessarily translate into positive outcomes in circumstances where researchers do not provide well thought out KM frameworks. While existing KM research already provides tools and techniques for dealing with heterogeneous knowledge, it is important that AKM scholars avoid an uncritical application of existing KM tools and techniques to the agriculture sector, but rather, analyse the sector and its knowledge actors before developing agriculture sector specific tools/techniques for dealing with heterogeneous agriculture knowledge.

Structural context: The agriculture sector is characterized by knowledge actors in structured organisational settings and knowledge actors in unstructured settings such as individual households and communities. This makes interactions and socialization amongst the sector's knowledge actors, that would enhance the different knowledge processes, socially complex. While knowledge actors in organisations are likely to seek information with organisations tending to implement strategies to facilitate knowledge processes amongst members, agriculture knowledge actors in unstructured settings such as farmers tend to be conservative in knowledge seeking and may prefer to rely more on their tacit (largely indigenous) knowledge for decision making (Mahindarathne & Min 2019). The context of the agriculture sector calls for change in focus by AKM researchers, from both KM and non-KM journals, to one which examines research participants in both settings rather than, as observed in the majority of studies, a single setting. As the fundamental thinking on which KM ideas were

originally developed is based on organisational settings, AKM researchers need to reflect on whether such settings remain appropriate in non-organisational settings as well as mixed settings.

6. Conclusion

As a contribution to achievement of key SDGs related to agriculture sustainability, KM journals should develop an AKM theme to facilitate the development of a deeper and more cohesive AKM theory. KM scholars exploring AKM should draw on the non-KM studies to develop an understanding of how AKM contexts differ from organisational KM contexts to develop a more agriculture-specific understanding of the role KM can play.

This study is not without limitations. By restricting it to the top KM journals and the "Academic Search Complete" database, this study may not have allowed complete coverage of all empirical articles in the field of AKM. Yet it is reasonable to assume that the review process covered a substantial proportion and realistic representation of the AKM studies.

References

Abbas, K. D. (2016) "Trends in knowledge production and generation in the agricultural sector: perspectives of Nigerian agricultural research institutes", *Mousaion*, Vol 34, No 3, pp 123-145.

Ahmed, A. and Newton, D. (2005) "Strengthening African universities' strategic role in knowledge and technology development: policies and practice from Sudan", *International Journal of Learning and Intellectual Capital,* Vol 2, No. 1, pp 66-80.

Ali, L. and Avdic , A. (2015) "A Knowledge Management Framework for Sustainable Rural Development: The case of Gilgit-Baltistan, Pakistan", *Electronic Journal of Knowledge Management*, Vol 13, No. 2.

Anderson, J., Learch, C. and Gardner, S. (2016) "National survey and segmentation of smallholder households in Uganda. Understanding their demand for financial, agricultural, and digital solutions", CGAP.

Anyira, I., Onoriode, O. K. and Nwabueze, A. (2010) "The role of libraries in the preservation and accessibility of indigenous knowledge in the Niger Delta Region of Nigeria", Library Philosophy and Practice.

Aromataris, E. and Riitano, D. (2014) "Systematic reviews: constructing a search strategy and searching for evidence", *AJN The American Journal of Nursing*, Vol 114, No.5, pp 49-56.

Assefa, H., Sehai, E. and Tegegne, A. (2011) "Agricultural Knowledge Management in Dairy Production Improvement: The Case of Bure Woreda, West Gojjam Zone, Amhara Region", *IUP Journal of Agricultural Economics*, Vol 8, No. 4.

Assé, R. and Lassoie, J. P. (2011) "Household decision-making in agroforestry parklands of Sudano-Sahelian Mali", *Agroforestry Systems*, Vol 82, No. 3, pp 247-261.

Bandara, W., Miskon, S. and Fielt, E. (2011) "A systematic, tool-supported method for conducting literature reviews in information systems", *AIS Electronic Library (AISeL)/Association for Information Systems*, pp 1-13.

Barua, P. and Rahman, S. H. (2018) "The Role of Indigenous Knowledge and Coastal Resource Management in Addressing the Climate Change Impact on Southeastern Bangladesh", *IUP Journal of Knowledge Management*, Vol 16, No. 2, pp 49-71.

Boyne, G. A. (2002) "Public and private management: what's the difference?", *Journal of management studies*, Vol 39, No. 1, pp 97-122.

Chisita, C. T. and Fombad, M. C. (2020) "Knowledge sharing to support climate change adaptation in Zimbabwe: Views from selected climate action organisations", *VINE Journal of Information and Knowledge Management Systems*.

De Bernardi, P. et al. (2021) "Knowledge transfer driving community-based business models towards sustainable food-related behaviours: A commons perspective", *Knowledge Management Research & Practice*, Vol 19, No. 3, pp 319-326.

Eisenberg, A., Amato, P. J. and Tao, D. (2009) "Kam Guilzhouh nyim Guangxxih di Benxtux Wenchual nyim Zihyuanc dih Gonxliix: Kam local indigenous knowledge and sustainable resource management in Guizhou and Guangxi provinces, China", *Ethnobotany Research and Applications*, Vol 7, pp 67-113.

Fait, M. et al. (2019) "A novel view on knowledge sharing in the agri-food sector", *Journal of Knowledge Management.*

Feng, W. et al. (2009) "Understanding expert systems applications from a knowledge transfer perspective", *Knowledge Management Research & Practice*, Vol 7, No. 2, pp 131-141.

Galindo, I. M. (2007) "Regional development through knowledge creation in organic agriculture", *Journal of knowledge management*.

García-Villaverde, P. M. et al. (2018) "The role of knowledge absorptive capacity on the relationship between cognitive social capital and entrepreneurial orientation", *Journal of Knowledge Management*.

Gardeazabal, A. et al. (2021) "Knowledge management for innovation in agri-food systems: a conceptual framework", *Knowledge Management Research & Practice*, pp 1-3.

Guimarães, A. D. and Mourão, J. D. (2006) "Management of plant species for controlling pests, by peasant farmers at Lagoa Seca, Paraíba state, Brazil: an ethnoecological approach", *Journal of Ethnobiology and Ethnomedicine*, Vol 2, No. 1, pp 1-5.

Heijting, S., De Bruin, S. and Bregt, A. K. (2011) "The arable farmer as the assessor of within-field soil variation", *Precision Agriculture*, Vol 12, No. 4, pp 488-507.

Hoffman, M., Lubell, M. and Hillis, V. (2015) "Network-smart extension could catalyze social learning", *California Agriculture*, Vol 69, No. 2.
Imam, M. F. et al. (2021) "Effectiveness of agricultural extension's farmer field schools (FFS) in Pakistan: the case of citrus growers of Punjab province" *Ciência Rural*, Vol 51.
Jiao, Y. et al. (2012) "Indigenous ecological knowledge and natural resource management in the cultural landscape of China's Hani Terraces", *Ecological research*, Vol 27, No. 2, pp 247-263.
Kamarudin, H. D., et al. (2015) "Exploring knowledge sharing practices among paddy farmers towards building a foundation for knowledge creation", *International Journal of Social Science and Humanity*, Vol 5, no. 1.
Kilpatrick, S. and Johns, S. (2003) "How farmers learn: different approaches to change", *The Journal of Agricultural Education and Extension*, Vol 9, No. 4, pp 151-164.
Klerkx, L., De Grip, K. and Leeuwis, C. (2006) "Hands off but strings attached: the contradictions of policy-induced demand-driven agricultural extension", *Agriculture and Human Values*, Vol 23, No. 2, pp 189-204.
Lopez, F. J. G., Ochoa Jimenez, S. and Jacobo Hernandez, C. A. (2021) "Knowledge Management and Innovation in Agricultural Organizations: An Empirical Study in the Rural Sector of Northwest Mexico", *Cuadernos de Desarrollo Rural*, Vol 17, No. 86.
Lwoga, E. T., Ngulube, P. and Stilwell, C. (2010) "Managing indigenous knowledge for sustainable agricultural development in developing countries: Knowledge management approaches in the social context", *The International Information & Library Review*, Vol 42, No. 3, pp 174-185.
Mahindarathne, M. G. and Min, Q. (2019) "Factors that Influence Farmers' Information Seeking Behaviour: A Study of Sri Lankan Vegetable Farmers", *Journal of Information & Knowledge Management,* Vol 18, No. 3.
Mamun, A. A. (2010) "Understanding the Value of Local Ecological Knowledge and Practices for Habitat Restoration in Human-Altered Floodplain Systems: A Case from Bangladesh", *Environmental Management*, Vol 45, No. 5, pp 922-938.
Mariano, S. & Awazu, Y. (2016) "Artifacts in knowledge management research: a systematic literature review and future research directions", *Journal of Knowledge Management.*
Mashavave, T. et al. (2013) "Interaction patterns determining improved information and knowledge sharing among smallholder farmers", *African Journal of Agricultural and Resource Economics*, Vol 8, No. 311-2016-5612
Massaro, M., Dumay, J. and Garlatti, A. (2015) "Public sector knowledge management: a structured literature review", *Journal of knowledge management.*
Misiko, M. et al. (2011) "Strengthening understanding and perceptions of mineral fertilizer use among smallholder farmers: evidence from collective trials in western Kenya", *Agriculture and Human Values*, Vol 28, No.1, pp 27-38.
Moussa, I. M. (2006) "Impact of Privatization of Advisory Services on Agricultural Knowledge and Information Systems: Evidence from 'LEC' Knowledge Management in Banikoara, Benin", *Quarterly Bulletin of the International Association of Agricultural Informationn Specialists,* Vol 51, No. 3-4, pp 208-214.
Nain, M. S., Singh, R., and Mishra, J. R. (2019) "Social networking of innovative farmers through WhatsApp messenger for learning exchange: A study of content sharing" *Indian Journal of Agricultural Sciences*, Vol 89, No. 3, pp 556-558.
Nielsen, B. B. (2002) "Synergies in strategic alliances: motivation and outcomes of complementary and synergistic knowledge networks", *Journal of Knowledge Management Practice*, Vol 3, No. 2, pp 1-15.
O'Connor, C. and Kelly, S. (2017) "Facilitating knowledge management through filtered big data: SME competitiveness in an agri-food sector", *Journal of Knowledge Management*.
Powell, A. (2017) "CABI's innovative use of technology, data, and knowledge transfer to reduce crop losses in the developing world", *Food and Energy Security*, Vol 6, No. 3, pp 94-97.
Rodan, S. (2002) "Innovation and heterogeneous knowledge in managerial contact networks", *Journal of Knowledge Management*, Vol 6, No. 2, pp 152-163.
Rodan, S. and Galunic, C. (2004) "More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness", *Strategic Management Journal*, Vol 25, No. 6, pp 541-562.
Sahoo, N., 2019. Participatory Rural Planning for Sustainable Agriculture: An Observation from Rural Jharkhand of India. Productivity, 60(2), pp. 214-225.
Serenko, A. and Bontis, N. (2021) "Global ranking of knowledge management and intellectual capital academic journals: a 2021 update", *Journal of Knowledge Management.*
Sumane, S. et al. (2018) "Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture", *Journal of Rural Studies*, Vol 59, pp. 232-241.
Tambo, J. A. et al. (2019) "The impact of ICT-enabled extension campaign on farmers' knowledge and management of fall armyworm in Uganda" *PLoS One*, Vol 14, No. 8.
Thomé, A. M., Scavarda, L. F. and Scavarda, A. J. (2016) "Conducting systematic literature review in operations management", *Production Planning & Control*, Vol 27, No. 5, pp. 408-420.
Thorn, J. P. et al. (2020) "Indigenous uses of wild and tended plant biodiversity maintain ecosystem services in agricultural landscapes of the Terai Plains of Nepal", *Journal of ethnobiology and ethnomedicine,* Vol 16, No. 1, pp. 1-25.
Tijjani, A. R., Anaeto, F. C. and Emerhirhi, E. (2017) "Perceived Effects of Use of Information and Communication Technologies (ICTs) on Rural Farmers' Knowledge in Orlu Agricultural Zone, Imo State", *Library Philosophy & Practice*.
Torres, C. L. et al. (2020) "Discovering innovation opportunities based on SECI model: Reconfiguring knowledge dynamics of the agricultural artisan production of agave-mezcal, using emerging technologies" *Journal of Knowledge Management*.

Wuryaningrat, N. F., Kawulur, A. F. and Kumajas, L. I. (2017) "Examining an endangered knowledge transfer practice known as 'mapalus' in an Indonesian village: implications for entrepreneurial activities and economic development" *International Journal of Business & Society*.

Wuttikorn, I. et al. (2019) "Web application of knowledge management in broiler production in agriculture for vocational education", *Journal for the Education of Gifted Young Scientists*, Vol 7, No. 4, pp. 1249-1261.

Wyckhuys, K. A. and O'Neil, R. J. (2007) "Local agro-ecological knowledge and its relationship to farmers' pest management decision making in rural Honduras", *Agriculture and Human Values*, Vol 24, No. 3, pp. 307-321.

Yemataw, Z. et al. (2016). "Exploiting indigenous knowledge of subsistence farmers' for the management and conservation of Enset (Ensete ventricosum (Welw.) Cheesman)(musaceae family) diversity on-farm" *Journal of Ethnobiology & Ethnomedicine*, Vol 12, No. 1, pp. 1-25.

Digital Innovation Hubs: Two-mode and Network-Based View on Technology and Services Provided

Anna Ujwary-Gil[1] and Bianka Godlewska-Dzioboń[2]
[1]Institute of Economics, Polish Academy of Sciences, Poland
[1]Network Analysis Laboratory, Cognitione Foundation, Poland
[2]Cracow University of Economics, Poland
ujwary@inepan.waw.pl
godlewsb@uek.krakow.pl

Abstract: The Digital Innovation Hub (DIH) is a relatively young research area emerging on the basis of well-known ideas of technology parks or clusters. DIH is mainly focused on the digital transformation of enterprises and the development of a given region in the context of Industry 4.0 based on digital technology. The European Union is the initiator of the "Digital Europe" program for 2021-2027, aiming to promote the transfer of digital specialist knowledge to economic entities. The authors chose the DIHs operating in Poland as a starting point for network analysis in the context of the technology and services provided by Polish DIHs. This research aims to measure network cohesion, the centrality of individual DIH, and its specialty (exclusivity). It is based on secondary data collected using the Smart Specialization Platform based on which the two two-mode networks have been developed: actor x technology (ATij) and actor x services provided (ASPij). Measurements and visualization were made using two network programs (UCINET and ORA PRO). The following social network analysis techniques were used: 1) Two-mode cohesion: density, diameter, and fragmentation; 2) Two-mode centrality: degree and betweenness, and 3) Two-mode specialty (exclusivity). The results show two-mode networks consisting of the following nodes: 15 actors (A) or DIHs; 29 technologies (T), and 16 services provided (SP) forming a meta-network. They provide an insight into the network structure, most influential actors (DIHs), technologies, and services, as well as the specialty of each DIH in the European country, thus giving rise to further comparative research, using secondary data for the other 26 countries of the European Union.

Keywords: digital innovation hub, DIH, two-mode network, centrality, cohesion, digital knowledge, technological knowledge, social network analysis, specialty, row exclusivity

1. Introduction

The Digital Innovation Hub (DIH) is a relatively new area of research and a concept of the European Commission. They first appeared as Competence Centers, which were to produce a specific technology to support digital transformation in Europe. Then, the DIH concept was developed. Apart from the production of specific products, 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 idea of establishing DIHs appeared for the first time in the European Commission communication entitled "Digitising European industry: Reaping the full benefits of a digital single market (COM, 2016). The Commission then committed € 500 million from the Horizon 2020 budget to creating the European DIH network. As part of the recruitment, applications from leading competence centers were accepted. Together with their partners, they created hubs specialized in the subject of announced competitions, such as digital innovations in production processes, photonics, robotics, or advanced data processing. Currently, there are over a dozen Polish hubs on the list of the European Commission. The first publications on DIHs indexed in Web of Science or Scopus appeared only in 2018.

European Union dedicated programs, incl. digital competences or Digital Europe (financial perspective for 2021-2027) made the digital transformation of enterprises towards Industry 4.0 a reality (Florek-Paszkowska et al., 2021; Ujwary-Gil et al., 2022). The program 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 Digital Europe Program 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 DIHs network

is to cover the widest possible area of the European Union countries. Subsidies for their development will be awarded directly by the European Commission.

In Poland, in 2019, 5 winning applications were selected from among 42 applications for the ministerial competition entitled "Standardization of digital innovation hub services to support the digital transformation of enterprises" (Ministry of Entrepreneurship and Technology, 2019). The program aimed to select, expand, and supplement the potential of centers that can perform the role of DIHs, develop good practices, and standardize the services they provide to support entrepreneurs in the field of product, service, and organizational transformation using the latest technological solutions. In the future, other innovation incubators will benefit from the experience of newly established DIHs. This type of organization aims to accelerate the transformation of the economy towards Industry 4.0. The digital revolution creates opportunities for businesses large and small, but many still struggle to know what technology to invest in and how to finance their digital transformation. Small and medium-sized enterprises (SMEs) are particularly slow to implement digital technologies (Gancarczyk and Ujwary-Gil, 2021). It is estimated that only one in five enterprises in the EU is highly digitized. 60% of large enterprises and more than 90% of small ones are slow to implement digital innovations, with the latter representing more than 99% of all enterprises in Europe (Eurostat, 2021).

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. Overall, DIHs operate as a comprehensive enterprise service offering (Vakirayi and Belle, 2020): 1) testing and experimenting with digital innovations in the areas listed; 2) intermediating between users and providers of digital innovations in the value chain; intermediation between companies and investors, providing enterprises in the region with knowledge, expertise, and technologies; 3) contacts with training providers, investors, access to financing digital transformation, strengthening innovation, a platform for cooperation for various stakeholders. Services understood in this way are to act as the so-called one-stop-shop offering companies in their region comprehensive access to the latest knowledge, experience, technology, as well as technological, construction, and measurement infrastructure. Moreover, they enable the testing and implementation of digital innovations for the created products, processes, and business models (Ujwary-Gil and Potoczek, 2020). DIH's offer is addressed to companies 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).

Therefore, as proposed by the European Commission, the Digital Innovation Hub is a one-stop-shop where start-ups and mid-caps (mid-capitalization) can get help in improving their business, manufacturing processes, products, and services through digital technologies. One of the key priorities of the European Industry Digitization Initiative launched in 2016 is to support a strong network of DIHs to ensure that every business in Europe can benefit from digital technologies (DEI, 2016). Its aim is to coordinate the work of digitization of industry, co-invest in the development of European digital innovation, provide an appropriate legal and regulatory framework, and strengthen the necessary skills to carry out the digital transformation.

The article aims to examine the network structure of DIHs operating in Poland from the perspective of two-mode networks: technology and services provided by DIHs in terms of two-mode cohesion, two-mode centrality, and two-mode specialty (row exclusivity). This is the first such DIHs study that looks at selected technologies and services through the prism of a network approach that assumes interdependence and relationships between actors. In this context, the actors are DIHs operating in Poland. With the above in mind, the research questions (RQ) are as follows:

RQ1: How cohesive are technology and services provided networks?
RQ2: Which digital innovation hubs, technologies, and services are centrally positioned in the networks?
RQ3: What are the DIHs' specialties in technology and services provided networks?

2. Network approach to Digital Innovation Hub

The study used social network analysis techniques to measure and visualize the structure of selected DIHs' networks operating in Poland. For this purpose, two network programs were used: UCINET (Borgatti et al., 2002) and ORA PRO (Altman et al., 2020). The network approach allows for the association of DIH data with technology and services provided (c.f., Ujwary-Gil, 2017). The secondary data of the Smart Specialization Platform (S3 Tools

and Data Sources, 2022) was used, which is very well structured (standardized for each DIH). Network data (nodes) consists of the following DIHs, i.e. actors (A), technologies (T), and services provided (SP) (Table 1).

Table 1: DIHs operating in Poland, technologies used, and services provided (sorted alphabetically)

ID	DIH name (A)	ID	Technology (T)	ID	Services provided (SP)
A01	Centre for Advanced Manufacturing Technologies, Wroclaw University of Science and Technology	T01	Additive manufacturing	SP01	Access to funding and investor readiness services
A02	CYBERSEC HUB	T02	Advanced, or high-performance computing	SP02	Awareness creation
A03	DIH4.AI	T03	Artificial intelligence	SP03	Collaborative researchs
A04	Emerging Transactional and Financial Technology Hub (ETFTH)	T04	Big data, data analytics, data handling	SP04	Commercial infrastructure
A05	HPC4Poland	T05	Cloud computing	SP05	Concept validation and prototyping
A06	Institute of Electron Technology (ITE)	T06	Communication networks	SP06	Digital maturity assessment
A07	IoT Poland Foundation Hub	T07	Cyber-physical systems	SP07	Ecosystem building, scouting, brokerage, networking
A08	IT and Expert Hub Supporting Biomedical Research, Technology and Education (BioMedHub)	T08	Cyber security	SP08	Education and skills development
A09	Krakow Technology Park	T09	Distributed ledger technology	SP09	Incubator/accelerator support
A10	Lublin Medicine Cluster	T10	Gamification	SP10	Market intelligence
A11	NASK National Research Institute	T11	Industrial biotechnology	SP11	Mentoring
A12	PIAP HUB	T12	Interaction technologies	SP12	Pre-competitive series production
A13	Poznan Science and Technology Park of Adam Mickiewicz University Foundation	T13	Internet of things	SP13	Testing and validation
A14	Regional Digital Innovation Hub related to Internet of Things (IoT North Poland HuB)	T14	Internet services	SP14	Visioning and strategy development for businesses
A15	Silesia Smart Systems	T15	Laser-based manufacturing	SP15	Voice of the customer, product consortia
		T16	Logistics	SP16	Other
		T17	Micro/nanoelectronics		
		T18	Mobility & location-based technologies		
		T19	Nanotechnology		
		T20	New media technologies		
		T21	Organic and large area electronics		
		T22	Photonics and imaging technologies		
		T23	Quantum computing		
		T24	Robotics		
		T25	Screens and display technologies		
		T26	Sensory systems		
		T27	Simulation, modeling, and digital twins		
		T28	Software as a service and service architectures		
		T29	Virtual, augmented, and extended reality		

Source: Based on S3 Tools and Data Sources: Digital Innovation Hubs (accessed 14 March 2022).

The nodes listed in Table 1 form the basis for analyzing the structure of the two-modal network using cohesion, centrality, and specialty (exclusivity) techniques. In the literature on the subject (e.g., Borgatti et al., 2013; Carley

and Reminga, 2004; Prell, 2012; Robins, 2015; Ujwary-Gil, 2020, 2019; Wasserman and Faust, 1994), the interested reader will find these network techniques much more widely discussed.

2.1 Two-mode cohesion

Two-mode cohesion calculates standard cohesion measures for a two-mode network like: density, diameter, and fragmentation directly on a two-mode dataset, taking into account the sizes of each mode (Borgatti and Everett, 1997). Density is the number of ties divided by n * m, where n is the number of rows and m are columns in a matrix. Diameter is the length of the longest geodesic in the two-mode network within components. Fragmentation is the proportion of vertices that cannot reach each other (Borgatti et al., 2013; Wasserman and Faust, 1994).

2.2 Two-mode centrality and row exclusivity

Two-mode centrality calculates the two-mode versions of degree and betweenness centrality. Any two-mode network can be represented as a bipartite graph and this can be submitted to the standard one-mode centrality routines. This routine normalizes the scores against the maximum possible scores in an equivalently sized connected two-mode network and provides appropriately scaled measures (Borgatti and Everett, 1997; Everett, 2016). The centrality degree of a node determines the number of direct incoming and outgoing relations, and betweenness centrality means the degree of indirect connections between nodes, allowing to determine who or what in the network is best connected with other nodes, acts as bridges (in positive and negative meaning) and is also the most central node in the entire network with potentially high impact on other nodes in the network (Borgatti and Everett, 2000; Sarkar et al., 2022).

Additionally, in this area, it is indicated which nodes are characterized by the so-called specialty or row exclusivity, which were calculated using the formulas (Carley and Reminga, 2004):

for technology specialty $\sum_{j=1}^{|T|} \mathrm{AT}(i,j) * \exp\left(1 - \mathrm{sum}\left(\mathrm{AT}(:,j)\right)\right)$

for services provided specialty $\sum_{j=1}^{|SP|} \mathrm{ASP}(i,j) * \exp\left(1 - \mathrm{sum}\left(\mathrm{ASP}(:,j)\right)\right)$

where:

|T| – number of elements in set T (technology)
|SP| – number of elements in set SP (service provided)
A – DIH's name, actor (A)
AT(i,j) – actor *i* uses technology *j*
ASP(i,j) – actor *i* provides service *j*

3. Results and data analysis

Based on the nodes in Table 1, two-modal networks were created: actor x technology (AT_{ij}) and actor x services provided (SP_{ij}), which are illustrated in Figures 1 and 2. Affiliation networks indicate which technologies and services are provided by a given DIH. The density is 0.315 (137 links) in the technology network, which means that the DIHs offer slightly over 30% of technologies in Poland. In the case of the services provided network, the density is 0.517 (124 links), i.e. almost 52% of services are offered by Polish DIHs of all possible (see Table 1 and Figure 1, 2). The diameter for both networks is 4.000. The longest distance between 2 technologies and services in the network is 4 (4 pairs of nodes had this geodetic distance). The larger the diameter, the less tightly connected the nets. The fragmentation for the technology network is 0.217, and for the service network, it is 0.065. It means that the percentage of nodes in the technology network that are disconnected from actors is 22%, and in the services provided network – 6.5%. There is a particular risk of not linking actors with technology and services. However, it is impossible to estimate this risk's acceptable/unacceptable level due to the lack of comparable studies.

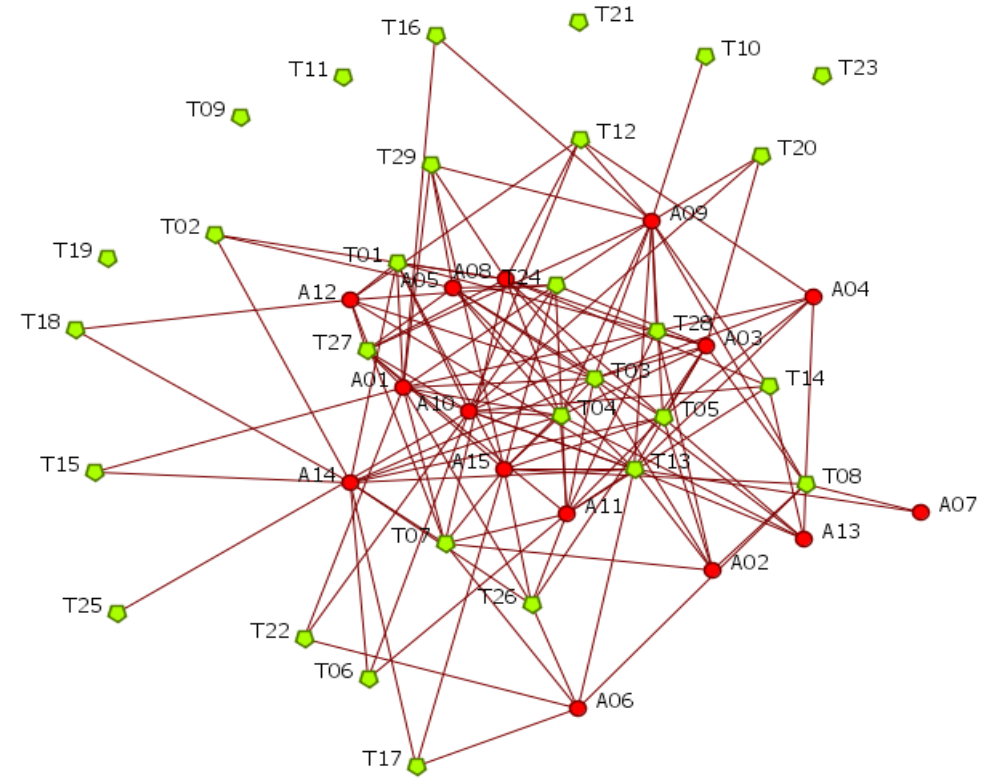


Figure 1: Visualization of an affiliation network: actor x technology

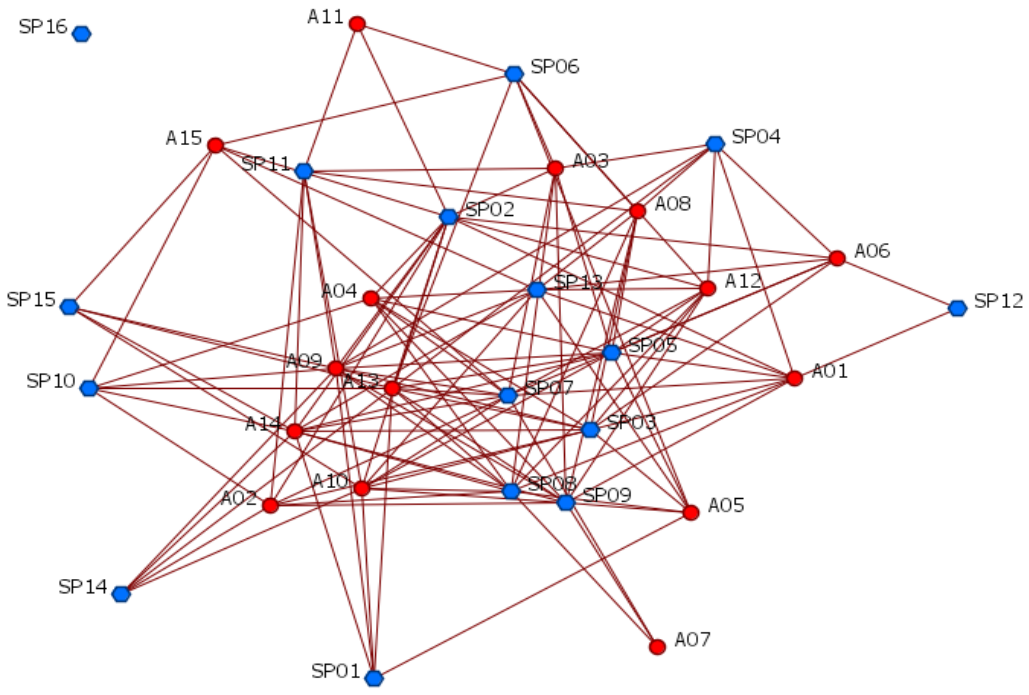


Figure 2: Visualization of an affiliation network: actor x services provided

Table 2 shows the normalized results for two-mode centrality: degree and betweenness for the network technology and services provided. The thing about two-modal centrality is that they show the results for each mode. For the technology network, the most central technologies (in the sense of incoming and outcoming connections) are artificial intelligence - T03 (0.800), big data, data analytics, data handling - T04 (0.667), cloud computing - T05 (0.677), and internet of things - T13 (0.933). On the other hand, betweenness centrality, a connecting node that is best connected with other nodes, with a potentially high impact on other nodes in the

network, is again artificial intelligence - T03 (0.052) and the internet of things - T13 (0.109). Central actors (DIHs) are A01 (0.542) and A09 (0.583), as is the case of betweenness centrality. Additionally, we can include here the actors A10 (0.119) and A14 (0.110). For the services provided network, the most central services are awareness creation - SP02, ecosystem building, scouting, brokerage, networking - SP07, education and skills development - SP08, incubator/accelerator support - SP09 (0.800). The services that connect the most are access to funding and investor readiness services - SP01 (0.088) as well as ecosystem building, scouting, brokerage, networking - SP07 (0.076). In contrast, the most influential DIHs in the service network are A09 (0.867), A13, and A14 (0.800). For betweenness centrality: A01 (0.058) and A14 (0.067).

Table 2: Two-mode centralities of technology network and services provided network with actor's specialties

Technology network							**Services provided network**						
T	D	B	A	D	B	Actor's Technology Specialty	SP	D	B	A	D	B	Actor's Services Provided Specialty
T01	0.467	0.020	**A01**	0.542	0.102	T15, T16	**SP01**	0.333	0.006	**A01**	0.600	0.058	SP12
T02	0.200	0.002	**A02**	0.250	0.010	T07, T08, T28	**SP02**	0.800	0.082	**A02**	0.533	0.026	SP14
T03	0.800	0.052	**A03**	0.417	0.040	T20	**SP03**	0.733	0.046	**A03**	0.533	0.026	SP04, SP06, SP11
T04	0.667	0.040	**A04**	0.250	0.012	T12	**SP04**	0.467	0.017	**A04**	0.533	0.019	SP10
T05	0.677	0.034	**A05**	0.333	0.025	T02	**SP05**	0.733	0.045	**A05**	0.467	0.019	SP01
T06	0.200	0.004	**A06**	0.250	0.022	T17, T22	**SP06**	0.467	0.029	**A06**	0.467	0.037	SP12
T07	0.533	0.025	**A07**	0.083	0.001	T08	**SP07**	0.800	0.071	**A07**	0.200	0.001	SP07, SP08, SP09
T08	0.533	0.028	**A08**	0.458	0.052	T02	**SP08**	0.800	0.061	**A08**	0.533	0.026	SP04, SP06, SP11
T09	0	0	**A09**	0.583	0.141	T10	**SP09**	0.800	0.061	**A09**	0.867	0.082	SP01, SP14, SP15
T10	0.067	0.000	**A10**	0.500	0.119	T25	**SP10**	0.400	0.011	**A10**	0.733	0.054	SP01, SP14, SP15
T11	0	0	**A11**	0.458	0.047	T06	**SP11**	0.467	0.025	**A11**	0.200	0.004	SP06, SP11
T12	0.333	0.011	**A12**	0.333	0.037	T18	**SP12**	0.133	0.000	**A12**	0.600	0.028	SP04, SP06
T13	0.933	0.109	**A13**	0.250	0.011	T14	**SP13**	0.667	0.042	**A13**	0.800	0.076	SP01, SP14, SP15
T14	0.333	0.009	**A14**	0.500	0.110	T15, T18	**SP14**	0.333	0.005	**A14**	0.800	0.067	SP01, SP14, SP15
T15	0.133	0.001	**A15**	0.500	0.064	T17	**SP15**	0.333	0.007	**A15**	0.400	0.018	SP15
T16	0.133	0.001					**SP16**	0	0				
T17	0.200	0.003	**Legend:**										
T18	0.133	0.001	D (degree centrality); B (betweenness centrality); T (technology); A (actor, DIH); SP (service provided).										
T19	0	0	**Value statistics for actor node centrality (D) in actor x technology network**										
T20	0.200	0.003	Min:	0.083	Mean:	0.381	Lower quartile:	0.250					
T21	0	0	Max:	0.583	Std.dev:	0.138	Median:	0.417					
T22	0.200	0.005					Upper quartile:	0.500					
T23	0	0	**Value statistics for technology node centrality (D) in actor x technology network**										
T24	0.533	0.023	Min:	0.067	Mean:	0.381	Lower quartile:	0.200					
T25	0.067	0.000	Max:	0.933	Std.dev:	0.235	Median:	0.333					
T26	0.400	0.012					Upper quartile:	0.533					
T27	0.533	0.024	**Value statistics for actor node centrality (D) in actor x services provided network**										
T28	0.533	0.024	Min:	0.200	Mean:	0.551	Lower quartile:	0.467					
T29	0.333	0.007	Max:	0.867	Std.dev:	0.191	Median:	0.533					
							Upper quartile:	0.733					
			Value statistics for services provided node centrality (D) in actor x services provided network										
			Min:	0.133	Mean:	0.551	Lower quartile:	0.333					
			Max:	0.800	Std.dev:	0.214	Median:	0.467					
							Upper quartile:	0.800					

The so-called "specialty" results are interesting, which detect row nodes that have ties to column nodes that comparatively few other row nodes have (Altman et al., 2020; Ashworth and Carley, 2006). The specialty (row exclusivity) results indicate the actors (DIHs) from the perspective of unique technologies and services provided, which may be beneficial information for companies with which DIHs cooperate in a given specialization. When computed on an actor x technology (AT_{ij}) and actor x services provided (AS_{ij}) networks, this is called technology/services provided exclusivity and detects actors who offer technology/services that few other actors provide. Figure 3, like Figures 1 and 2, was obtained using the ORA PRO program (Altman et al., 2020).

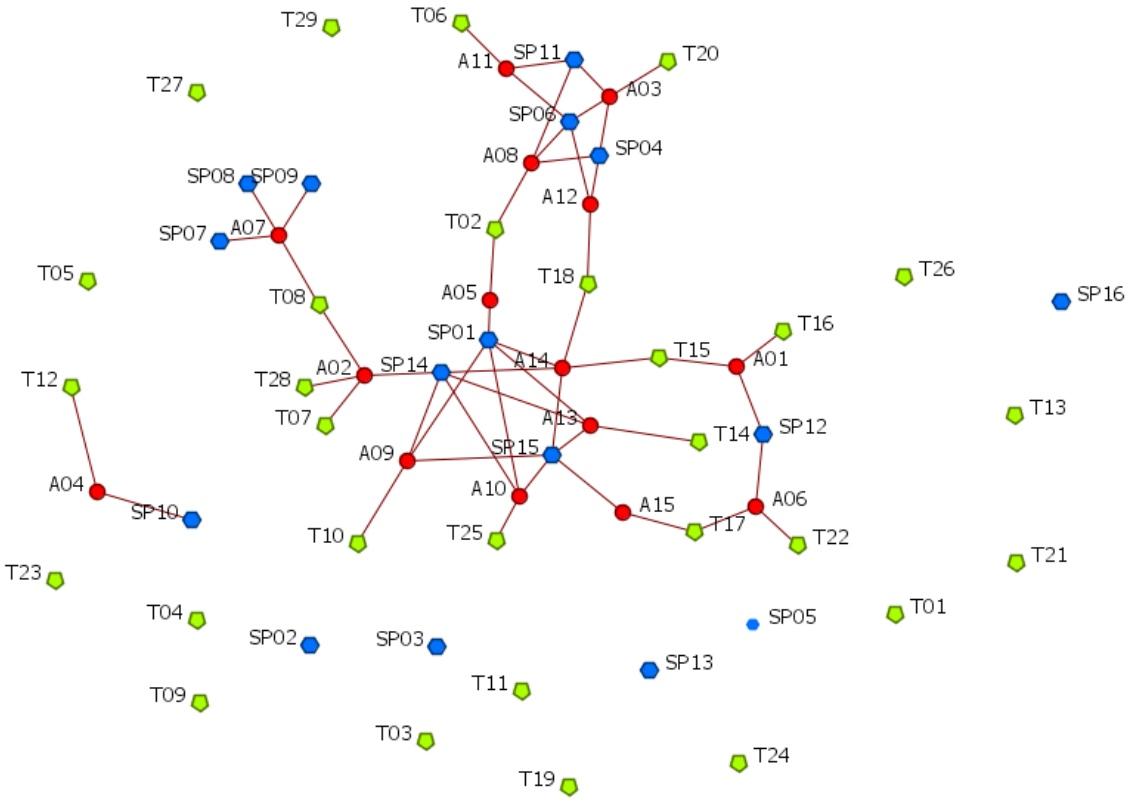


Figure 3: Visualization of actors' (DIHs) technology and services provided specialties

Figure 3 shows the links between actors and technology; and actors and services in the context of their specialty (exclusivity). It also indicates through which technologies and services a given DIH are linked to another in the region. For example, actor A01 is associated with actor A06 through SP012 (pre-competitive series production) and with actor A14 through T15 (laser-based manufacturing). In turn, actor A09 is related to actor A05 and A14 through SP01 (access to funding and investor readiness services); and with actor A02 through SP14 (testing and validation). On the other hand, with actor A13 through SP01 (access to funding and investor readiness services), SP14 (testing and validation), and SP15 (voice of the customer, product consortia). The same actors, A01 and A09, have the highest betweenness centrality (see Table 1). Such analysis can be the basis for technological or service cooperation between DIHs based on shared specializations.

4. Conclusion

The article is the first attempt to capture the digital innovation hubs of a given region from the perspective of a network of relationships and interdependencies. Wherever there is a given community of coexisting entities, the network analysis instruments are used to study the network of relations structure, as well as the position of nodes in the network and their potential impact on the remaining ones in the studied population (within the adopted network boundary). Here, the network boundary were DIHs operating in a given region, i.e. one of the European Union countries. Concerning the research questions posed in the introduction (RQ1, RQ2, RQ3), the following answers are formed:

RQ1: How cohesive are technology and services provided networks?

The topology of technology and services provided networks in terms of their density, diameter, and fragmentation indicate that the studied networks have a relatively high density of connections between actors and technologies (31.5%); actors and services (52%). The diameter of the network is 4. The longer the distance, the further the node is from other network participants, which may result in isolating it from the flow of knowledge, information, or experiences. The risk of network fragmentation (scattering) is visible in the case of the technological network (0.217) and services provided network (0.065), but there is no reference to other networks here to indicate the scale of the risk.

RQ2: Which digital innovation hubs, technologies, and services are centrally positioned in the networks?

The degree of centrality (incoming and outcoming) and betweenness centrality for each node in the networks were presented in Table. For actors in the technology network, the minimum centrality (min) value was 0.083, the maximum (max) 0.583. The mean for the entire network was 0.381, and the standard deviation (SD) was 0.138. On the other hand, for technology nodes, value statistics are slightly different, the value of min. = 0.067, max. = 0.993, mean = 0.381, and SD = 0.235. In services provided network and actors of this network, min. = 0.200, max. = 0.867, mean = 0.551, SD = 0.191; for services provided node: min. = 0.133, max. = 0.800, mean = 0.551, and SD = 0.214.

The most central technologies from the point of view of the most frequently offered by actors (DIHs) are T13 (Internet of things), T03 (Artificial intelligence), T05 (Cloud computing), T04 (Big data, data analytics, data handling). The technologies T07 (Cyber-physical system), T08 (Cyber security), T24 (Robotics), T27 (Simulation, modeling, and digital twins), and T28 (Software as a service and service) are equivalent in terms of central position in the network (0.533). architectures). The T13 (Internet of things) technology fulfills the functions of a broker or an intermediary between technologies, which may mean that many products and services are based on the use of this technology. In turn, the central actors (in terms of the number of technologies offered) are A09, A01, A10, A14, and A15. The functions of brokers, intermediaries between actors in the technology network can be assigned to actor A09, whose centrality betweenness was 0.141, and to actor A10 (0.119).

In the service network, the most central services are SP02 (Awareness creation), SP07 (Ecosystem building, scouting, brokerage, networking), A08 (Education and skills development), and A09 (Incubator/accelerator support). The service that acts as an intermediary between services in the network is SP02 (Awareness creation). In turn, the most central actors in the service network are A09, A13, A14, and acting as a broker in the service network is A09 (0.082).

The value of these studies is the indication of technological specialization and services in a given region, which may be an indication for potential investors from Poland, but also from other countries with which DIHs cooperate technologically or as part of the provision of services/products, taking into account their central role in technology network and services.

RQ3: What are the DIHs' specialties in technology and services provided?

To identify which DIHs (actors) specialize in a given technology and services provided, row exclusivity formulas (as presented in Section 2.2), also called specialty, were used. Table 2 included specific technologies and services that are unique to a given DIH, i.e. actors (A01-A15), which for technology are as follow: A01' unique technological competences are T15 (Laser-based manufacturing) and T16 (Logistics); for A02: T07 (Cyber-physical systems), T08 (Cyber security), and T28 (Software as a service and service architectures); A03: T20 (New media technologies); for A04: T12 (Interaction technologies); for A05: T02 (Advanced, or high-performance computing); for A06: T17 (Micro/nanoelectronics) and T22 (Photonics and imaging technologies); for A07: T08 (Cyber security); for A08: T02 (Advanced, or high-performance computing); for A09: T10 (Gamification); for A10: T25 (Screens and display technologies); for A11: T06 (Communication networks); for A12: T18 (Mobility & location-based technologies); for A13: T14 (Internet services); for A14: T15 (Laser-based manufacturing) and T18 (Mobility & location-based technologies); finally for A15: T17 (Micro/nanoelectronics).

In the case of services, unique services are provided by the following actors: for A01: SP12 (Pre-competitive series production); for A02: SP14 (Visioning and strategy development for businesses); for A03: SP04 (Commercial infrastructure), SP06 (Digital maturity assessment), and SP11 (Mentoring); for A04: SP10 (Market intelligence); for A05: SP01 (Access to funding and investor readiness services); for A06: SP12 (Pre-competitive series production); for A07: SP07 (Ecosystem building, scouting, brokerage, networking), SP08 (Education and skills development), and SP09 (Incubator/accelerator support); for A08: SP04 (Commercial infrastructure), SP06 (Digital maturity assessment), and SP11 (Mentoring); for A09, A10, A13, and A14: SP01 (Access to funding and investor readiness services), SP14 (Visioning and strategy development for businesses), and SP15 (Voice of the customer, product consortia); for A11: SP06 (Digital maturity assessment) and SP11 (Mentoring); for A12: SP04 (Commercial infrastructure) and SP06 (Digital maturity assessment); finally for A15: SP15 (Voice of the customer, product consortia). Contrary to centrality measures (see RQ2), the specialization of actors (row exclusivity) in

this approach focuses on DIHs, which have unique (compared to other DIHs) technological and service competences in the region.

5. Limitations and future research

The research was carried out using secondary and publicly available data collected as part of the EU's Smart Specialization Platform tools, including the Digital Innovation Hub. One country (Poland) was taken into account, whose Digital Innovation Hubs profiles were presented in a standardized way through this Platform. The data is primarily declarative, mostly based on submissions from organizations, research centers, and institutions whose idea is to provide technologically advanced digital services that are the domain of European DIH and Industry 4.0. This research area was narrowed down to only two networks: technology and services provided, which in no way exhausts the areas of DIHs analysis operating in the region. The comprehensive research will be the subject of further studies in other EU countries, which will enable comparative measurements, taking into account the measures presented in these studies. This would make it possible to assess what DIHs (in terms of their dominant technologies or services) characterize other EU regions, as well as what their structure and connections are.

References

Altman, N., Carley, K.M. and Reminga, J. (2020), ORA User's Guide 2020, Carnegie Mellon University, School of Computer Science, Institute for Software Research, Pittsburgh, Pennsylvania, Technical Report CMU-ISR-20-110.

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.

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. and Everett, M.G. (2000), "Models of core/periphery structures", Social Networks, Vol. 21 No. 4, pp. 375–395.

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, Harvard.

Borgatti, S.P., Everett, M.G. and Johnson, J.C. (2013), Analyzing Social Networks, SAGE Publications, London.

Carley, K.M. and Reminga, J. (2004), Ora: Organization Risk Analyzer, Carnegie Mellon University, School of Computer Science, Institute for Software Research, Pittsburgh, Pennsylvania, CASOS Technical Report, CMU-ISRI-04-106.

COM (2016), „Digitising European industry: Reaping the full benefits of a digital single market," available at:https://ec.europa.eu/transparency/documents-register/api/files/COM(2016)180_0/de00000000324429?rendition=false

DEI (2016), "Digitising European industry," available at: https://www.eca.europa.eu/lists/ecadocuments/ap19_13/ap__digitising_industry_en.pdf.

Eurostat (2021), How digitalised are EU's enterprises?, available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211029-1

Everett, M.G. (2016), "Centrality and the dual-projection approach for two-mode social network data", Methodological Innovations, SAGE Publications, London.

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.

Gancarczyk, M. and Ujwary-Gil, A. (2021), "Entrepreneurial cognition or judgment: Management and economics approaches to the entrepreneur's choices", Journal of Entrepreneurship, Management and Innovation, Vol. 17 No. 1, pp. 7–23.

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.

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.

MPiT (2019), "Standaryzacja usług hubów innowacji cyfrowych dla wsparcia cyfrowej transformacji przedsiębiorstw," available at: https://www.gov.pl/web/rozwoj-technologia/mpit-oglasza-konkurs-dla-hubow-innowacji-cyfrowych

Prell, C. (2012), Social Network Analysis: History, Theory and Methodology, SAGE Publications, London.

Robins, G. (2015), Doing Social Network Research: Network-Based Research Design for Social Scientists, Sage Publications, London.

Sarkar, S., Bhagwat, A. and Mukherjee, A. (2022), "A core-periphery structure-based network embedding approach", Social Network Analysis and Mining, Vol. 12 No. 1, available at: https://doi.org/10.1007/s13278-021-00749-9.

S3 Tools and Data Sources (2022), Digital Innovation Hubs, available at: https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool

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. (2020), Organizational Network Analysis: Auditing Intangible Resources, Routledge, New York.

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. 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.

Vakirayi, T. and Belle, J.-P.V. (2020), “Exploring the role of digital innovation hubs in socioeconomic development”, presented at the 2020 Conference on Information Communications Technology and Society, ICTAS 2020 - Proceedings, available at: https://doi.org/10.1109/ICTAS47918.2020.233992.

Wasserman, S. and Faust, K. (1994), Social Network Analysis: Methods and Applications, Cambridge University Press, Cambridge.

The Positive Impact of Relation Capital in Family firm: The Latent Generation

Marzia Ventura[1*], Anna Maria Melina[1] and Walter Vesperi[2]
[1]Magna Graecia University of Catanzaro, Catanzaro (IT)
[2]University of Messina, Messina (IT)
marziaventura@unicz.it
amelina@unicz.it
wvesperi@unime.it

Abstract: The purpose of this paper is to focus on the role that the family system plays in the creation of a family firm and during the first generation. The concept of latent generation emerges, a generation, coeval with the first generation, which through the constant and mutual sharing of the dimensions of the relational capital that has a positive impact on strategic choices of the family firm.

Keywords: Family firms, Conceptual Model, Latent Generation, Relation Capital, Knowledge management

1. Introduction

Family Firms (in abbreviation FFs) play a significant role in the current economic system. FFs are organizations in which two or more family members influence the making strategic choices (Tagiuri and Davis, 1996; Davis et al, 1997) through the exercise of family ties, management roles or property rights. In FF there is a unique interaction between "family system" and the "business system" (Davis et.al., 1997; Tagiuri and Davis, 1996).

Kellermanns et al. (2008) argue that FF must satisfy at least one of three criteria: (i) being family ruled/managed, (ii) having a vision for the company consistent with the strategic direction held by the family and (iii) be potentially sustainable across multiple generation in the organization. The influence of the family, in business system, can vary over time e it can be manifested in many different ways (Astrachan et al., 2002; Klein et al, 2005). Generational involvement in FF represents a relevant element as family members of the new generations tend be a driving force for change (Kepner, 1991) and innovation (Litz and Kleysen, 2001). These interpersonal relationships defined by frequent interactions involve family members in many decisions. A large field of research has focused on the dilemma of long-term survival. In particular, scholars identify the succession as the most critical moment in the life of the FF. Succession is a challenge for FF, as it may involve the successor's ability to acquire the predecessor's key knowledge and skills adequately in order to maintain and improve the company's organizational performance (Cabrera-Suarez, et al., 2001). Starting from the assumption that FFs, even during the first generation, integrate family and business interests (Handler, 1994; Bozer, et al., 2017) creating complex relational dynamics that can interfere with the survival of FF, consequently, emerges the presence of a unexplored and not considered generation and currently not considered by the academic literature. We have defined this unexplored and not considered generation as "latent generation" that is, the generation that precedes the first generation made up of family members of the entrepreneur and that for relational dynamics and relational capital that affect the management of FF (Arregle, et al., 2007). The term relational capital collectively captures a firm's intangible assets, including the quality of relations, general business environment, collaboration, communication, value and image of the firm, as well as trust, obligation, and identification between various firm stakeholders (Cucculelli et al., 2019; Daspit and Long, 2014). The relational dimension represents the resources acquired or generated through personal relationships, such as trust, obligations, norms, and identification (Carr et al., 2011; Nahapiet and Ghoshal, 1998). Relational capital has been shown to create value and lead to competitive advantages (Adler and Kwon, 2002, Maurer et al., 2011, Carey et al., 2011, Kohtamäki et al., 2012) through ability to develop trust and identification (Daspit and Long, 2014), and overall positive impact on a firm's success and performance (Niazi, 2017; Sullivan, 1999). Lawson et al. (2008) and Villena et al. (2011) describe that relational capital occurring through the frequent interaction process. Granovetter (1985), Kale et al. (2000) and Nahapiet and Ghoshal (1998) explained that relational capital is demonstrated by mutual trust, mutual respect and friendship that exists between the two parties who conduct business relationships through interactions that occur from year to year. Other researchers reiterate this, stating that it is represented by various attributes, again such as mutual trust (Carey et al., 2011), mutual reciprocity (Mathwick et al., 2008) and commitment (McLure et al, 2005). In managerial and organization studies, a consolidation of a new phenomenon requires a reflection to evaluate futures directions in order to obtain an in-

depth and organic vision of the phenomenon. For this reason, our study extends the theoretical framework on FFs and the relationship between the first generation and "Latent generation". The purpose of this conceptual paper is to provide a moment of reflection for the field of FFs studies, offering a clear understanding of the phenomenon by focusing on the first generation and the previous generation (latent generation). The study therefore aims to investigate aspects of the academic literature currently not fully addressed and to offer new theoretical approaches. The results of this study offer scholars and practitioners interested in FF' studies to gain new insights about the first generation and relationships with family members. We also argue that an "implicit" generation handover also exists in the first generation.

2. Theoretical Framework

2.1 Defining family and business system

Mainstream on FFs studies focuses on understanding the mutual impact of family relations and business systems, identifying these relations as the critical variable of these firms (Astrachan, 2003; Dyer, 2003; Habbershon et al., 2003; Rogoff and Heck, 2003; Zahra, 2003 Chrisman et al., 2003). For decades, a very large area of academic debate has focused on models and mutual relationships in FF. Recognizing that the family and the business are fundamental elements in FFs, several studies suggest that the success of FFs depends on the overlap between family and business (Olson et.al, 2003, Mitchell, et al., 2003). These studies aim to encourage the simultaneous development of the family system and the creation of profitable businesses (Stafford, et.al., 1999).

Researchers in the field of management and organization theories have begun to define FFs, based on the presence of the "family" component within the ownership and management of the company (De Massis, et al., 2018; Daspit et al., 2021). Following these studies, it emerges that there are three elements to be analyzed for the definition of the FFs: a) ownership, i.e. the property is controlled by a family unit; b) management is mainly entrusted to family members; c) transgenerational succession, i.e. at least two generations are present at the same time. Chrisman et al. (2003) define an FF based on the degree of family involvement in a variety of business-related aspects such as ownership, management or succession.

Given that the success of a succession process is positively related to the harmonious coexistence of its family members (Venter, et.al, 2005), family principals may exercise pressures on the social capital in their company (Ruiz Jiménez, et. al., 2015) as a form of power to achieve family harmony.

Additionally, the greater the desire to transfer the firm to the next generation, the greater the legitimacy and the urgency of the family will be to pursue family harmony and to stimulate family members' identification with the firm (i.e., family-centered noneconomic goals).

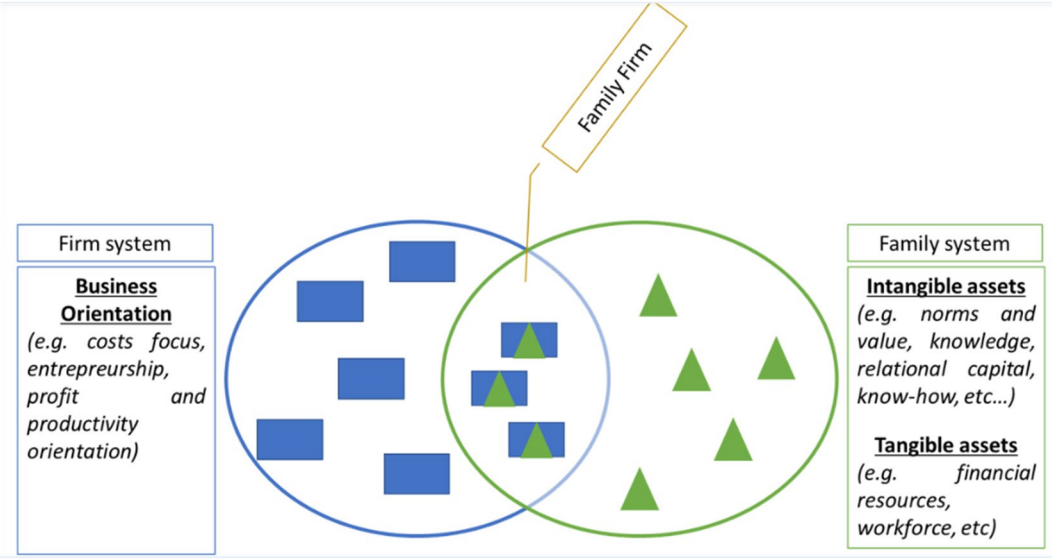


Figure 1: Overlap of family and firm system in FF

Source: Tagiuri and Davis, 1996

Figure 1 shows the reciprocal relationships between business system and family system (Tagiuri and Davis, 1996). Within a FF, the assets of the business system and the family system are combined. According to this perspective, the FF is the integration of different assets and orientations. FFs have a complex two-component nature, consisting of a combination of family and business systems. Family members are part of both the family system and the business system. This situation can generate a conflict as each system has its own rules, roles, values and knowledge. While close relationships are an important factor in family systems; the business system is a system in which rationality and formal relations are more dominant. Family ownership and management can provide the business with valuable resources and strategic skills in the value creation process. Habbershon and Williams (1999) identify FFs as a set of distinctive resources and skills, resulting from the interaction of family members with the business. The advantage of these relationships consists in the creation of assets that are difficult to imitate by competitors, being combined in a unique way and largely dependent on family relationships with the company. A high degree of family involvement can increase the company's tendency to prioritize the control and survival of the FF over profit maximization or growth objectives (Berrone, et al., 2012; Kotlar and De Massis, 2013; De Massis, et al., 2016). In the creation of a new business, family members are actively involved and can provide both intangible and tangible assets such as commitment, long-term reputational and emotional investment in the company, specific knowledge and operational know-how, and relational capital (Habbershon and Williams, 1999; Sirmon and Hitt, 2003; Miller and Le Breton-Miller, 2006; Gomez- Mejía, et al., 2007). Academic literature has focused on family management and involvement from the first generation to the next. On the other hand, a high level of family involvement is evident right from the creation phase of the new business activity, with the aim of preserving the family assets invested in the business (Berrone et al. 2012; Gómez-Mejía et al. 2007; Carney 2005). The level of family involvement in the board of directors is not formalized but is able to influence the planning and implementation of strategic initiatives. McNeish et.al. (2010) discussed that the relational capital acts through knowledge sharing. Infact, Andersén (2015) discussed that a family firm's level of relational capital, derived from mutual relationship of familiness, play an important role in facilitating organizational learning thus enabling it to better transform and use internal and external knowledge. The result of knowledge sharing in relational capital can make the latent generation and first generation focus on the long-term benefits of the relationship (Luhmann, 1979; McAllister, 1995; Wicks and Berman, 2004; Williamson, 1981; Zaheer et al., 1998). In the current competitive environment, knowledge is the most important strategic resource for the success and survival of an organization (Nahapiet et al, 1998; Spender et al, 1996). The ability of an organization to exploit knowledge depends on the people within the organization who create share and use knowledge. Knowledge transfer is a process that requires commitment of resources, managerial time, attentions, and efforts.To make the knowledge transfer effective, family firms may leverage relational capital with the generations to mobilize their own organizational and human capital for achieving a better knowledge (Chung-Jen Chen et al, 2009).

Knowledge sharing is a core activity in most companies, nevertheless, the studies and research exploring knowledge sharing in family context appear limited (Woodfield and Husted, 2019). Sirmon and Hitt (2003) argue that FFs have many sources of knowledge held by individuals within the organization, which when combined can enrich the knowledge base and ultimate competitive advantage of the business. Sanchez-Famoso and Maseda (2014) argue that to activate knowledge in FFs, sharing through interaction is also essential to strengthen or transform existing organizational knowledge. In this sense, Woodfield and Husted (2017) underline that FFs benefit from a greater relational flow between the members of the organization, which is particularly relevant to tacit-to-tacit knowledge transfer. Knowledge sharing is a social, interactive, and complex process, which includes both tacit and explicit knowledge (Polanyi, 1966). Trevinyo-Rodríguez and Bontis (2010) emphasize that the sharing of knowledge between family members (so-called family wisdom) is essential and benefits future generations. In FFs, knowledge sharing is often framed as mentoring process or knowledge accumulation (Chirico, 2008). Durst and Edvardsson (2012) argue that in FFs knowledge sharing is often characterized by the managerial awareness and intentions of the individual in leadership positions in the organization. Lin (2013) found that FFs share knowledge through sharing networks where the intention to share is based on a reciprocal and multidirectional flow to the benefit of the entire organization. In according to Ganesan et al., 2005, although uncoded and tacit knowledge is particularly difficult to share, the strong relational bonds of FFs can produce powerful informal mechanisms for sharing knowledge. Frequent face-to-face meetings, many shared values can be the basis for informal and effective knowledge sharing practices. Informal social interactions increase the opportunities for sharing ideas and knowledge within FFs. Several authors (e.g., Ensley and Pearson, 2005) point out that "familiarity" can be a source of relevant, rare and inimitable resources and skills. Habbershon and Astrachan (1997) argue that the informal knowledge-sharing practices of well-known FFs are impromptu meetings and discussions that help build unity and consensus on organizational goals, values and decisions.

Within a FF, conversations and relations do not necessarily take place within the business context, but also outside of it, such as during family events or in casual conversations after work. These informal exchanges can foster shared knowledge, a re-evaluation of beliefs, generating a greater understanding of the collective vision. Pieper and Klein (2007) see each individual in the organization as capable of influencing the business system.

Knowledge sharing in FFs is therefore seen as the process of transferring the wisdom, skills and know-how of individuals to generate a greater resource of knowledge. Cunningham et al. (2016) highlight that sharing knowledge should not seek to build a static stock of resources but should allow for the mobilization of knowledge in mutual and meaningful exchanges.

3. Methodology

This study uses a dual methodological approach: qualitative and exploratory. Through an exploration of the literature reconstructs a conceptual framework based on the reciprocal relationships between business and family and the informal mechanisms of knowledge sharing, capable of facilitating an alternative analysis of the family firm. The model proposed is based on the analysis of case study, semi - structured interviews and observed participation.

4. Results

The academic literature on FFs highlights that the reciprocal relationship between the business system and the family system manifest themselves as continuous and interdependent flows of knowledge and information exchange. Several studies focus on relationships and the composition of the board of directors of FFs (Maseda, et al., 2019; Molly, et al., 2019), focusing on the presence of family and non-family members. While studies on the role of relationships in FFs, during the creation phase and the first generation, seem limited. The vast majority of FFs, especially in the creation phase and the first generation are SMEs (European Commission, 2009). In the early phase of the life of a FF and during the first generation, the entrepreneur is supported by the family, which aims to preserve the resources invested. The family, therefore, does not formally enter the board of directors or the management of the new FF, but is able to influence strategic choices. Informal governance mechanisms allow FFs to develop and generate stakeholder value (Chrisman et al., 2018). The conceptual model proposed below is based on these assumptions. Several studies show the importance of social relations as flows of knowledge and information exchange in FFs (Sievinen, et al., 2021; Calabrò, et al., 2018; De Massis and Foss, 2018). The conceptual model is first result obtained by our study and it focuses on the informal relationships that influence the creation and strategic management of the FFs during the first generation, forming an informal board of directors.

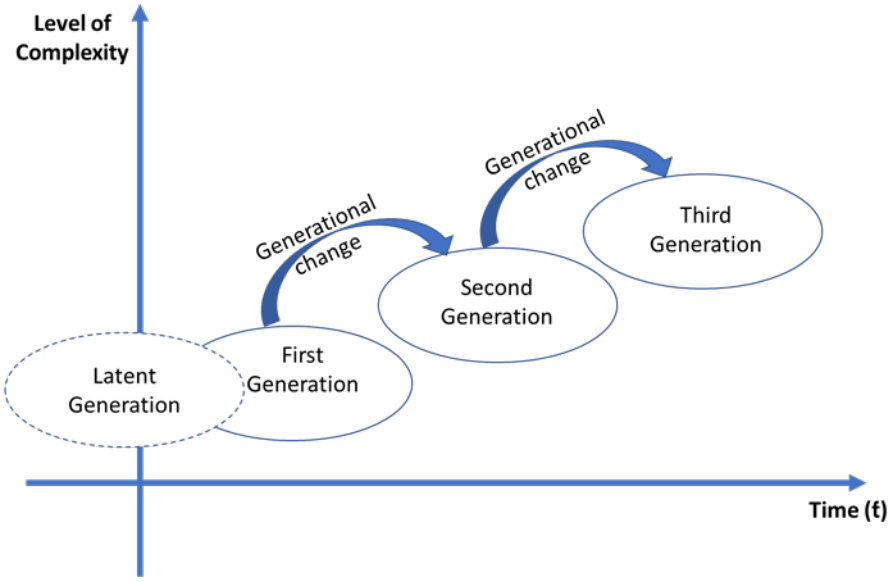


Figure 2: The Conceptual model of latent generation

Source: own elaboration

Figure 2 represents the relationship between the latent generation and the first generation. Figure 2 relates two dimensions: Level of Complexity (LoC) and Time (t). The first dimension - LoC - is a generic dimension that represents the evolution of the organizational model (Ventura, et al., 2020). The second dimension is time. FFs are subject to generational change over time. This generational change allows the FF to survive over time. Figure 2 highlights the passage from one generation to another over time. This step leads to an increase in organizational complexity. The innovative element of figure 2 is the presence of the latent generation. The latent generation is a generation coeval with the first generation. Often represented by close relatives (e.g., parents, brothers or uncles) who are not formally on the board of the FF but influence the governance of the FF itself. As mentioned above, latent generation influences governance through informal knowledge sharing mechanisms.

In figure 2, the latent generation is represented overlap to the first generation. Hult et al. (2002) explain that the sharing of knowledge occurring relationships between latent and first generation can lead to improved performance (Jacobs and Swink, 2011; Prahinski and Kocabasoglu, 2006). Furthermore, the knowledge that is shared between latent and first generation is required trust, which is one of the important dimensions of relational capital (Carey et al., 2011). The relational capital and knowledge of the latent generation represent the levers of the competitive advantage for the first generation. The latent generation has accumulated specific knowledge and relational capital before the first generation starts the business. In figure 2, the overlap between latent generation and first generation represents the influence that the family determines in strategic choices. Through the knowledge sharing and informal mechanisms, the latent generation determines influences in the life of the company. For this reason, in the figure 2 the latent generation is represented before the origin of the axes. The other main feature of the latent generation is the lack of a real generational shift with the first generation. The latent generation, through an "implicit" generation pass, supports the first generation for a limited period.

Interactions that occur in the family firm relationships create relationships manifested by mutual trust and respect, and good friendships. As stated, relationships based on good intentions and manifested through a number of attributes are known as relational capital. Relationships built on trust, friendship, of mutual respect and reciprocity are what makes the latent generation willing to share knowledge with the first generation. This leads to facilitating the first generation to make decisions, thought to apply latent generation knowledge, impacting on performance by first generation (McNeish et al., 2010; Rashed et al., 2013). The latent generation supports the first generation by knowledge sharing, especially relational capital. The latent generation possesses specific knowledge and relational capital in the sector in which the 1st generation starts their entrepreneurial activity. However, these authors also found that high levels of familiness inhibited family firms in terms knowledge acquisition. (Intihar and Pollack, 2012). Hammond, Pearson, and Holt (2016) viewed relational social capital as contributing to social legacy in family firms through enhancing consensus among family members and argued that a strong relational aspect was necessary for family firm continuity.

5. Conclusions and opportunities for future research

This study contributes to the development of FF studies, supporting the theory that a "generation" (latent generation), not previously considered in the literature, influences the life of the FF in the early stages, through the sharing of knowledge and relational capital. The conceptual model provided highlights the importance of the relatives (e.g., parents, brothers and/or uncles) of the founding entrepreneur of FFs. The concept of "latent generation" is deduced, meaning the close relatives of the founding entrepreneur who support the growth and management of the FF through a continuous and mutual flow of knowledge and information. Studies on FFs focused on a generation that includes parents, siblings and/or uncles that affects the strategic choices of the FF, even though it is not formally present. The latent generation, therefore, determines the emergence of an "informal board of directors" and "informal mechanisms for knowledge sharing". The reflections on the latent generation focus on the composition of the informal board of directors with close family members of the entrepreneur, not belonging to the company. Our model suggests that FFs, during creation and the first generation, are supported by a coeval generation that, through informal relationships, influences strategic choices. We have positioned our study in the area of knowledge management studies, focusing the attention of the flows between the business system and the family system on sharing knowledge.

This study is not without limitations. First, it is necessary to highlight that the issue of FFs and the relationship between business and family remain social and economic phenomena that are often difficult to generalize. The theoretical model proposed in Fig. 2 requires empirical validation. Furthermore, the proposed model does not

consider the phenomenon in relation to the economic sector, the type of product, the genre or the initial investment.

Above all, we are still testing the implications that the proposed conceptual model of latent generation has on the cases under analysis in a study. The study provides new direction to the family firms, which are analysed during the first generation. The analysis of the latent generation, from the perspective of informal relationships and sharing of knowledge, can be useful for analyzing the role of the family and relationships during entrepreneurial action. However, we will consider our efforts successful if we encourage other scholars to work on the impact of the latent generation, currently unexplored.

Future research could introduce and analyze the concept of latent generation through empirical investigation, to understand which variables to consider. Therefore, while aware of its limitations, we hope that what we propose in this article will help to advance the debate on FFs. We welcome future research efforts to examine aspects of latent generation.

References

Arregle, J. L., Duran, P., Hitt, M. A., & Van Essen, M. (2017). Why is family firms' internationalization unique? A meta-analysis. Entrepreneurship Theory and Practice, 41(5), 801-831.

Astrachan, J. H. (2010). Strategy in family business: Toward a multidimensional research agenda. Journal of Family Business Strategy, 1(1), 6-14.

Berrone, P., Cruz, C., & Gomez-Mejia, L. R. (2012). Socioemotional wealth in family firms: Theoretical dimensions, assessment approaches, and agenda for future research. Family Business Review, 25(3), 258-279.

Bozer, G., Levin, L., & Santora, J. C. (2017). Succession in family business: multi-source perspectives. Journal of Small Business and Enterprise Development.

Cabrera-Suárez, K., De Saá-Pérez, P., & García-Almeida, D. (2001). The succession process from a resource-and knowledge-based view of the family firm. Family Business Review, 14(1), 37-48.

Cai, S., Jun, M. and Yang, Z. (2010) 'Implementing supply chain information integration in China: the role of institutional forces and trust', Journal of Operations Management, Vol. 28, No. 3, pp.257–268

Calabrò, A., Minichilli, A., Amore, M. D., & Brogi, M. (2018). The courage to choose! Primogeniture and leadership succession in family firms. *Strategic Management Journal*, *39*(7), 2014-2035

Carr, J. C., Cole, M. S., Ring, J. K., & Blettner, D. P. (2011). A measure of variations in internal social capital among family firms. Entrepreneurship theory and practice, 35(6), 1207-1227.

Chirico, F. (2008). Knowledge accumulation in family firms: Evidence from four case studies. International Small Business Journal, 26(4), 433-462.

Chrisman J.J., Chua J.H., De Massis A., Minola T., Vismara S. (2016) Management processes and strategy execution in family firms: From "what" to "how" Small Business Economics, 47 , pp. 719-734.

Chrisman, J. J., Chua, J. H., & Sharma, P. (2005). Trends and directions in the development of a strategic management theory of the family firm. Entrepreneurship theory and practice, 29(5), 555-575.

Chrisman, J. J., Chua, J. H., Le Breton-Miller, I., Miller, D., & Steier, L. P. (2018). Governance mechanisms and family firms. *Entrepreneurship Theory and Practice*, *42*(2), 171-186.

Craig, J. B., & Newbert, S. L. (2020). Reconsidering socioemotional wealth: A Smithian-inspired socio-economic theory of decision-making in the family firm. Journal of Family Business Strategy, 11(4)

Cucculelli, M., Peruzzi, V., & Zazzaro, A. (2019). Relational capital in lending relationships: evidence from European family firms. Small Business Economics, 52(1), 277-301.

Cunningham, J., Seaman, C., & McGuire, D. (2016). Knowledge sharing in small family firms: A leadership perspective. Journal of Family Business Strategy, 7(1), 34-46.

Dagnino, C. A. C., & Pinna, E. (2017). The generational change in family businesses: Comparative analysis between Italy and Peru. Journal of Evolutionary Studies in Business, 2(2), 160-190.

Daspit, J. J., Chrisman, J. J., Ashton, T., & Evangelopoulos, N. (2021). Family Firm Heterogeneity: A Definition, Common Themes, Scholarly Progress, and Directions Forward. *Family Business Review*

Davis, J. A., Hampton, M. M., & Lansberg, I. (1997). Generation to generation: Life cycles of the family business. Harvard Business Press.

De Massis, A., & Foss, N. J. (2018). Advancing family business research: The promise of microfoundations. *Family Business Review*, *31*(4), 386-396.

De Massis, A., Frattini, F., Kotlar, J., Petruzzelli, A. M., & Wright, M. (2016). Innovation through tradition: Lessons from innovative family businesses and directions for future research. *Academy of management Perspectives*, *30*(1), 93-116

De Massis, A., Frattini, F., Majocchi, A., & Piscitello, L. (2018). Family firms in the global economy: Toward a deeper understanding of internationalization determinants, processes, and outcomes. Global Strategy Journal, 8(1), 3-21.

Durst, S., & Edvardsson, I. R. (2012). Knowledge management in SMEs: a literature review. Journal of Knowledge Management.

Dyer Jr, W. G. (2003). The family: The missing variable in organizational research. *Entrepreneurship theory and practice*, *27*(4), 401-416.

Gagne, M., Marwick, C., Brun de Pontet, S., & Wrosch, C. (2021). Family business succession: What's motivation got to do with it?. Family Business Review, 34(2), 154-167.

Gómez-Mejía, L. R., Haynes, K. T., Núñez-Nickel, M., Jacobson, K. J., & Moyano-Fuentes, J. (2007). Socioemotional wealth and business risks in family-controlled firms: Evidence from Spanish olive oil mills. *Administrative science quarterly*, *52*(1), 106-137.

Hatak, I. R., & Roessl, D. (2015). Relational competence-based knowledge transfer within intrafamily succession: An experimental study. Family Business Review, 28(1), 10-25.

Jacobs, M.A. and Swink, M. (2011) 'Product portfolio architectural complexity and operational performance: incorporating the roles of learning and fixed assets', Journal of Operations Management, Vol. 29, Nos. 7–8, pp.677–691 [online] http://doi.org/10.1016/j.jom.2011. 03.002.

Kellermanns, F. W., Eddleston, K. A., Barnett, T., & Pearson, A. (2008). An exploratory study of family member characteristics and involvement: Effects on entrepreneurial behavior in the family firm. Family business review, 21(1), 1-14.

Klein, S. B., Astrachan, J. H., & Smyrnios, K. X. (2005). The F–PEC scale of family influence: Construction, validation, and further implication for theory. Entrepreneurship theory and practice, 29(3), 321-339.

Kotlar, J., & De Massis, A. (2013). Goal setting in family firms: Goal diversity, social interactions, and collective commitment to family–centered goals. *Entrepreneurship Theory and Practice*, *37*(6), 1263-1288.

Lawson, B., Tyler, B.B. and Cousins, P.D. (2008) 'Antecedents and consequences of social capital on buyer performance improvement', Journal of Operations Management, Vol. 26, No. 3, pp.446–460

Le Breton–Miller, I., & Miller, D. (2006). Why do some family businesses out–compete? Governance, long–term orientations, and sustainable capability. Entrepreneurship theory and practice, 30(6), 731-746.

Lin, H. F. (2013). Examining the factors influencing knowledge management system adoption and continuance intention. Knowledge Management Research & Practice, 11(4), 389-404.

Maseda, A., Iturralde, T., Aparicio, G., Boulkeroua, L., & Cooper, S. (2019). Family board ownership, generational involvement and performance in family SMEs: a test of the S-shaped hypothesis. *European Journal of Management and Business Economics*.

Mathwick, C., Wiertz, C. and de Ruyter, K. (2008) 'Social capital production in a virtual P3 community', Journal of Consumer Research, Vol. 34, No. 6, pp.832–849

McLure Wasko, M. and Faraj, S. (2005) 'Why should I share? Examining social capital and knowledge contribution in electronic networks of practice', MIS Quarterly, Vol. 29, No. 1, pp.35–57

McNeish, J., Jit, I. and Mann, S. (2010) 'Knowledge sharing and trust in organizations', IUP Journal of Knowledge Management, Vol. 8, Nos. 1/2, pp.18–38.

Molly, V., Uhlaner, L. M., De Massis, A., & Laveren, E. (2019). Family-centered goals, family board representation, and debt financing. *Small Business Economics*, *53*(1), 269-286.

Pieper, T. M., & Klein, S. B. (2007). The bulleye: A systems approach to modeling family firms. Family Business Review, 20(4), 301-319.

Prahinski, C. and Kocabasoglu, C. (2006) 'Empirical research opportunities in reverse supply chains', Omega-International Journal of Management Science, Vol. 34, No. 6, pp.519–532

Rashed, C., Azeem, A. and Halim, Z. (2013) 'Effect of information and knowledge sharing on supply chain performance: a survey-based approach', Journal of Operations and …, Vol. 3, No. 2, pp.61–77

Ruiz Jiménez M.C., Vallejo Martos M.C.,Martines Jiménez R.M. (2015) Organisational harmony as a value in family businesses and its influence on performance Journal of Business Ethics, 126 , pp. 259-272

Sambasivan, M. and Yen, C.N. (2010) 'Strategic alliances in a manufacturing supply chain: influence of organizational culture from the manufacturer's perspective', International Journal of Physical Distribution & Logistics Management, Vol. 40, No. 6, pp.456–474

Sanchez-Famoso, V., & Maseda, A. (2014). The role of social capital in family firms to explain the innovation capabilities in recession time: An empirical study. In Entrepreneurship, innovation and economic crisis (pp. 77-84). Springer, Cham.

Schulze, W. S., Lubatkin, M. H., Dino, R. N., & Buchholtz, A. K. (2001). Agency relationships in family firms: Theory and evidence. Organization science, 12(2), 99-116.

Sharma, P. (2004). An overview of the field of family business studies: Current status and directions for the future. Family business review, 17(1), 1-36.

Sievinen, H. M., Ikäheimonen, T., & Pihkala, T. (2021). The role of dyadic interactions between CEOs, chairs and owners in family firm governance. *Journal of Management and Governance*, 1-31.

Steier, L. (2001). Family firms, plural forms of governance, and the evolving role of trust. Family Business Review, 14(4), 353-368.

Tagiuri, R., & Davis, J. (1996). Bivalent attributes of the family firm. Family business review, 9(2), 199-208.

Trevinyo-Rodríguez, R. N., & Bontis, N. (2010). Family ties and emotions: a missing piece in the knowledge transfer puzzle. Journal of Small business and enterprise development.

Ventura, M., Vesperi, W., Melina, A. M., & Reina, R. (2020). Resilience in family firms: a theoretical overview and proposed theory. *International Journal of Management and Enterprise Development*, *19*(2), 164-186.

Villena, V.H., Revilla, E. and Choi, T.Y. (2011) 'The dark side of buyer-supplier relationships: a social capital perspective', Journal of Operations Management [online] http://doi.org/10.1016/ j.jom.2010.09.001.

Ward, J. (2016). Perpetuating the family business: 50 lessons learned from long lasting, successful families in business. Springer.

Wicks, A.C. and Berman, S.L. (2004) 'The effects of context on trust in firm-stakeholder relationships: the institutional environment, trust creation, and firm performance', Business Ethics Quarterly, Vol. 14, No. 1, pp.141–160

Woodfield, P. J., & Husted, K. (2019). How Does Knowledge Sharing Across Generations Impact Innovation?. International Journal of Innovation Management, 23(08), 1940004.

Woodfield, P., & Husted, K. (2017). Intergenerational knowledge sharing in family firms: Case-based evidence from the New Zealand wine industry. Journal of Family Business Strategy, 8(1), 57-69.

Zahra, S. A. (2003). International expansion of US manufacturing family businesses: The effect of ownership and involvement. *Journal of business venturing*, *18*(4), 495-512.

Challenges and Trends of Knowledge Management in SME Enterprises in the Context of CSR

Dariusz Wielgórka
Częstochowa University of Technology, Faculty of Management, Częstochowa, Poland
dariusz.wielgorka@pcz.pl

Abstract: Knowledge management, especially in the context of CSR, is still a new and challenging topic for Polish enterprises from the SME sector. However, the opportunities offered by the effective implementation of this process for organisations, as well as the global trend of its realisation, signal that it is worth conducting research into this phenomenon. The research objective of the article is to analyse knowledge management in the context of CSR in companies operating on the Polish market in the SME sector. The research was conducted in 2022, using the CATI method among 600 randomly selected companies from the SME sector operating on the Polish market. Moreover, the article presents the experience of companies - leaders of responsible business, giving practical examples of actions and tools supporting knowledge management. The results of the research show, among others, that: enterprises applying CSR have more or less developed their own systems of responsible business knowledge management, however, these are often unconscious processes. Enterprises do not use (at all or insufficiently) all available resources and tools for managing CSR knowledge. Those knowledge management tools that are applied in companies are most often not verified for their effectiveness. Almost half of the surveyed companies use experiential learning (participation in specific projects) as an element of educating employees about CSR, thus not limiting themselves to education with the use of "hard" resources only. The majority of companies do not verify or evaluate in any way the knowledge of employees on CSR. Company boards are minimally involved in the process of managing CSR knowledge in the organisation. The main area of benefit from knowledge management in the context of CSR is the relationship with employees, which improves thanks to their greater involvement, loyalty and identification with the company's mission and vision. This translates into improvements in processes and activities and more effective implementation of the CSR strategy. Also important is the image aspect and a chance for greater competitiveness, built on high competences of the team. Knowledge management in the context of CSR cannot be limited solely to descriptive knowledge (knowledge describing phenomena). Implementation of a knowledge management system is undoubtedly a challenge for companies and their managers. The use of CSR concepts in knowledge management is a current trend in the development of the SME sector.

Keywords: knowledge management KM, SME, CSR

1. Introduction to the essence of socially responsible management (CSR) in SMEs

The idea of social responsibility concerning voluntary actions to protect the environment and social aspects in the activities of enterprises gained popularity in the 1990s (Kulczycka, Wirth, 2010). The concept of social responsibility of an organisation is a multi-faceted notion, which is why one can come across many definitions of this concept (Arouri, Pijourlet, 2017). Corporate social responsibility is an issue increasingly taken up by theoreticians and practitioners of socio-economic life (Tylec, 2017). In the literature, one can encounter opinions that today, from the point of view of management, CSR is a business strategy, one of the most modern and promising (Sikorska, 2010). Reflections on CSR are carried out, among others, on the grounds of economics, law, sociology, philosophy or ethics. One of the oldest books related to CSR was written in 1953 by H. Bowen (The Social Responsibilities of Businessman). In this book, social responsibility was defined for the first time.

According to Bowen's concept, CSR is a businessman's commitment to make policies, decisions and follow such lines of action that will be desirable as goals and values of our society (Bowen, 1953). It is worth noting that the concept referred to the activities of the entrepreneur, while today CSR is mainly associated with the activities of organisations. Nowadays, corporate social responsibility can be understood as including pro-social and pro-environmental aspects by an economic organisation in its business activities. Responsible practices include observing ethical standards in relations with employees, competitors and contractors, increased investment in human resources, activities for the development of the local community or environmental protection, i.e. voluntary involvement (Białasiewicz, Marek 2011). R.W. Griffin and R.J. Ebert present a model of organisation's responsibility based on activities directed at stakeholders. The main areas of CSR that should be taken into account by an enterprise include (Griffin, Ebert, 2013): environment, customers, employees, investors. In the English-language literature, one can encounter the concept of CSR, which refers to the treatment of stakeholders in an ethical and responsible manner. Ethical and responsible is understood here as a way of behaviour acceptable in a civilised society.

One of the main objectives of CSR is to create higher standards of living while maintaining the profitability of doing business. A higher standard of living concerns both the people employed by the company and those directly associated with it, as well as the local community. A definition of CSR was also proposed by the European Union in a communication presented by the European Commission "A renewed EU strategy 2011-2014 for Corporate Social Responsibility". This strategy complements the document "Europe 2020 - A strategy for smart, sustainable and inclusive growth" with information on the direction of EU policy with regard to CSR. According to this document, CSR is defined as the responsibility of enterprises for their society. A prerequisite for CSR is respect for legislation and collective agreements between social partners (Caroll 2008). In order to effectively implement the CSR concept, business entities should have a mechanism to integrate social, environmental, ethical as well as consumer concerns into their operations and strategy, in close cooperation with stakeholders (Hopkins, 2007). It is worth mentioning that in an earlier definition of CSR, the European Commission presented the concept as a voluntary commitment that goes beyond legal requirements. Among the numerous benefits of CSR presented in the literature - indirectly indicating the necessity of including it in the enterprise strategy are mentioned, among others (Fiedor, 2016), (Kowalska, 2014):

- balancing corporate strength with corporate responsibility,
- better relations with stakeholders,
- shaping image: improving reputation and increasing company value
- environmental protection, rational use of natural resources,
- reduction of pollution,
- preventing or mitigating possible disputes between the company and the local environment,
- correcting social problems generated by business,
- increase in employee engagement and motivation, productivity,
- decrease in absenteeism and staff turnover, attracting and retaining the best employees
- employees,
- encourage long-term profitability (e.g., through reduced fees)
- related to environmental pollution),
- improve image and reputation, relations with the community and local authorities,
- increase in customer loyalty, company culture,
- increase in innovation, investors' interest, competitiveness of economic efficiency.

The successful implementation of the CSR concept in SMEs depends on many different factors, which are internal and external. External factors are related to the enterprise's environment, while internal factors are shaped by management. The most important external factors include: the region in which the enterprise operates, the impact of external stakeholders, the functioning of non-governmental, industry and cultural organisations, and the economic situation of the country. On the other hand, the most important internal factors include: the size of the company, the object of activity, the period and scope of activity, the organizational and legal form, the financial situation, family ownership (Sokołowska, 2013).

Business management should be systemic, flexible and open to the changing environment, adapted to it and, where possible, shaped to achieve the organisation's goals. An important management challenge that has gained renewed importance is corporate social responsibility (Kazmierczak, 2017). Social impact and social responsibility need to be managed (Drucker 1976). This is a new direction of change in the strategic management of organisations (Lisiecka, 2015). In the context of considering socially responsible management, an important problem concerns the qualification of CSR issues to a theory, concept or method of management. The literature on the subject does not offer unambiguous solutions in this respect. Most often, CSR is considered a concept of management. Current research on socially responsible management concerns the implementation, maintenance and improvement of this concept. The characteristics of the SME sector determine the scope and style of socially responsible management in SMEs. The variety of expressions contained in CSR definitions causes that enterprises from the SME sector, often fail to understand what role the concept should play in their operations, and what benefits they may derive from its application. CSR should constitute a comprehensive approach to the organisation's management, and cover: identification of main areas and socially responsible entities, planning, organising, shaping, controlling, and influencing the organisation's activity on the external and internal environment. CSR can be implemented using a variety of tools and measures depending on the needs and size of the enterprise. Socially responsible management in an enterprise also depends on many external factors concerning the environment, and internal factors concerning the specific functioning. Socially responsible management requires that the organisational culture, apart from economic values, should also

include social and environmental values. Socially responsible management in SMEs is usually less formalised, and poorly formalised in micro-enterprises. Therefore, an appropriate selection of CSR activities is important. In management compliant with the CSR concept in the SME sector, the owner plays an important role. It is the owner who decides whether his enterprise will follow the direction of social responsibility.

2. Knowledge management system in the context of CSR

In the most general manner, knowledge management is defined as a management method, the basic aim of which is the unconventional development of competitive advantage (Glabiszewski, Sudolska, 2009) by contemporary operating enterprises, including non-profit organisations (Perechuda, 2005). The great supporters of the knowledge management concept are T.H. Davenport and S.C. Völpel, who pointed out, however, that knowledge management primarily plays an important role in improving methods of creating new knowledge, and then in its proper dissemination and use (Davenport, Völpel, 2001). Another definition of knowledge management is proposed by P. Murray and A. Myers, who presented it as a sum of processes enabling the creation, dissemination and use of knowledge, in order to achieve the goals set by the organisation (Strojny, 2000). Knowledge management was also characterised by D.J. Skyrme, who described it as a precise and systematic management of knowledge resources and the related processes of creating, collecting, disseminating and using knowledge to ensure the organisation's proper functioning (Skyrme, 1999). The above-mentioned definitions of knowledge management have common elements that make it possible to identify some basic features that all the previously presented definitions have. These include mainly: the need to create, store and later transfer knowledge in order for the enterprise to function properly and support it in achieving its strategic goals (Sudolska, 2006). The implementation of the assumed knowledge management system first requires the creation of appropriate conditions within the organisation that will contribute to the fact that knowledge resources can be created, collected and made available to all units that need them. Only when these conditions are provided can knowledge management systems be implemented (Skrzypek, 2002). Providing the right conditions to support the implementation of such a system into an organisation depends largely on a number of factors, among which the following stand out: adequate resources, the right management system and organisational structure (Liczmańska-Kopcewicz, 2017), appropriate organisational culture and communication, and a properly designed organisational strategy. However, knowledge management is still a young concept and not widely used by organisations. For this reason, knowledge is still a resource that, when properly used, can contribute to a given company's competitive advantage in the market (Centobelli, Cerchione, Esposito, 2017).

Knowledge in small and medium-sized enterprises cannot be created according to the same procedures as in large organisations, which results from the small potential in terms of human resources, capital, technology and development. The knowledge management system should prevent the loss of knowledge possessed by the organisation, but should also create knowledge within the existing resources. This system must be an attempt at a holistic approach to organisational phenomena and processes. In each organisation, the area of key competences will be different, which is connected with diversity in selecting elements of the knowledge management system. Knowledge processes can be a source of knowledge acquisition (in the resource sense).

Knowledge (in the resource sense) can be the basis for launching knowledge processes. In an organisation, the main sources of knowledge are: generation of own knowledge on the basis of employees' cognitive activity or adaptation of knowledge incorporated from outside. There are many definitions and components of a knowledge management system in the literature. The concept of a knowledge management system should be understood as processes consisting of the creation and acquisition of formal knowledge, as well as tacit knowledge, its subsequent codification, collection, protection and transfer, and the building of a knowledge-based and value-creating organisation, using information technology and a system of metrics. The management of an organisation must independently create a knowledge management system in its organisation, adapted to the specifics of the enterprise and its human and financial capabilities. An attempt to comprehensively implement knowledge management in an SME must, taking into account the scale, cover such areas as the IT system, organisational culture and employee management. The conditions determining the scale of implemented solutions in a given organisation include: the size of employment, financial capabilities, area of operation, changeability of the environment.

Planned and strategic knowledge management remains rare in Polish organisations. However, each of them uses some specific knowledge resources, which are necessary for effective business operations. Knowledge management in a conscious and properly designed way may increase the effectiveness of business activities and

strengthen the competitive position of an enterprise. Companies that have made the principles of sustainable development an element of their strategy can use knowledge management also in this context. There are many definitions of knowledge management, but in a nutshell it can be said to be the ability to transform information and intellectual assets into value for customers and employees. In even simpler terms, knowledge management can be defined as ensuring that stakeholders have the right information at the right time and in the right form so that they can increase their effectiveness and the performance of the organisation as a whole (Preuss, Cordoba-Pachon, 2009). By knowledge is meant not only information and data, but also intellectual capital, which consists of:

- knowledge,
- experience
- technology
- customer relationships (relational capital),
- skills.

The main "carrier" of intellectual capital is therefore the company's employees, who in a knowledge-based economy become the organisation's most important resource. However, while knowledge, technology and skills are relatively easy to identify and verify, the category of experience is more elusive. The knowledge that employees have gained from their various work experiences may remain unconscious (so-called tacit or hidden knowledge) - the task of knowledge management will be to "extract" it and reformulate it in such a way that the whole organisation can benefit from it. In the approach to knowledge management in practice, we can distinguish two streams: dynamic and static.

Table 1: Static and dynamic approaches to knowledge management

Area	**Static approach**	**Dynamic approach**
Structure of the organisation	Closed, hierarchical	Team-based
Type of knowledge being developed	Open knowledge	Explicit and tacit knowledge
Resources	Electronic (documents and data sets)	People
Objectives of KM	Strengthening business performance	Development of experience, dialogue and innovation (→ results)
KM activities	Acquisition, storage and distribution of knowledge	Continuous interaction and development enhanced through dialogue
Role of the company	Protecting knowledge from imitation → protecting Competitive advantage	Effective integration and application of knowledge and development of employees

Static is used in organisations which, from the point of view of modern business, we would define as an outdated model: strongly hierarchical and not very innovative. Dynamic is used in organisations with a more modern business model, focused on process, interaction and innovation. Knowledge management in the context of CSR can help strengthen a company's performance in this field. Employees need information to perform their tasks taking into account sustainability criteria and the strategy adopted by the company, among others:

- information on what corporate social responsibility is, why the company pursues a CSR strategy, and how this translates into company performance,
- precise information on the company's CSR strategy and implementation plan,
- information on tasks of given department in CSR strategy implementation plan,
- information on key stakeholders of the company and the given position,
- data needed in the process of social reporting.

3. Research on knowledge management in SMEs in the context of CSR

A comprehensive qualitative and descriptive study was conducted in 2022 using a survey method based on an interview questionnaire and the data obtained was analysed using statistical methods. The aim of the survey was to analyse the application of CSR principles in the operating strategy of the surveyed enterprises, how SMEs manage knowledge in the context of CSR in the sector of micro, small and medium enterprises in Poland. The study addressed, among others, the following issues:

- identification of resources used to manage knowledge about responsible business in SMEs
- identification of tools used by SMEs to diffuse CSR knowledge within the organisation

- identification of ways to include CSR issues in organizational culture
- identify the role of management, owners in managing CSR knowledge
- identify ways to take care of intellectual capital development in the context of CSR
- identification of methods to measure effectiveness of above mentioned activities by SMEs.

Interviews were conducted with owners, co-owners and persons responsible for management in the segment of SME companies in Poland, from various industries. 600 randomly selected companies from the SME sector operating in the Polish market, which 40% were micro-entreprises employing up to 9 people, 30% small entrepreneurs employing up to 49 people, and 30% medium-sized entrepreneurs employing up to 249 people. The structure of the survey was weighted to the structure of companies in Poland according to the regon database operator (Central Statistical Office). The research sample prepared in this way enables the analysis of data at the level of the entire SME population in Poland. The survey has been carried out using the CATI (Computer Assisted Telephone Interview) method in 2022. It is one of the methods of collecting information in quantitative research. The CATI survey was conducted using a special program that assisted the person calling the respondent throughout the conversation. The main advantages of a CATI survey include:

- wide applicability
- saving survey results in one place, in an electronic form,
- ease of conducting an interview - based on ready-made question templates, set order,
- easy and quick entering of answers into the system by the interviewer,
- reduction of survey costs in comparison to traditional telephone surveys which were not supported by computer software,
- possibility to analyse the results at each stage of the survey, not only after its completion.

The interview questionnaire consisted of a core part (relevant questions) and a metric (classification questions). The main part of the questionnaire aimed to obtain information on knowledge management in the context of CSR. The questionnaire included information about the surveyed enterprises: number of employees, income, balance sheet total, legal form, type of activity according to PKD, period of operation, official position of the person completing the questionnaire.

The surveyed companies gave answers to particular groups of factors according to the following scale 1 - unimportant factor, 2 - unimportant factor, 3- moderately important factor, 4 - rather important factor, 5 - very important factor. After receiving the results, the points were added up and the share in the total number of points possible was quantified (number of interviews received x 5).

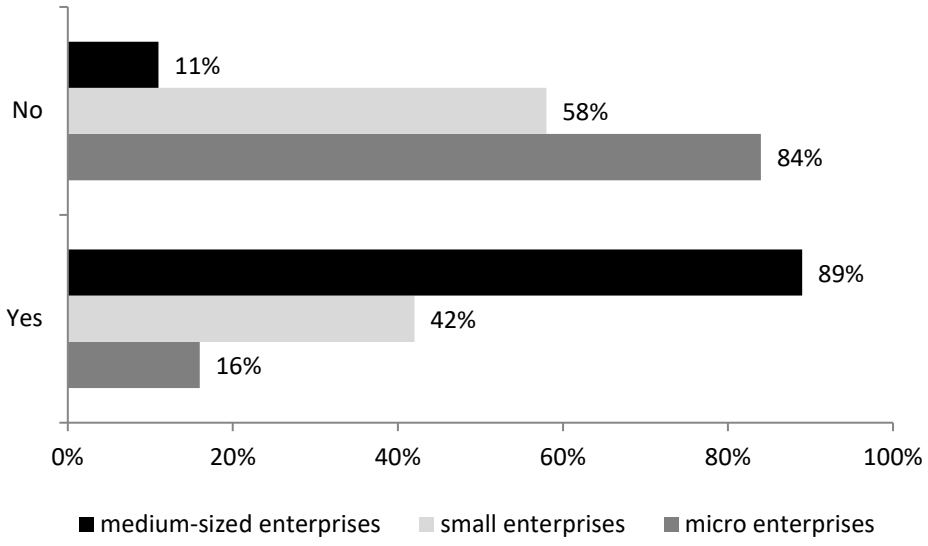


Figure 1: Does the company apply the principles of the CSR concept in its activities?

89% of medium enterprises apply the CSR principles in their activities, unfortunately in the micro group only 16% of the assessed entities apply any principles of the CSR concept. The larger the enterprise, the more it implements the CSR concept principles.

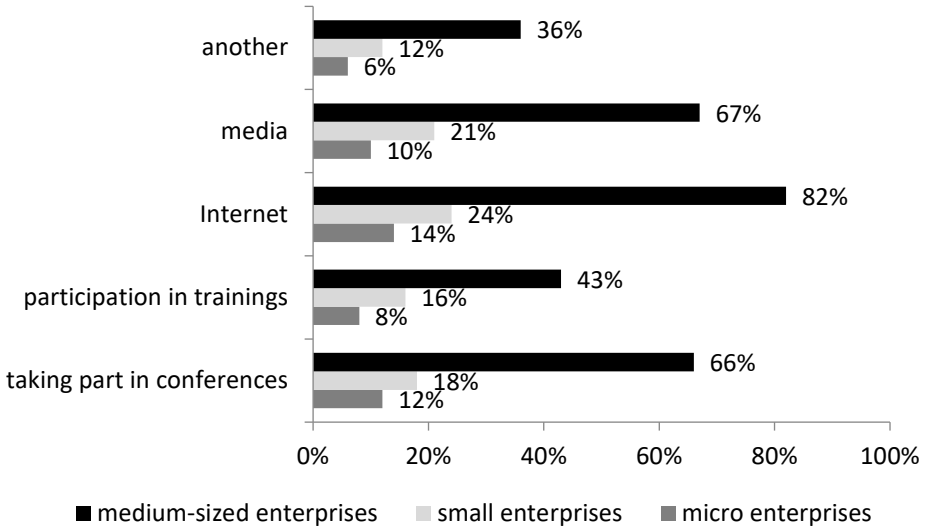


Figure 2: Sources of knowledge of surveyed enterprises on CSR - percentage of the selected answer in the total

The main source of knowledge on CSR among the surveyed entities is the Internet (83% for medium enterprises, 24% for small, 14% for micro). More than half of medium-sized entities (66% of the surveyed) indicate participation in conferences as the source of knowledge on CSR. 36% of the surveyed medium-sized enterprises indicated another as a source of knowledge, which included unmentioned items, among others: company materials, sent e-mail, databases.

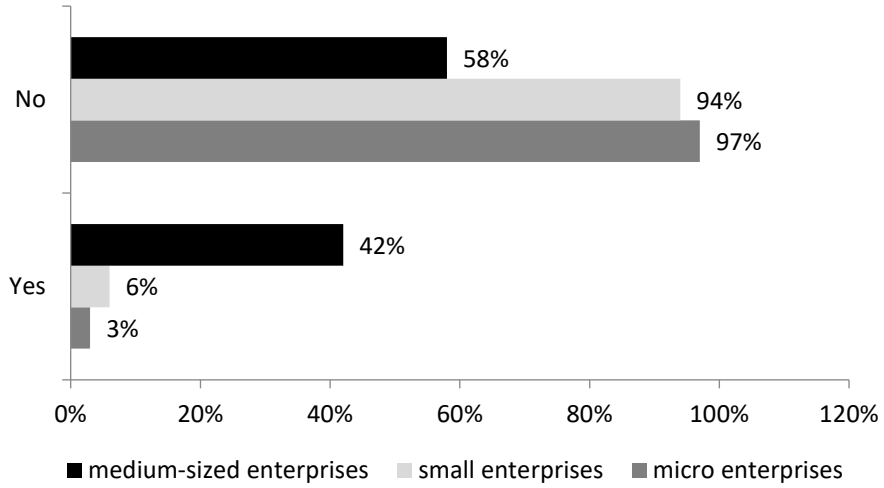


Figure 3: Do decision-makers (management, owners) encourage employees to develop CSR knowledge?

A big problem among SMEs is the low activity of managing persons in the aspect of encouraging employees to learn and develop knowledge related to CSR (6% in the group of small enterprises, 3% in the group of micro enterprises, 42% in the group of medium enterprises). It may also result from low awareness of the management staff, especially in the category of micro and small enterprises.

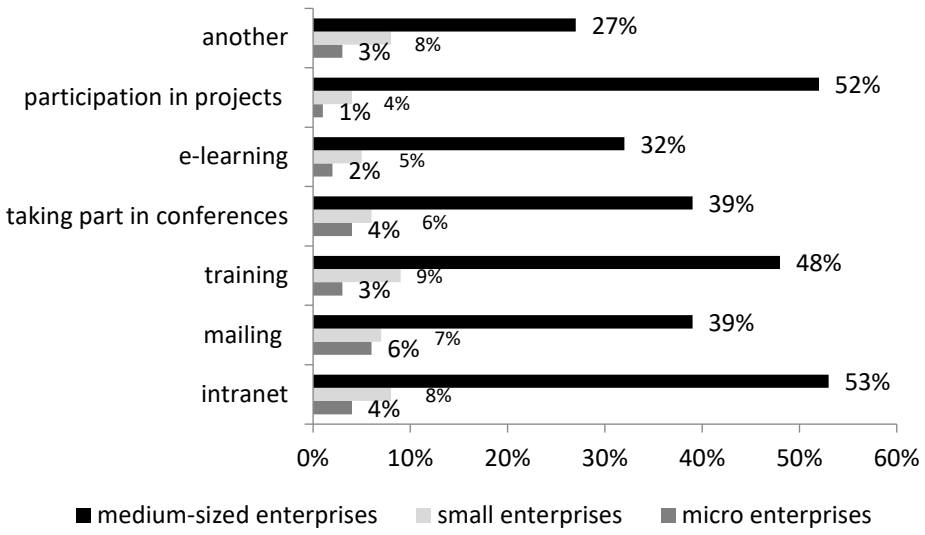


Figure 4: Tools to educate employees on CSR - percentage of the selected answer in the total

Considering the tools for educating employees in CSR, one should pay attention to the large disproportion between micro, small and medium enterprises. Various tools practically do not function in the first mentioned category. The group of medium enterprises is dominated by the intranet, participation in projects, conferences as tools for educating employees in CSR. 27% of the surveyed medium-sized enterprises indicated the item another not previously mentioned as a tool to educate employees on CSR.

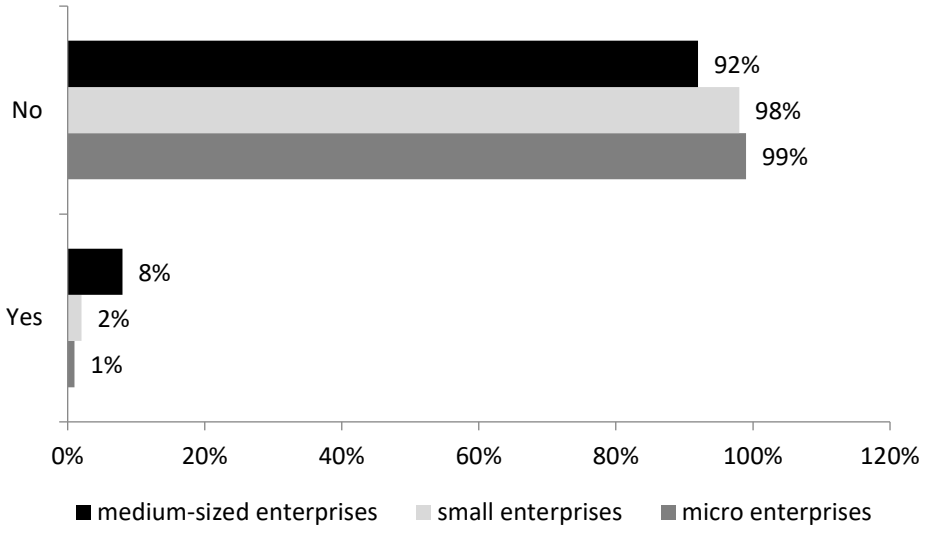


Figure 5: Does the company in any way test the effectiveness of tools to educate employees on CSR?

A big problem among the surveyed group of SME enterprises is the lack of research on effectiveness of tools for educating employees. Only 8% of the surveyed entities from the group of medium-sized enterprises indicated that they conduct research on the effectiveness of tools for educating employees.

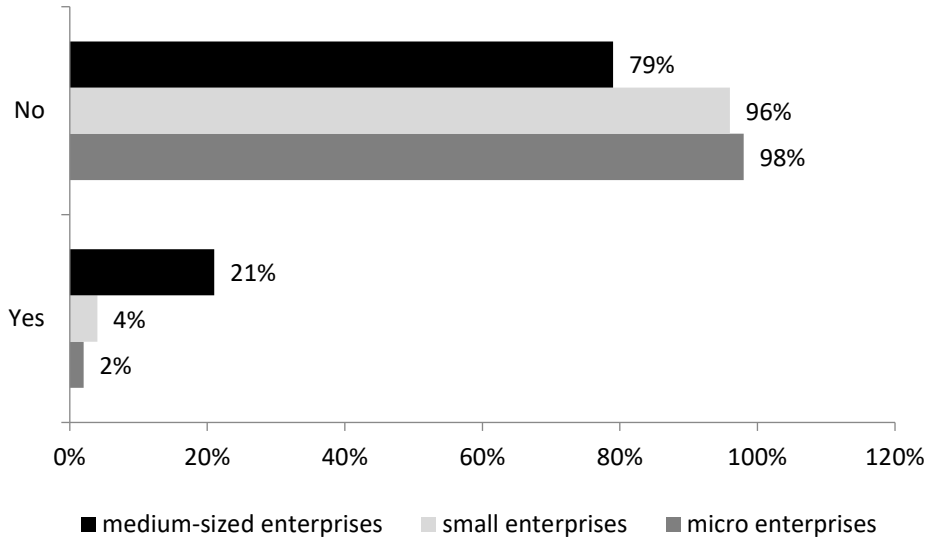


Figure 6: Does the company verify in any way the employees' knowledge on CSR?

Only 21% of medium enterprises, 4% of small, 2% of micro companies verify in any way the knowledge of their employees regarding CSR. The results of the survey show that enterprises applying CSR have more or less developed their own systems of responsible business knowledge management, however these processes are often unconscious and concern mainly larger companies. Enterprises do not use (at all or insufficiently) all available CSR knowledge management resources and tools. The knowledge management tools that are applied in companies are most often not verified in terms of their effectiveness. Almost half of the surveyed medium-sized enterprises use experiential learning (participation in specific projects) as an element of educating employees on CSR, thus not limiting themselves to education with the use of "hard" resources only. The majority of companies do not verify or evaluate in any way the knowledge of employees regarding CSR. Decision-makers (management boards, owners) are minimally involved in the process of managing CSR knowledge in the organisation. Therefore, there is a huge scope for development of this area among enterprises from the SME sector applying the principles of Corporate Social Responsibility. The implementation of the strategy of responsible business and sustainable development has a chance to succeed when it is supported by the management board and persons in managerial positions, and finds general acceptance among the company's employees. Therefore, processes and tools of multidimensional knowledge management in the context of CSR, should be elements of the strategic implementation of vision and mission in companies, and accompany in a continuous way other key processes such as internal communication or human resources management. The experience of companies shows that comprehensive knowledge management in the context of CSR has a chance to be a tool for building understanding for this concept, engaging in its implementation and increasing the effectiveness of activities. In large enterprises, e.g. at Microsoft, knowledge management within Microsoft is aimed at strengthening employees' awareness of CSR, understanding and identification with the company's strategy, objectives and mission of social responsibility, as well as strengthening employees' personal involvement in work for the benefit of local communities. An example of a project in which Microsoft is using the potential of CSR knowledge management is employee volunteering. Thanks to the application of this process, already at the stage of creating internal documents regulating the functioning of the programme, employees were able to co-decide on their shape. Thus, it was possible to transform the company's hidden social capital into formal knowledge in the form of rules and regulations of the employee volunteering programme. New employees are subject to an induction process, the so-called "New Hire", which includes a presentation on Microsoft's CSR strategy and its practical implementation. Employees receive updates on CSR activities in a monthly newsletter, as well as in the form of slides on screens in company buildings. The topic of social responsibility is also addressed at monthly meetings with the CEO. Communication tools for individual projects, such as employee volunteering, are also used. PwC, in turn, manages CSR knowledge not only by collecting it, but also by developing it through employee interaction processes. In addition to the "Gateway" knowledge repository or external subscriptions, there is also the "Profile" system, which contains information about employees' professional experiences, and the "Spark" portal, which aims to stimulate innovation based on employee engagement and ideas. CSR reporting is also an important process.

4. Conclusion

The basic element of knowledge management in the context of CSR is its collection by means of various tools - both traditional ones (sets of materials and publications) and virtual ones (internet platforms, blogs, intranet). A more advanced stage is the extraction of knowledge "hidden" in the experiences and intellectual potential of employees. This is done through processes such as: interactive cooperation between employees, e.g. in the form of an experience exchange platform or implementation of joint projects, including employee volunteering projects. An important role is also played by the reporting process (within social reports, application of GRI guidelines or Global Compact reports), which allows to extract and organise the knowledge inside the company.

The conducted own research has confirmed that the process of knowledge management in the context of CSR in the group of SMEs should include the decision-makers (the management board, owners), adjusting the tools for transferring and developing knowledge to their needs and scope of responsibilities. A proven form of management board involvement are meetings and intensive training sessions in the development and management of CSR strategy. Subsequently, our own research has shown that the primary channel for disseminating CSR knowledge in SMEs is internal communication tools, i.e. intranet, thematic mailings, newsletters. Frequent actions to support the development of employees' knowledge on responsible business also include internal and external training, thematic educational programmes and co-financing of individual activities in this area. People play a key role in the SME sector, their competences, skills and experience, properly used, may be a guarantee of success of the company they work for. In order to make proper use of their knowledge resources, it is necessary to introduce a knowledge management system in the organisation. The implementation of a knowledge management system is undoubtedly a challenge for enterprises and their managers. The surveyed SMEs indicated that the main area of benefit from knowledge management in the context of CSR is the relationship with employees, which improves thanks to their greater involvement, loyalty and identification with the company's mission and vision. This translates into improvements in processes and activities and more effective implementation of the CSR strategy. Also important is the image aspect and a chance for greater competitiveness, built on the high competences of the team. The success of knowledge management in the context of CSR consists of several key elements: a strategic connection with a well-prepared and implemented CSR concept, the involvement of the management board and employees, as well as - which many of the surveyed enterprises emphasise - appropriate communication. The level of commitment to responsible business is also important. If a company has clearly defined goals and treats them strategically, the transfer and development of CSR knowledge throughout the team seems a natural consequence of their implementation. In the future, the research should be further deepened by broadening the research sample and implying new trends in intellectual capital management.

References

Arouri, M., Pijourlet, G. (2017), *CSR Performance and the Value of Cash Holdings: International Evidence*, Journal of Business Ethics 140, pp. 263-284.

Białasiewicz M., Marek S., (2011), *Podstawy nauki o organizacji. Przedsiębiorstwo jako organizacja gospodarcza*, PWE, Warszawa.

Bowen H., (1953), *The Social Responsibilities of Businessman*, Harper, New York.

Caroll A.B. (2008), *A History of Corporate Social Responsibility: Concepts and Practices*, Business and Management, Business Policy and Strategy, History, January, 19-46, DOI: 10.1093/oxfordhb/9780199211593.003.0002

Centobelli P., Cerchione R., Esposito E., (2017) *Knowledge management in startups: Systematic literature review and future research agenda,* Sustainability 9 (3), 361

Davenport T.H., Prusak L., (1998), *Working Knowledge – How Organisations Manage What They Know*, Harvard Business School Press, Boston.

Davenport T.H., Völpel S.C., (2001), *The rise of knowledge towards attention management*, "Journal of Knowledge Management", no. 3.

Drucker P.F., (1976), *Skuteczne zarządzanie*. Wyd. PWN, Warszawa.

Fiedor B. (2016), *Implementacja koncepcji CSR jako przesłanka trwałości firmy i jej sukcesu rynkowego*, „Przegląd Organizacji" 1/2016, s. 23-28.

Glabiszewski W., Sudolska A., (2009), *Rola współpracy w procesie kształtowania konkurencyjności przedsiębiorstwa*, „Organizacja i Kierowanie", nr 2 (136).

Griffin R.W., Ebert R.J.,(2013), *Business Essentials*, Pearson Education, Edinburgh.

Hopkins M., (2007), *Corporate Social Responsibility and International Development: Is Business the Solution?*, Earthscan, London.

Kaźmierczak M., (2017), *Determinanty zarządzania społecznie odpowiedzialnego w sektorze małych i średnich przedsiębiorstw,* Wyd. UEP, Poznań.

Kowalska S., (2014), *Argumenty za i przeciw społecznej odpowiedzialności biznesu*. „Zeszyty Naukowe Wyższej Szkoły Humanitas. Zarządzanie", nr 1, s. 211-221.

Kulczycka J., Wirth H., (2010), *Społeczna odpowiedzialność w strategii firm górniczych w Polsce,* Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energii Polskiej Akademii Nauk, nr 79 , 147-157.

Liczmańska-Kopcewicz K., (2017), *Uczestnictwo konsumentów w tworzeniu innowacji poprzez media społecznościowe,* „Przedsiębiorczość i Zarządzanie", Tom XIII, Zeszyt 4.

Lisiecka K., (2015), *Społeczna odpowiedzialność w relacjach z interesariuszami w systemi ochrony zdrowia,* [w:] *Zrównoważony rozwój organizacji – aspekty społeczne*, Borys T., (red.): Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu nr 378, Wrocław

Preuss L., Cordoba-Pachon J.R. (2009), *A knowledge management perspective of Corporate Social Responsibility*, Corporate Governance, vol. 9 NO. 4 2009,

Nonaka I., (1991), *The Knowledge-Creating Company*, Harvard Business Review, November-December.

Perechuda K., (2005), Z*arządzanie wiedzą w przedsiębiorstwie*, Wydawnictwo Naukowe PWN, Warszawa.

Pritchard D., (2010), *What is This Thing Called Knowledge*, Routledge, New York.

Sikorska M. (2010), *CSR w Polsce. Forum UNDP. Zarządzanie zasobami ludzkimi*, [w:] *Kultura i gospodarka*, Kochanowicz J., Narody M. (red.): Wydawnictwo Naukowe Scholar, Warszawa 2010.

Skrzypek E., (2002), *Kapitał intelektualny jako czynnik stymulujący rozwój przedsiębiorstwa*, [w:] Partycki S. (red.), *Strategia rozwoju społecznej gospodarki rynkowej w Polsce*, Wydawnictwo Marii Curie Skłodowskiej, Lublin.

Skyrme D.J., (1999), *Knowledge Networking Creating the Collaborative Enterprise*, Butterworth-Heinemnn, Oxford.

Sokołowska A., (2013), *Społeczna odpowiedzialność małego przedsiębiorstwa. Identyfikacja – ocena – kierunki doskonalenia,* Wyd. Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław.

Strojny M., (2000), *Teoria i praktyka zarzadzania wiedzą*, „Ekonomika i Organizacja Przedsiębiorstwa", nr 10.

Sudolska A., (2006), *Zarządzanie wiedzą jako czynnik sukcesu rynkowego przedsiębiorstwa*, [w:] Jagoda H., Lichtarski J. (red.), *Nowe kierunki w zarządzaniu przedsiębiorstwem – celowość, skuteczność, efektywność,* Prace Naukowe Akademii Ekonomicznej im. Oskara Langego we Wrocławiu nr 1104, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław.

Tylec A., (2017), *Strategiczny CSR?* Zeszyty Naukowe Politechniki Śląskiej „Organizacja i Zarządzanie", nr 114, 509-521.

Implementing a European KM Approach in a Brazilian Innovation Institute on a Remote Basis

Markus Will[1], Ronald Orth[1], Felix Budde[1], Fernanda Neumann[2] and Victoria Santos[2]
[1]Fraunhofer IPK, Division Corporate Management, Berlin, Germany
[2]SENAI Innovation Institute for Biosynthetics and Fibers (SENAI CETIQT), Rio de Janeiro, Brazil
markus.will@ipk.fraunhofer.de
ronald.orth@ipk.fraunhofer.de
felix.budde@ipk.fraunhofer.de
fneumann@cetiqt.senai.br
vesantos@cetiqt.senai.br

Abstract: This case study paper outlines the approach and experiences gained in a KM project conducted between two continents on a completely remote basis – due to the pandemic in 2021. The project scope comprises the systematic initiation, design and implementation of a comprehensive knowledge management system at an innovation institute in Rio de Janeiro, Brazil. The practical business process-oriented KM (BPO-KM) methodology of the Berlin-based Competence Center Knowledge Management at Fraunhofer IPK, was used to define KM goals, to analyze strengths and gaps in knowledge handling and to set up customized KM action programs. Starting with the examination of the institute's business strategy, the overall KM goals were derived together with the institute's top management and KM core team. According to the holistic KM approach on the levels "People, Organization, Technology", an online survey ("KM Fitness Check") was conducted with over 100 respondents. The survey results were discussed in an online kick-off workshop in order to prioritize the main strategic and operational KM challenges. In online breakout sessions with different working groups, using collaborative online tools, the knowledge flows inside the institute's value adding core processes were analyzed in depth ("KM Process Profiles"). In parallel, the KM core team was supported to develop a map of the institute's crucial knowledge to serve as a common taxonomy for the research groups and administrative functions involved in the KM project, such as HR, IT and project management office. After this initial analysis phase, suitable solutions for the main KM challenges were designed and transformed into three main action programs to start the actual implementation of the institute's KM system. In a preliminary evaluation, a systemic controlling logic was defined to keep track on results, benefits and impacts of the KM actions regarding the institute's business strategy. Major learnings, discussed in this paper, include the following findings: a) accompanying change management and communication from the beginning is key to keep motivation high, b) connecting KM to other organizational functions is crucial to anchor KM in the organization, c) remote and online project collaboration bears advantages and drawbacks.

Keywords: Business Process-Oriented KM, Brazil, KM Fitness Check, Business Strategy, Change Management

1. Introduction

Since 2012, Fraunhofer IPK has been assisting the Brazilian industry training service SENAI with establishing 25 innovation institutes based on Fraunhofer's applied research model. The establishment of this national network of innovation institutes was triggered by the Brazilian industry's demand to increase added value in the national economy and supply chains through technological development and applied research, generating direct benefit for Brazilian companies and enhancing their competitiveness on the global market (Kohl et al. 2020).

The SENAI Innovation Institute (ISI) for Biosynthetics and Fibres in Rio de Janeiro is one the most successful institutes inside this network. After a phase of rapid growth – up to 100 new researchers and employees in roughly five years of operation – the ISI for Biosynthetics began to face typical challenges of knowledge management (KM). In a nutshell, a more systematic way of handling the key resource of an applied research institute, knowledge, was needed. When starting a respective initiative internally, the ISI in Brazil asked Fraunhofer IPK's Competence Center Knowledge Management (CCKM) in Germany for methodological support.

In this paper, the used methodological approach from KM goals definition and analysis to solution, actions and KM controlling is described with a focus on the practical results of this case of international collaboration on a completely virtual basis between June and December 2021 due to the COVID-19 pandemic.

2. Methodology

The methodological core of this KM project at ISI Biosynthetics & Fibres in Rio de Janeiro is based on a Business Process-Oriented Knowledge Management approach. This approach includes a specific and systematic connection to the strategic level of KM in the initialization phase and in the evaluation/controlling phase as well as an additional focus on the accompanying aspect of change management and internal communication. This is especially relevant for the analysis and solution/implementation phase. In this regard, the KM project followed the logic of CCKM's holistic approach to KM in three main pillars (Mertins, Orth 2006):

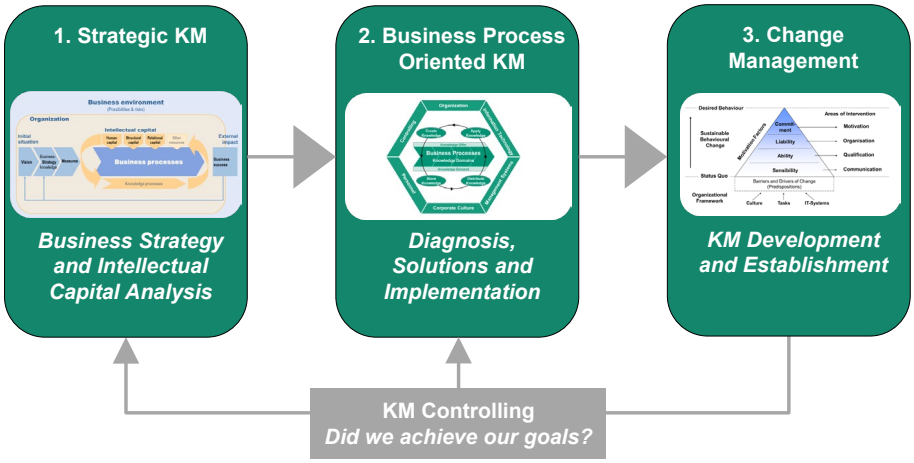


Figure 1: Holistic KM Approach of Competence Center Knowledge Management at Fraunhofer IPK

The approach outlined above fulfils requirements for the operation of knowledge management in the sense of a management system according to current standards and specifications as recently published, e.g. ISO 30401, DIN SPEC 91443. These standards provide guidance on the planning, implementation, monitoring and continuous development of systematic knowledge management. In addition to the orientation towards the company's strategy and goals, the definition of priorities and areas of application for KM, the derivation of concrete and verifiable targets as well as the planning and implementation of KM measures are emphasised as relevant on the basis of a systematic process (PDCA cycle). Furthermore, it is addressed how enabling framework conditions, structures and incentives can be created so that employees build up, share and purposefully apply knowledge in their daily work (ISO 2021, DIN 2021).

According to this holistic approach to KM, the methods and procedures applied in this KM project are described for each of the three pillars in the following paragraphs.

3. Procedure and Instruments

In the following, the procedure and utilized instruments are described. Therefore, the different levels (strategic, operational, change management) are examined in detail.

3.1 Strategic Knowledge Management (Strategic Level)

The increasing importance of knowledge as a resource for maintaining the competitiveness of organizations is undisputed. Against this background, the interest in a targeted management of this valuable resource has come to the fore. Accordingly, the introduction of knowledge management is not an end in itself; rather, it serves to achieve higher-level organizational goals. Since knowledge is available in the sub-units of the organization, targeted strategies and measures are needed to utilize this knowledge in a way that creates value for the organization as a whole. The formulation of concrete knowledge goals is therefore often demanded as the central starting point of knowledge management, as these control all downstream activities.

The challenge for companies is to link knowledge management to the corporate and business strategy and to continuously review the effectiveness and goal achievement of knowledge management measures. Only this way the central questions of the introduction and control of knowledge management in the company can be clarified: Where is it most worthwhile to invest? What contribution does knowledge management make to the company's success? The presentation and measurement of the achievement of objectives and the contribution

to success of measures enable effective controlling in the phase of implementation and ongoing control of knowledge management.

In the present case, the used approach to solve this challenge was to utilize the existing model for strategic management of applied research institutes, which is based on the German and European method for Intellectual Capital Statements (Alwert et al. 2008; European Commission 2008; Will 2015), and the Integrated Strategy Development (Will 2012; 2020; Will, Mertins 2013) which links the business strategy of an organization to the intangible resource base, i.e. the organization's intellectual capital as the strategic driver for business success. According to this methodology, the following strategic management model for applied research institutes was used as a framework to derive a first set of high-level KM goals by discussing the envisioned strategic contribution of KM to the ISI's business success with the directorate and KM core team of ISI Biosynthetics & Fibres:

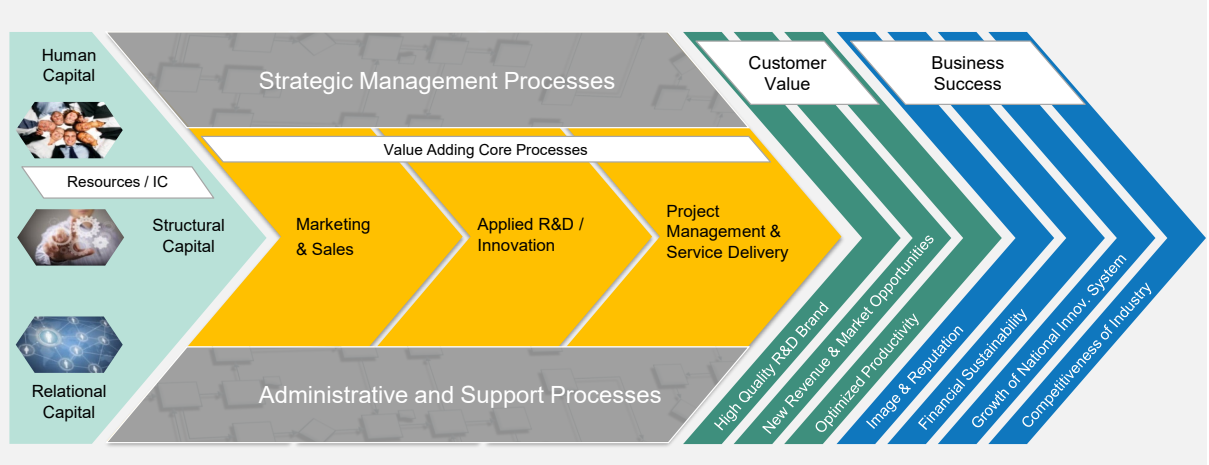


Figure 2: Strategic Management Model of Applied Research Institutes

Summarizing the main strategic objectives in a concise way, the layer of "Business Success" could be used as a starting point for the discussion to link the detected demand for KM to these high-level business objectives. The results of this discussion were consolidated into a first set of Strategic KM Goals which were not only used as a guiding frame for all subsequent steps at the operational KM level, but also form the basis for the KM controlling system. Thereby they to support a systematic and continuous evaluation of the progress and contribution of the actual KM actions and implemented solutions to the overall business objectives, e.g. desired financial results as well as the intended image on the market and retention of industrial clients.

Therefore, the following framework for the strategic KM controlling was established to ensure a consistent analysis of the actual status of the handling of knowledge as well as a derivation of suitable solutions, KM instruments and actions aligned with the overall business and KM strategy from the beginning:

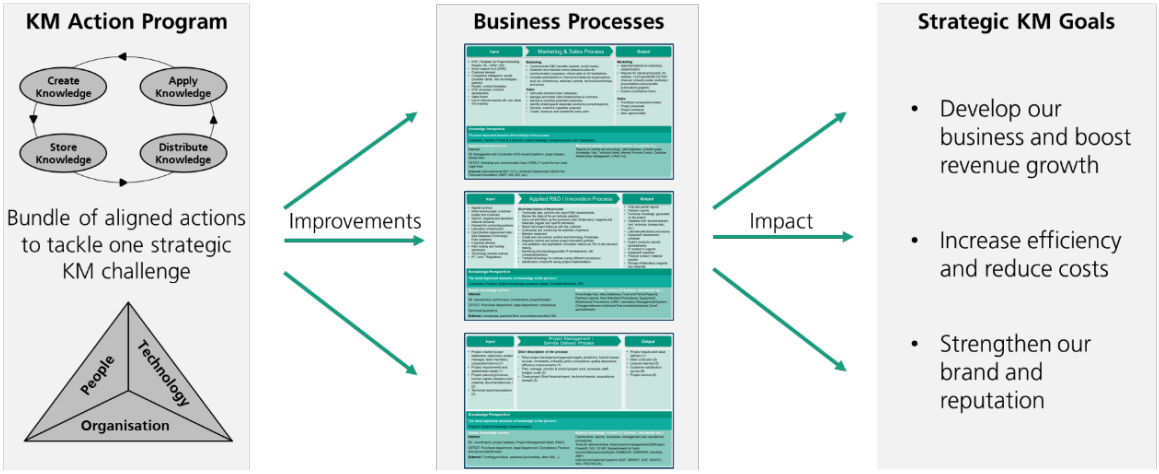


Figure 3: Strategic KM Controlling and Evaluation Framework

As shown in Figure 3, the concrete actions – bundled into meaningful action programs – have to be aligned and geared towards operational improvements at the level of the value-adding business processes of the organization, which shall directly help to achieve the Strategic KM Goals, which, in return, would generate a positive impact on the aspired business objectives. Having this strategic frame at the methodological and content level set up, the following steps of the operational and process-oriented KM can be aligned with the overall business strategy.

3.2 Business Process-Oriented Knowledge Management – BPO-KM (Operational Level)

The BPO-KM Methodology is based on the "POT" (People-Organization-Technology) model and the basic assumption that knowledge is utilized in business processes to produce certain results of value for the customer and for the own organization (Figure 4). The three dimensions of the POT model and their relevance to knowledge management can be summarized as follows (Mertins et al. 2016):

People: As carriers of knowledge, experience and competences, the employees of an organization represent a central success factor of knowledge management. In the field of human resources, the aim is, therefore, to examine key qualifications for knowledge management and to identify development needs.

Organization: The term organization encompasses both the organizational structure and the process organization. The level of knowledge management penetration in the organization depends largely on the extent to which the existing structures and processes enable the smooth execution of the KM core activities (see below).

Technology: In the field of information technology, numerous solutions can be found that support effective knowledge management, e.g. to facilitate communication, cooperation and access to information and knowledge resources. In this respect, the choice of adequate instruments from ICT area is decisive for the success of knowledge management.

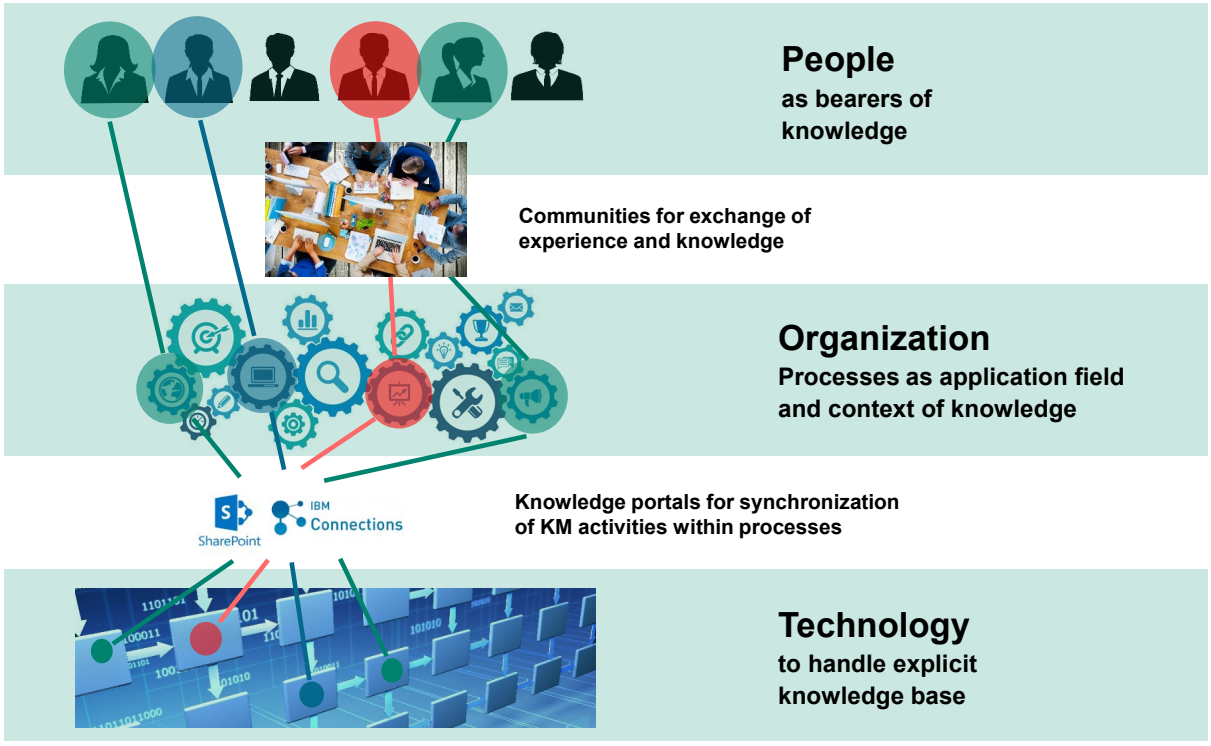


Figure 4: "POT" Model links three operational levels of KM: People, Organization and Technology

To operationalize this general model for the actual KM analysis and solution phase, the core logic of the BPO-KM methodology was applied, aiming at closing the loop of four KM core activities as an integral part of the ongoing value creation of an organization: creating, applying, distributing and storing relevant knowledge for the success of the organization's business processes (see Figure 5).

In the following paragraphs, the main methods and procedural steps of the analysis and solution phase on the operational KM level are summarized:

Knowledge domains and knowledge map

Knowledge is always knowledge about something, i.e. knowledge refers to specific areas, e.g. as knowledge about the customer, knowledge about one's own product or knowledge about methods and procedures. Therefore, when implementing knowledge management, it is of central importance to describe and concretize the knowledge of the respective organization. The description of a knowledge domain, i.e. a concrete knowledge area, makes it possible to develop and establish a precisely definition of knowledge for the respective company in practice. For the visualization of the knowledge domains, instruments such as a mind map are suitable.

Knowledge-oriented analysis and design of business processes

The basis of the knowledge-oriented analysis and design of business processes is the method of business process-oriented knowledge management (BPO-KM) developed at Fraunhofer IPK (Heisig 2005; Orth, Mertins 2016). Against this background, the analysis and design method focus on the value-adding processes of the company, since this is where the daily handling of knowledge takes place. The integration of the WM core activities into the business processes ensures the link between knowledge management and the tasks of day-to-day business.

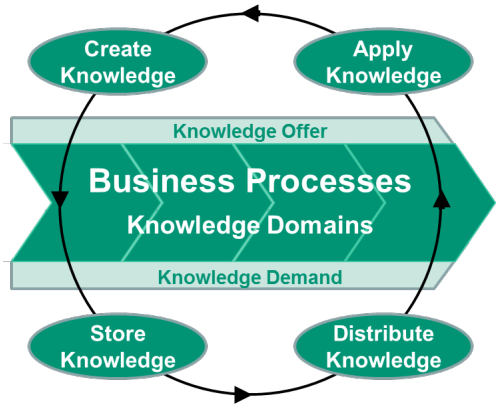


Figure 5: Core logic of Business Process-Oriented Knowledge Management: Closing the loop of four KM core activities inside the value-adding business processes

The BPO-KM method is divided into three consecutive steps:

- Selection and description of processes
- Analysis of strengths and weaknesses in the handling of knowledge
- Selection of KM solutions and introduction of them in a process-oriented manner

Step 1: Selection and description of processes

Aligning KM activities with concrete business processes ensures that the operational processes of the organization are considered, thus ensuring the integration of knowledge management into the day-to-day work of the organization. Thus, at the beginning of the project, it is important to select suitable business processes that are to be improved in the future with knowledge management instruments and solutions.

Within the framework of the project, the essential parameters were compiled into a process profile. When filling out the process profile, the most important tasks, the people involved, as well as the input variables and results of the process are defined. It also specifies which knowledge is relevant for the process and which instruments and tools are currently used.

Step 2: Analysis of strengths and weaknesses in dealing with knowledge

After identifying the processes to be analysed, this step takes a closer look at the handling of knowledge as well as central knowledge domains and framework conditions. The aim is to identify strengths and potential for improvement in the handling of knowledge and to derive fields of action for improvement measures.

At the ISI, the KM Fitness Check was used to identify and evaluate strengths and weaknesses in the handling of knowledge. This is a continuously developed questionnaire that can be adapted to the specific needs of the

organization. In its basic features, the catalogue does justice to the holistic understanding of knowledge management. The KM Fitness Check is based on the principle of the Fraunhofer KM Reference Model (Mertins et al. 2016) and is thus composed of questions on the four core activities (generating, storing, distributing and applying knowledge) as well as on the three design fields (personnel, organization, technology). These question areas are supplemented by the assessment of the knowledge domains. This creates an overall picture of how knowledge is handled in the company.

The KM Fitness Check is an analysis method that provides an excellent introduction to the topic of knowledge management. The survey of all employees is an important instrument for participation and sensitization in the context of the introduction of knowledge management. On one hand, employees are given the opportunity to help shape the process through their assessments of the issues, and on the other hand, by dealing with the questions, they are invited to reflect the handling of knowledge in their daily work (Kohl 2016).

The results of the survey provide an overview of the status quo in dealing with knowledge with regard to concrete activities such as creating, storing, distributing and applying knowledge, as well as with regard to the framework conditions in the company. Important knowledge domains are identified and their availability is assessed. This results in an overall assessment of how knowledge is handled in the company, which is based on the assessment of the employees.

Step 3: Select KM solutions and introduce them in a process-oriented manner (KM Roadmap)
The previously identified potential for improvement can be developed through suitable knowledge management methods and instruments. The scope for design in the selection and development of solutions is large. The Fraunhofer KM solution collection provides a comprehensive repertoire with design recommendations for this phase of knowledge management implementation (Voigt 2016).

Once suitable WM instruments have been selected, they must be adapted to the organization-specific conditions and integrated into the company processes during their implementation. To support the sustainable anchoring of knowledge management in the company, it is advisable to clearly name the solution modules in the company-specific process model and to clearly define the corresponding tasks.

The subsequent implementation process itself should also be planned systematically. The creation of a solution roadmap has proven to be a useful tool here. The roadmap makes it possible to specify the desired target state, to define important milestones on the way to achieving the goal and to concretize the time planning of the introduction process.

3.3 Level „Change Management“

As many KM initiatives have shown, it is of utmost importance for a successful implementation of a KM system and the respective KM instruments and actions to integrate the actual (future) users of the KM system into the project from the beginning. Key questions to be answered throughout the whole KM project and the different phases are:

- How does knowledge management have to be introduced into a company in order to ensure its success in daily routine?
- How can the best possible acceptance and motivation on part of the employees be achieved?

The intervention model for pro-active change management (Finke, Will 2003; 2005) as part of CCKM’s holistic KM approach assumes that the employees have a certain pre-disposition that needs to be taken into account when analyzing the four factors of motivation and deriving the respective accompanying actions in the four fields of intervention, as shown in Figure 6 below:

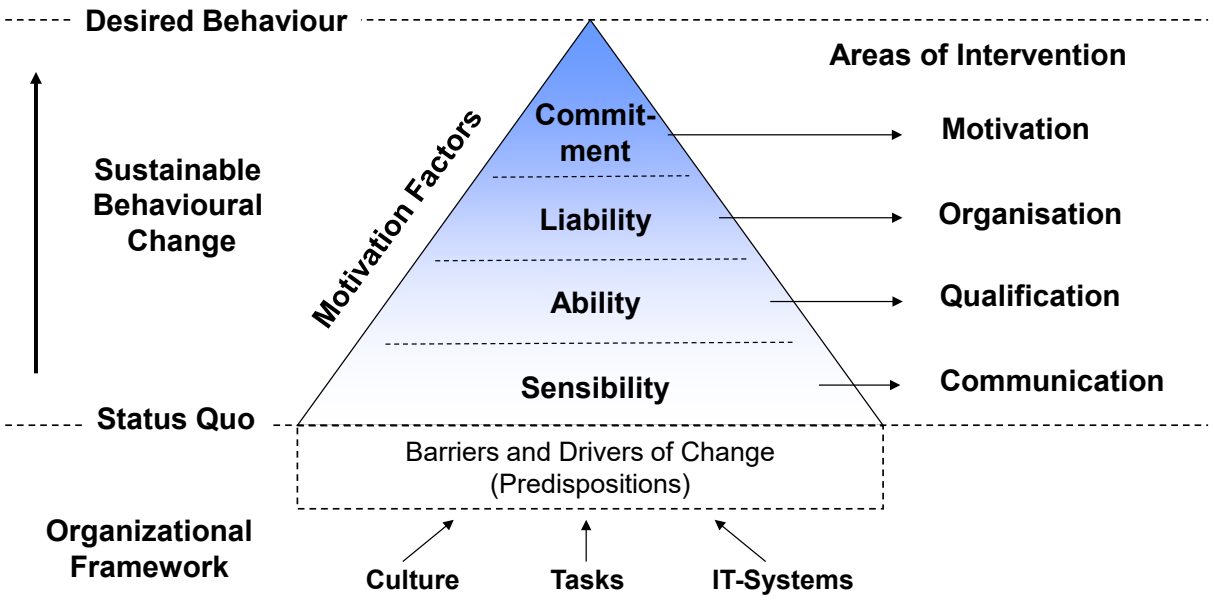


Figure 6: Intervention Model for Pro-active Change Management

According to this intervention model, the four factors of motivation can be summarized as follows:

- **Sensibility.** The concerned employees have to be thoroughly informed about the objectives and methods of knowledge management, about change measures and decisions, and the implications for their individual performance and working situation.
- **Ability.** The concerned employees must be competent enough to cope with the demands of change and fit the requirements of new KM activities.
- **Liability.** The executive personnel must initiate corresponding measures of steering and control, and they should take over the function of a change agent.
- **Commitment.** The concerned staff has to be involved in the change process with regard to the given conditions.

The challenge in the practical context is to understand the needs and the current status of the employees' motivation regarding the adoption of new behaviors, i.e. new or different tasks or a change in the way things should be done. In order to create the desired sustainable change of behavior, suitable approaches have to be included into the KM actions and/or accompanying actions regarding communication or qualification as well as organizational measures and involvement of the employees have to be planned and executed in parallel to the actual KM project work, i.e. the employees' requirements regarding the four factors of motivation have to be considered and met in each project phase in order to guarantee a successful implementation of KM in the organization.

4. Results

In this chapter the main practical results of the KM project at ISI Biosynthetics & Fibres are summarized. The results description will follow the structure of section 3.2.

4.1 Strategic KM Goals

Following the methodological approach proposed in section 3, the existing strategic management model of applied research institutes was used to derive a first set of high-level KM goals. The guiding question to these strategic KM goals was how KM shall contribute to the overall strategic objectives and business success of the ISI. The derived strategic KM goals are as follows:

4.1.1 Develop our business and boost revenue growth by…

- **combining knowledge** and fostering **synergies** between our technological platforms and research groups (technology convergence);
- creating **new application ideas** to trigger demand ("tech. push projects");

- leveraging our potential to produce **breakthrough innovations** with higher added value for our customers.

4.1.2 Increase efficiency and reduce costs by…

- using existing knowledge systematically to **avoid double work** (inventing the wheel a second time);
- **re-using newly created knowledge** and transferring competencies from one project to the next application context;
- **retaining crucial knowledge** when key people leave;
- increasing speed in administrative processes, harmonize procedures.

4.1.3 Strengthen our brand and reputation by…

- building up new knowledge and **showcasing pre-work** to reduce R&D risks for our clients;
- showing "hidden" competencies to **build confidence** and to communicate the "unknown";
- **institutionalizing reputation** through professional handling of knowledge (structural capital).

4.2 Knowledge Map and Knowledge Domains

In a next step the ISI developed a knowledge map. The relevant knowledge domains for the ISI are: Organization, Partners, Customers, Markets & Competitors, Products & Services, Scientific Methods, Expert Knowledge in the research areas, Projects and IPR. All knowledge domains were further detailed into smaller sub-domains. The knowledge domain of Partners as an example is one of the branches of the developed mind map. Knowledge about partners was then split up into knowledge about partners from the industry, research and development, associations as well as suppliers.

4.3 Selected Process Profiles

After exploring the different knowledge domains, the perspective was focused on the business processes (see section 3.2, step 1). At the ISI, three processes were selected and examined in more detail: *Marketing and Sales, Applied R&D / Innovation as well as Project Management / Service Delivery.* The profiles provide a comprehensive overview template including a short process description, information about input and output as well as a knowledge perspective regarding most important knowledge domains, human and material knowledge carriers.

4.4 ISI's Strengths and Weaknesses in Dealing with Knowledge

The analysis of the strengths and weaknesses in dealing with knowledge at the ISI was conducted via an online survey based on the "KM Fitness Check" (see section 3.2, step 2). The aim of the employee survey was to achieve awareness regarding KM and work time allocation in general and specifically to get insights for the ISI on their processes and status quo in knowledge management in detail. The survey was, aligned with the KM approach, structured into three parts: Knowledge Domains (Part I), Knowledge Handling (Part II), Knowledge Framework Condition (Part III). Core results of the survey will be summarized in the following.

The ISI shows strengths in willingness to share knowledge, applying (existing) knowledge as well as a strong people-based KM approach. KM challenges were identified on strategic as well as operational level. Strategic challenges are found regarding creating and storing knowledge about projects, knowledge about customers (plus market & competitors), storing explicit knowledge (finding data and making data available), as well as synergies between research groups (exchanging experiences across departments). Operational challenges are mostly present in framework conditions in form of IT systems.

The results of the survey were validated and prioritized to identify possible fields of actions. These action fields were further operationalized in the next section.

4.5 Knowledge Management Action Roadmap

With help of the combined results of the strategic goal definition, knowledge map, process profiles as well as KM strengths and improvement potentials found through the online survey a KM Roadmap was developed as a result of step 3 of section 3.2, see Figure 7. The KM Roadmap includes selected KM solutions and introduces them in a process-oriented manner.

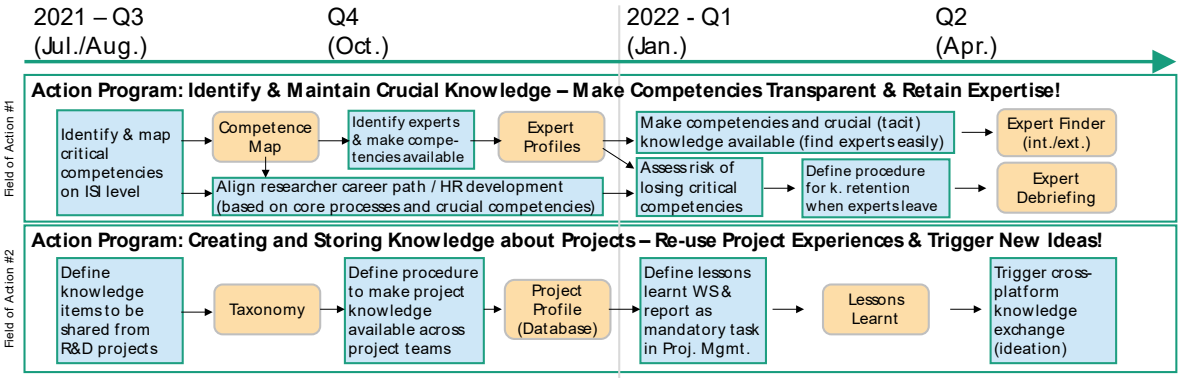


Figure 7: Action roadmap including two operationalized action programs

The horizontal action programs include all actions to be taken to reach the specific goals. The upper action program has the aim to identify and maintain crucial knowledge in the organization. The action program foresees different actions to build up a competence map, expert profiles up until to an expert finder over the course of one year.

The last step was to link the actions between the business processes and the strategic KM Goals. This happened via an impact diagram shown in Figure 8.

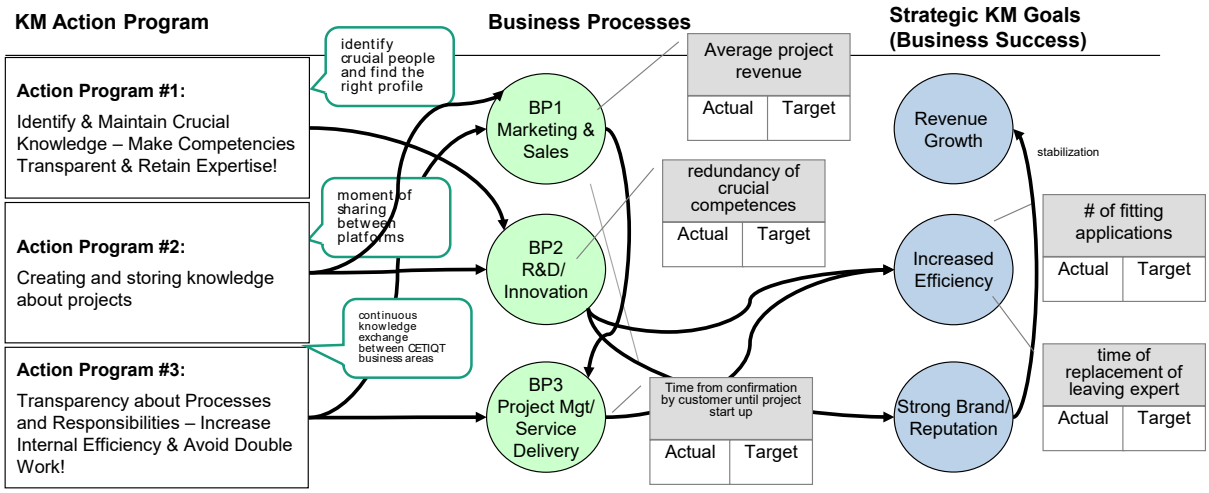


Figure 8: Impact diagram to link actions with business processes and strategic KM goals

5. Discussion, Limitations and Outlook

The results of this KM project, as summarized in the previous chapter, were assessed as highly beneficial for the systematic set-up of the KM pilot initiative at ISI Biosynthetics & Fibres by the responsible KM core team and the ISI's directorate. Of course, these first steps of analysis and implementation of concrete KM actions are only the beginning of a longer journey towards a full-fletched KM system. But it was seen as crucial to choose the right and systematic approach to initialize this endeavor based on the proven methodologies presented in this paper. This is especially important with regard to the mentioned aspect of change management and involvement of the employees as the "KM users" in order to ensure a successful implementation and operation of KM in the later stages which is only possible if the future users understand the background from the beginning, i.e. the specific demand and challenges, the envisioned benefits for the organization, as well as for their daily work.

In order to keep motivation high from the beginning, transparency and a structured, but easy-to-understand, approach is essential. Therefore, the KM core team at the ISI Biosynthetics, supported by the methodological experts of CCKM at Fraunhofer IPK, took care of informing and integrating the ISI's staff in different formats:

- The overall KM initiative and the underlying demand was presented by the ISI directorate and the KM core team during a general assembly of all employees to ensure a first sensitization even before concrete operational steps were initiated.

- After the definition of the overall methodological approach by the experts, all employees were invited to take part in the survey "KM Fitness Check" which was introduced at another general meeting, and which was designed to give further input about KM while triggering the reflection of one's own handling of knowledge in the context of the daily business.
- The results of the survey were presented at an official KM Kick-off meeting with all ISI employees, and the key findings were discussed, clustered and prioritized into the main KM challenges which formed the basis for the definition of the first fields of action and the respective operational KM objectives to tackle these concrete challenges. In this way, each employee had the opportunity to not only be part of the analysis of strengths and weaknesses regarding the handling of knowledge inside the ISI, but were also involved in the definition of the concrete action programs, resulting from this first phase of analysis.
- In parallel, an extended core team of key staff (senior researchers and group leaders) was involved in the description and knowledge-oriented analysis of the main business processes. In virtual breakout sessions, using MS Teams breakout rooms and conceptboards, each of the three value-adding core processes was analyzed by one "process team" consisting of key staff from different functions and hierarchical levels, gathering the process knowledge from the internal experts in a systematic way, moderated by the methodological experts of CCKM.
- In later steps, e.g. the detailing of the initial knowledge map and drafting the first layers of the taxonomy, as part of action program no. 2, key staff was also involved in order to develop the taxonomy based on the existing mental structures and vocabulary in use at the ISI. Here, it was noted that the involved colleagues from the research groups were motivated at the beginning of the task, but as the work load grew, they were asking themselves the "why" question and had doubts about the results and benefits of this task. When discussing this challenge between the KM core team and the methodological experts of CCKM, it became apparent that the "bigger picture" had got lost on the way when diving deep into the operational and technical task of defining the taxonomy. As a consequence, the framework for strategic evaluation was used to show the impact of the task on the higher level, and the roadmap of the action program to show the connections to the envisioned final results and the respective benefits for the daily work. The illustrative nature of the roadmap allowed the KM core team to easily and actively follow the KM project objectives and helped to compare the current implementation status with the planned timeline. Respective communication efforts were, again, needed and crucial to ensure the commitment of the involved staff. Informal stories about smaller benefits that were generated as "side effects" during the KM actions completed the strategy of pro-active change management as the key success factor for the effective implementation of KM in the organization.

Further lessons learnt and study limitations in this KM project included the finding that it is also important to integrate other administrative units such as HR, project management office or the IT department, which belong to the surrounding organization of SENAI's national department in the case of the ISI Biosynthetics & Fibres. Depending on the actual topics to be worked on in the different action programs, the respective administrative units should also be integrated in early stages, e.g. the HR department regarding the definition of competence profiles, or the IT department regarding the definition of the taxonomy and structures for better data retrieval. That is why the ISI directorate had decided to have these units already participating in the analysis phase inviting them to take part in the survey "KM Fitness Check" to use the opportunity to sensitize them for the specific challenges of the value-adding core unit ISI when defining the necessary adaptations and actions within their support processes. A possible language barrier should also be accounted for in integrating the administrative units as fluent English skills are not as present as in the technical-scientific staff.

Further research opportunities open up regarding the roll-out of the used KM approach and methods to the whole ISI network. The ISI Biosynthetics & Fibres is one of 26 institutes in the SENAI network. The goal for the future is to enable the ISIs to learn from each other and to foster transfer of best practices in the ISI network. This would allow the transfer from organizational to inter-organizational knowledge management. The ISI headquarter could take on the role of the facilitator to channel the KM effort in the network.

Overall, the application of the proven KM methods from the European side at the ISI for Biosynthetics & Fibres in Brazil can be assessed as a successful and systematic initiation of the KM initiative which is ongoing and will produce further results and learnings in the future. The extracted lessons learnt, once more, showed that a well-structured methodological KM approach is good and important, but not enough: it should be seen as a basis to constantly adapt and translate the single steps and KM actions into internal communication and involvement,

always making sure that the connection to the overall strategic objectives is assured and visible for all levels of staff and the different roles in the organization.

References

Alwert, K., Bornemann, M. & Will, M. (2008): Wissensbilanz – Made in Germany. Leitfaden 2.0. Berlin: German Federal Ministry for Economics and Technology Germany.

DIN ISO (2021): Knowledge Management Systems – Requirements (DIN ISO 30401:2021-02). Retrieved from https://www.beuth.de/de/norm/din-iso-30401/331113422

DIN SPEC (2021): Systematic Knowledge Management for SMEs – Tools and Procedures (DIN SPEC 91443:2021-08). Retrieved from https://www.beuth.de/de/technische-regel/din-spec-91443/342178827

European Commission (2008): InCaS: Intellectual Capital Statement – Made in Europe. European ICS Guideline. Online: www.incas-europe.org

Finke, I., Will, M. (2003). Motivation for Knowledge Management. In: Mertins, K., Heisig, P., Vorbeck, J. (eds) Knowledge Management. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-24778-4_4

Finke, I., Will, M. (2005): Mitarbeiterorientierte Einführung von Wissensmanagement, in: Barske, Heiko/Gerybadze, Alexander/Hünninghausen, Lars/Sommerlatte, Tom (Hrsg.): Das innovative Unternehmen – Produkte, Prozesse, Dienstleistungen (Digitale Fachbibliothek), Düsseldorf, Nr. 2012.01.01, S. 1-58.

Heisig P (2005): Integration von Wissensmanagement in Geschäftsprozesse. Springer, Dissertation,

Kohl, H., Will, M., Prim, M. F., Pavim, A. X. (2020). Building up a national network of applied R&D institutes in an emerging innovation system. Production, 30, e20190151. DOI

Kohl, I. (2016): Den Status quo im Umgang mit Wissen erkennen, In: Kohl, H., Mertins, K. und Seidel, H. (Hg.): Wissensmanagement im Mittelstand. Grundlagen - Lösungen - Praxisbeispiele. 2. vollständig überarbeitete und ergänzte Auflage. Heidelberg: Springer Gabler, pp. 53–61.

Mertins K, Orth R (2006): Strategisches und operatives Wissensmanagement – Ein ganzheitlicher Ansatz. VDI-Berichte 1964:3–24.

Mertins, K.; Kohl, I.; Orth, R. (2016): Ein Referenzmodell für Wissensmanagement. In: Kohl, H., Mertins, K. und Seidel, H. (Hg.): Wissensmanagement im Mittelstand. Grundlagen - Lösungen - Praxisbeispiele. 2. vollständig überarbeitete und ergänzte Auflage. Heidelberg: Springer Gabler, pp. 31–40.

Orth, R.; Mertins, K. (2016): Wissensorientierte Analyse und Gestaltung von Geschäftsprozessen. In: Kohl, H., Mertins, K. und Seidel, H. (Hg.): Wissensmanagement im Mittelstand. Grundlagen - Lösungen - Praxisbeispiele. 2. vollständig überarbeitete und ergänzte Auflage. Heidelberg: Springer Gabler, pp. 63–71.

Technische Universität Berlin

Voigt, S. (2016): Wissensmanagement-Lösungen auswählen, In: Kohl, H., Mertins, K. und Seidel, H. (Hg.): Wissensmanagement im Mittelstand. Grundlagen - Lösungen - Praxisbeispiele. 2. vollständig überarbeitete und ergänzte Auflage. Heidelberg: Springer Gabler, pp. 107–113.

Will, M. (2012): Strategische Unternehmensentwicklung auf Basis immaterieller Werte in KMU - Eine Methode zur Integration der ressourcen- und marktbasierten Perspektive im Strategieprozess. Stuttgart: Fraunhofer Verlag.

Will, M. (2015): Intellectual Capital Statement as a Strategic Management Tool – The European Approach. In: Ordoñez de Pablos, P.; Edvinsson, L. (Eds.): Intellectual Capital in Organizations. Non-Financial Reports and Accounts. Routledge Chapman & Hall, pp. 93-108.

Will, M. (2020): Integrated Strategy Development Based on Intangibles. In P. Ordónez de Pablos & L. Edvinsson (Eds.): Intellectual Capital in the Digital Economy. New York: Routledge. ISBN: 978-0-367-25067-6

Will, M., Mertins, K. (2013): Strategy Development Based on Intangibles in SME – An Integrated Approach. In: Palgrave Macmillan (Eds.): Journal for Knowledge Management Research & Practice. Issue 11, pp. 175–183.

Exploring Factors Triggering Individual Knowledge Hiding at the e-Commerce Operation Workplace

Jin Xue[1, 2], Matthew Tingchi Liu[1] and Hoi Ngan Loi[3]
[1]University of Macau, Macau SAR, China
[2]Suzhou Institute of Trade & Commerce, Suzhou, China
[3]Macao Polytechnic University, Macau SAR, China
jinxue0620@hotmail.com
matthewl@um.edu.mo
hnloi@ipm.edu.mo

Abstract: Knowledge often requires both experience (implicit knowledge) and exploration (explicit knowledge) (Park and Gabbard, 2018); the knowledge in the e-commerce industry is constantly changing. E-commerce companies must figure out knowledge hiding behaviors inside the organization and eliminate them. Although knowledge management and knowledge sharing implementation have been conducted in organizations academically and practically for many years, employees still share knowledge reluctantly. For instance, in an e-commerce company with multiple online shops, operators are reluctant to share knowledge with colleagues since the techniques and the newest information have huge impacts on the online sales, which will affect the operator's income and job stability in future (Han, Hampson and Wang, 2021). However, it is detrimental to the overall interests of the company because knowledge can bring competitive advantages to enterprises, and ensure that enterprises are distinguished from other organizations and occupy a favorable position in commercial competition. This paper investigated the antecedents of employees' knowledge hiding behavior from the knowledge type perspective and explores each path behind the individual type of knowledge: job insecurity path and timeliness path. At the same time, considering the existing fact that companies already have policies that encourage knowledge sharing but still have knowledge hiding behaviors, this paper also explores whether employees' perception toward corporate knowledge sharing strategies will affect the above two paths. The empirical data was collected from nearly 400 employees (frontline operators and junior managers) from six e-commerce business entities in China. The results verified that employees with a stronger perception of career plateau tend to hide tacit knowledge (derived from their experience) due to job insecurity behind. As to explicit knowledge, the higher the timeliness of the knowledge, the less likely it is that employees would like to hide their knowledge.

Keywords: implicit knowledge, explicit knowledge, career plateau, job insecurity, employees' strategy consensus, knowledge hiding

1. Introduction

There is a proverb that says *"Graduated apprentice, Starved master",* which means that if a master teaches his apprentice, the master will lose his job. This ancient proverb exists in both Chinese and Japanese culture and reminds people to hide core knowledge from others in case they lose their jobs. Today, knowledge hiding is still very common in the workplace in both Asian and Western countries. According to Peng and Pierce (2015), a survey found that 76% of employees hide knowledge from colleagues with different forms in America. Even though collectivism is prevalent in China, the proportion of knowledge hiding workers is nearly 50%. Take the e-commerce industry as an example, knowledge has a huge impact on the company's online sales, which will affect the operator's income and job stability. People obtain knowledge via experience (implicit knowledge) and exploration (explicit knowledge). The knowledge in the e-commerce industry is constantly changing and updated quickly (CAICT, 2021).

Knowledge can bring competitive advantages to enterprises and ensure that enterprises occupy a favorable position in commercial competition; it is particularly prominent in knowledge-intensive enterprises (Connelly, 2012). Thus, knowledge can be regarded as an important resource in enterprise development, and its transition and transmission are worthy of investigation in research. According to Hobfoll (1989)'s Conversation of Resource Theory (COR theory), people have the motivation and intention to maintain their existing resources and seek new ones. Drawing on COR theory, since the knowledge will impact the company's online sales which will further affect their income and job stability, employees tend to hold or hide the knowledge to retain their advantages and pursue more corporate sources and personal benefits.

A myriad of literature has studied the antecedents and subsequence of knowledge sharing behavior in teams, and some results have been obtained, but knowledge hiding and knowledge sharing are not opposite concepts (Peng and Pierce, 2015). Studies in the field of organizational behavior show that negative behavior is not the

opposite of positive behavior, there are significant differences in behavioral motivation and influencing factors, and the impacts are asymmetric (Han, Hampson and Wang, 2021). Thus, the research on knowledge hiding is meaningful and growing.

This work hopes to detect the antecedents of employees' knowledge hiding behavior from the perspective of knowledge type and explore each path behind the individual type of knowledge: job insecurity path and timeliness path. At the same time, because companies already have policies that encourage knowledge sharing but still have knowledge hiding behaviors, we will also explore whether employees' perceptions toward corporate knowledge sharing strategies will affect the above two paths.

2. Theory and Hypotheses Development

As we mentioned above, the fact that knowledge is a very important resource for enterprises has been confirmed by scholars and practitioners (Connelly, 2012). To explain our two-path model of knowledge hiding in the e-commerce industry more clearly, we need to first present the fundamental expound. Knowledge refers to "a mixture of framework experience, values, background information and expert insights, which provides a framework for evaluating and integrating new experiences and information" (Han, Hampson and Wang, 2021). In this study, knowledge includes the information, ideas and expertise relevant for the tasks performed by organizational members.

Knowledge has been summarized into two types: implicit (or perceptual or tacit) knowledge, explicit (or conceptual) knowledge (Yang, 2003). Implicit knowledge refers to personal kinesthetics understanding of the world through direct experience and involvement in a particular situation. Explicit knowledge indicates abstract concepts and a scheme of interrelated concepts that may be transferred across situations (Yang, 2003; Yang, Zheng and Viere, 2009).

For the operators of e-commerce companies, the knowledge here is demonstrated in two different ways, one is implicit knowledge, which is based on the operators' experience in the working environment (Chen, Chang and Hsu, 2017). Usually, this kind of knowledge is the perception of the industry's acumen accumulated, the proficiency in using operation tools, and the skills in e-commerce operation tasks, obtained through long-term work. The other one is explicit knowledge, which is usually the new product used for business analysis and sales promotion provided by the platform system (Moorman, 1995). This kind of knowledge is usually updated every six months or so, which has a great impact on the online sales of e-commerce companies, and with time, the impact is weakened, just like the IT product life cycle.

Jha and Varkkey (2018) identified factors that triggered knowledge-hiding behavior among R&D employees including distrust, competitive work environment, perceived career insecurity, lack of recognition, lack of reciprocation and lack of confidence in one's knowledge. Serenko and Bontis (2016) found that job insecurity motivates knowledge hiding and employees may reciprocate negative knowledge behavior under compensation concern. Based on recent findings about the antecedents of knowledge hiding (Singh, 2019; Serenko and Bontis, 2016), and the typology of knowledge (Yang, Zhen and Viere, 2009), we proposed two paths that may explain knowledge hiding phenomenon in the e-commerce industry: the implicit knowledge may be held mainly within the pattern of job insecurity while the explicit knowledge may be hidden mainly within the pattern of timeliness (Chatterjee et al., 2021). Figure 1 depicts the proposed model.

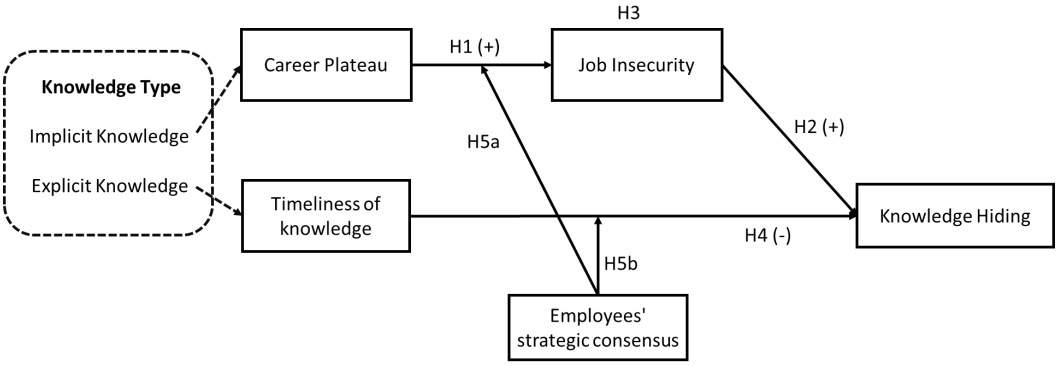


Figure 1: Proposed model

2.1 Career plateau, job insecurity and hiding implicit knowledge

Experienced staff usually picture their career blueprint clearly and are sensitive to their potential job opportunities and career plateau because of their accumulated working experience. Career plateau is regarded as the identification of objective facets, such as age and job tenure, by scholars in the very early studies (Chao, 1990). Then, the description and definition of career plateau were reshaped by Chao (1990) as a person believes that his or her future promotion is limited, regardless of objective criteria. It implies that a subjective definition of career plateau is more acceptable in academic studies (Chao, 1990; Niven and Johnson, 2019). Besides, a large proportion of empirical research has found a general link between career plateau and employee's poor well-being and performance (Yang, Niven and Johnson, 2019).

Job insecurity is described as the perceived likelihood of involuntarily losing one's current job (Darvishmotevali, Arasli and Kilic, 2017; Shoss, 2017). The majority of the literature shows that job (in)security is an important predictor of employee wellbeing and work-related attitudes (Yang, Liu et al., 2014a; Shoss, 2017). Job insecurity is a negative situation that triggers unwanted outputs in employees. Research revealed that job insecurity has led to a decrease in job satisfaction (Reisel et al., 2007) and organizational commitment (Frone, 2018), an increase in stress levels (Probst and Jiang, 2017; Xue et al., 2022) and a decrease in employee performance (Frone, 2018).

Knowledge hiding is a typical impropriate behavior in the workplace, which will undermine employees' work performance. Connelly et al. (2012) defined knowledge hiding as an attempt by an individual to deliberately hide the knowledge requested by another person and proved that knowledge hiding consists of three independent but related factors—rationalized hiding (i.e., the concealer provides a reason for failing to provide the requested knowledge by implying that he or she cannot provide the requested knowledge or accusing the other party), playing dumb (i.e., the concealer pretends to know nothing about the relevant knowledge) and evasive hiding (i.e., even if you do not intend to provide the information, the concealer will provide incorrect information or a misleading promise that will give a complete answer in the future).

It has been said that the most important resource for organizations today is qualified employees because they are playing a vital role in adapting organizations to the constantly updated business environment and solving the problems they face. Nonetheless, the organization may eliminate some employees they think are unqualified during the crisis, or if there are multiple people in the same position, the organization may dismiss the excess and only leave one or two. Many employees will start worrying about unemployment and feel a strong sense of insecurity. Based on the COR theory, employees tend to hold their accumulated experience to keep the advantage in work to increase their feelings of security and well-being. So, employees who continue to work in insecure situations are unlikely to share implicit knowledge with others. Thus, we propose that:

Hypothesis 1: Employees with a stronger perception of career plateau have experienced greater job insecurity.

Hypothesis 2: Employees who perceived stronger job insecurity are more likely to hide knowledge.

Hypothesis 3: Employees' job insecurity mediates their perception of career plateau and knowledge hiding.

2.2 Timeliness and hiding explicit knowledge

As illustrated earlier, explicit knowledge in the e-commerce industry can also be viewed as one form of innovation in which knowledge content can represent its innovative characteristics. Scholars indicated that perceived innovation characteristics of knowledge are derived from individuals' evaluation, which in turn leads to their decision to adopt or reject innovation (Venkatesh, Morris and Davis, 2003). The characteristics of this knowledge are very prominent in the e-commerce platform. The competition in the e-commerce industry is very fierce, which leads to frequent platform technology updates to maintain and enhance the platform's competitive advantage in the market (Pandey, et al., 2021). Vakulenko et al., (2019) have indicated that every time it goes through a cycle (usually about half a year), the e-commerce platform will launch a new operation tool to help e-commerce enterprise operators quickly analyze data, optimize store operation management solutions and improve sales performance. The new products of technological innovation launched by this platform are new knowledge for online store operators. The sooner you master this knowledge, the greater advantage you can gain in the market (Pandey, et al., 2021).

Harviainen, Lehtonen and Kock (2022) found that time is strongly tied to the people's information-sharing behavior in the tightly knit Finnish game development industry, which brings forth new insights on how timeliness influences knowledge sharing within creative industries. They asserted that by sharing high time-sensitive knowledge, employees could help the company seek a more decisive advantage in the market and be able to acquire an advantage themselves. On the other hand, employees may tend to hide knowledge with low timeliness, which can equip them better in inner-company competition. Thus, we propose that:

Hypothesis 4: For knowledge with a higher level of timeliness, employees are less likely to hide.

2.3 The moderation effect of employees' strategic consensus

Employees' strategic consensus can be broken down into three aspects: strategic understanding, strategic recognition and strategic commitment. Strategic understanding means that employees at all levels have a common understanding and accurate knowledge of the company's vision, mission, and strategic goals and means of realization (Rapert, Velliquette and Garretson, 2002; Ateş, 2020). Strategic identity represents employees' general recognition of the company's strategic goals and means of realization. Strategic commitment indicates the process of corporate strategy execution. During the process, employees at all levels have a positive attitude and cooperate to achieve the sharing of resources and capabilities.

Ateş (2020) indicated that whether employees understand and keep to the company's strategy depends on whether they believe the company's strategy. If employees do not have a consensus with the company's strategy, they will be unwilling to follow their leaders and execute the task from the perspective of the company's benefit (Rapert, Velliquette and Garretson, 2002). In that case, the execution quality of the company's strategy will be deplorable, and various problems may appear at work. Take the e-commerce industry as an example. Employees' knowledge hiding behavior is still universal because of their primary concerns about promotion, competition and crisis at the workplace (Harviainen, Lehtonen and Kock, 2022). Managers long for employees who take the initiative to stop hiding knowledge. Thus, updating the rules from a strategic perspective to dispel employees' concerns and attenuate employees' tendency of knowledge hiding behavior seems possible. In addition, the newly innovated products launched by the e-commerce platform are typically explicit knowledge for online store employees, which is strongly tied to timeliness. In other words, the faster employees obtain the knowledge, the more prominent advantage both the employees and the company can gain. In this scenario, the timelier the knowledge is, the less willing the employees to hide the explicit knowledge. If the employees' consensus on the company's strategy is higher, their unwillingness to hide knowledge is stronger. Therefore, we propose that:

Hypothesis 5a: Employees' strategic consensus moderate the positive relationship between employees' career plateau and their job insecurity, in that, the association is stronger when employees' strategic consensus is lower, while weaker when employees' strategic consensus is higher.

Hypothesis 5b: Employees' strategic consensus moderate the negative relationship between the timeliness of knowledge and employees' knowledge hiding behavior, in that, the association is stronger when employees' strategic consensus is higher, while weaker employees' strategic consensus is lower.

3. Methodology

We collected data from employees from six e-commerce companies (namely Suzhou Beijiajia Electronic Commerce Co., Ltd; Suzhou Jinjin Food Co., Ltd; Suzhou New Departure Advertising Media Co., Ltd; Suzhou Jimei Daily Chemical Co., Ltd; Suzhou YiXiangJi Co., Ltd and Suzhou Shiang Network Technology Co., Ltd). These institutions are all located in Suzhou city, Jiangsu province, which is reported to be the leading e-commerce industry in China. c Following the back-translation procedure suggested by Brislin (1980), we created a Chinese version of all measures. Each company's human resource manager provided a list of randomly selected participants. We showed each participant a QR code to scan, which leads to a cover letter outlining the details of the survey and a questionnaire. We also provided each participant with a small gift to increase the response rate. To reduce the possible biases such as consistency motifs and illusory correlation, this survey adopted a two-wave design with a four-week lag (Peng, 2013). All the participants are frontline employees and junior managers. During the first stage (T1), participants completed measures of the predictor variable (career plateau and timeliness of knowledge), moderating variables (employees' strategy consensus), individual demographics (employee gender, age, education and organizational tenure), firm characteristics (company age, size and ownership style). During the second stage (T2), participants rated mediator (job insecurity) and dependent

variable (knowledge hiding). Specifically, we sent questionnaires to 450 participants at T1 first. About four weeks later (T2), the questionnaire on knowledge hiding was completed by those who finished the first-stage survey. Finally, we got 433 questionnaires in the first wave and 382 questionnaires in the second wave, among which 375 people have taken part in both stages of the survey with a response rate of around 79%. During our review, we studied gender, age, education and tenure but did not identify any significant differences between those who had responded and those who had not.

4. Results

4.1 Reliability and validity

The measurement items for testing the research model were developed by modifying existing validated scales to fit the context of each construct of this research. All items of the measurement were evaluated using a 7-point Likert scale, ranging from 1 = strongly disagree to 7 = strongly agree. We utilize SPSS as the quantitative analytic technique to predict the initial development of a theory or research model and AMOS for confirmation analysis. The analytic results showed solid individual item reliability, internal consistency and validity.

The study tested the reliability of each item (via factor loading) and the internal reliability (via Cronbach's Alpha and composite reliability (CR). The smallest value of Cronbach's Alpha of the research was 0.812, indicating a favorable level of reliability (Nunnally, 1978). Besides, since the smallest CR value of all variables is 0.814 (>0.700) which achieves an acceptable level of internal consistency (Chin et al., 2003). For the convergent validity, all the values of the average variance extracted (AVE) of each construct were acceptable as they exceeded 0.5 (Fornell and Larcker, 1981), ranging from 0.522 to 0.811. Table 1 shows the relevant values of the measurement model.

As to the discriminant validity of the measurement model, the correlations of the construct with other constructs in this study were lower than the value of the square root of the AVE of each construct, indicating an acceptable level of discriminant validity (Fornell and Larcker, 1981). As shown in Table 1, the hypothesized five-factor structure fitted the data well: $\chi 2$=384.162, df= 142, root mean square error approximation (RMSEA)= 0.065, comparative fit index (CFI)=0.966, Tucker–Lewis's index (TLI)=0.959, standardized root mean square residual (SRMR)=0.047. Therefore, the results presented satisfactory reliability, validity and model fit at the measurement model.

Table 1: Confirmatory factor analysis (CFA) results

Factor	Items	Factor loading (t-value)	α	CR	AVE	Sources
Timeliness of knowledge (TI)	TI1	0.742(25.868) ***	0.954	0.921	0.797	Moorman (1995)
	TI2	0.929(23.244) ***				
	TI3	0.988(12.630) ***				
Career Plateau (CP)	CP1	0.865(20.633) ***	0.914	0.919	0.791	Allen et al. (1999)
	CP2	0.984(25.551) ***				
	CP3	0.811(18.755) ***				
Job Insecurity (JI)	JI1	0.833(19.869) ***	0.913	0.957	0.881	Elsamen and Alshurideh (2012)
	JI2	0.984(26.372) ***				
	JI3	0.991(26.733) ***				
Employee Strategy consensus (ES)	ES1	0.692(13.840) ***	0.812	0.814	0.522	Rapert, Velliquette and Garretson (2002)
	ES2	0.732(14.847) ***				
	ES3	0.760(15.557) ***				
	ES4	0.704(14.144) ***				
Knowledge Hiding (KH)	KH1	0.875(21.438) ***	0.965	0.965	0.821	Connelly et al. (2012)
	KH2	0.977(26.06) ***				
	KH3	0.970(25.728) ***				
	KH4	0.933(23.933) ***				
	KH5	0.853(23.149) ***				
	KH6	0.818(19.290) ***				
	Goodness-of-fit indexes					
χ^2 (142f) =384.162	RMSEA		CFI	SRMR		TLI
(*p*=.000)	0.065		0.966	0.047		0.959

Note: ** p ≤ 0.001. N=375

Table 2: Means (M), standard deviations and correlation among variables

Variable	*M*	*SD*	TI	CP	JI	EC	KH
Timeliness of knowledge (TI)	5.250	1.318	0.892[a]				
Career Plateau (CP)	3.782	1.683	0.037	0.889[a]			
Job Insecurity (JI)	3.483	1.671	0.087	0.518***	0.938[a]		
Employee Strategy Consensus (ES)	4.774	1.299	-0.248***	0.005	-0.028	0.722[a]	
Knowledge Hiding (KH)	2.853	1.536	-0.184**	0.276***	0.273***	-0.001	0.906[a]

Note: [α] Numbers on the diagonal represent the square roots of AVE for each factor; ** p<0.01, ** * p<0.001 N=375

4.2 Tests of structural relationships and hypotheses

Hypothesis 1, 2, 3 and 5a were tested in model 1 with PROCESS macro 3.3 proposed by Hayes (2019). Analyses were conducted through bootstrapping (5,000 bootstrap samples) to test the moderated mediation model. The results indicated that positive relationships existed between employee career plateau and job insecurity (β=0.352, p<0.001), employee job insecurity and employee knowledge hiding (β=0.134, p=0.015), employee career plateau and knowledge hiding (β=0.175, p<0.001). Therefore, Hypothesis 1 and 2 are supported. The interaction term career plateau x employee strategy consensus is significantly related to knowledge hiding (β=-0.173, p<0.001), indicating that the effect of employee career plateau on employee job insecurity is stronger when the employee strategy consensus is low than when it is high (see Figure 2). Thus, Hypothesis 5a was supported (as shown in Table 3). Hypothesis 3 postulated a mediating effect of job insecurity on the relationship between employee career plateau and knowledge hiding. The results of the bootstrapping approach confirmed the significant indirect effect of employee career plateau on knowledge hiding through job insecurity (Θ=-0.023, [-0.047, -0.002]), supporting Hypothesis 3. This analysis also revealed that the index of moderated mediation for

job insecurity did not include 0 when employee strategy is at low and middle level (see Table 4), indicating that the career plateau→job insecurity→knowledge hiding likelihood path is moderated by employee strategy consensus. Hypothesis 4 and 5b, which proposed a conditional direct effect from the timeliness of knowledge on employee knowledge hiding, were tested in Model 2 and were also supported ($\beta_{X(TI)}$ =-0.222, <0.001; $\beta_{X(TI) \times W}$ =-0.160, <0.001, see Table 3). The results indicated that timeliness of knowledge is negatively related to employee knowledge hiding, and employee strategy consensus negatively interacted the relationship significantly. The negative impact of timeliness of knowledge on employee hiding is stronger when employee strategy consensus is high than when it is low.

Table 3: Regression results

	Model 1						Model 2		
	M(JI)			Y(KH)			Y(KH)		
Antecedent	β	SE	p	β	SE	p	β	SE	P
X(CP)	0.352	0.043	<0.001	0.175	0.052	<0.001			
X(TI)							-0.222	0.064	<0.001
M(JI)				0.134	0.056	0.018			
W(ES)	-0.012	0.053	0.817						
X(CP) x W	-0.173	0.028	<0.001						
X(TI) x W							-0.16	0.041	<0.001
Control Variables									
Scale	-0.081	0.022	<0.001	-0.07	0.025	0.004	-0.080	0.024	0.001
Age	-0.053	0.018	0.004	-0.073	0.021	<0.001	-0.064	0.021	0.003
Gender	0.009	0.09	0.925	-0.069	0.103	0.503	0.011	0.104	0.918
Education Level	0.137	0.044	0.002	0.048	0.051	0.339	0.102	0.050	0.040
Tenure	0.231	0.038	<0.001	0.057	0.045	0.208	0.135	0.042	0.001

Note: X: independent variable; M: mediator; W: moderator.

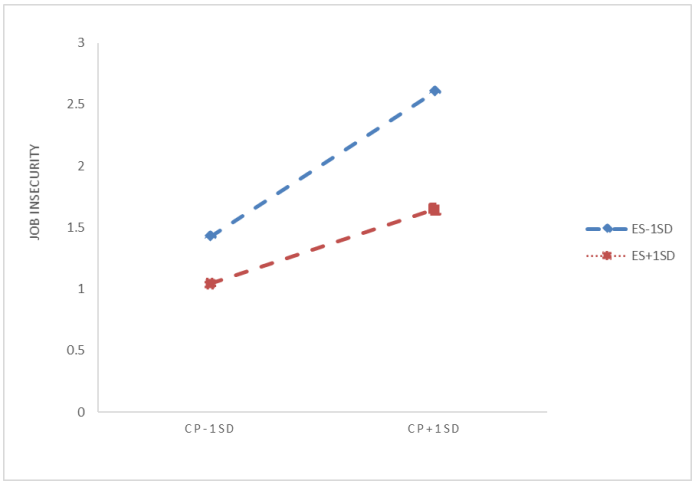


Figure 2: The moderating effect of SE on the relationship between CP and JI

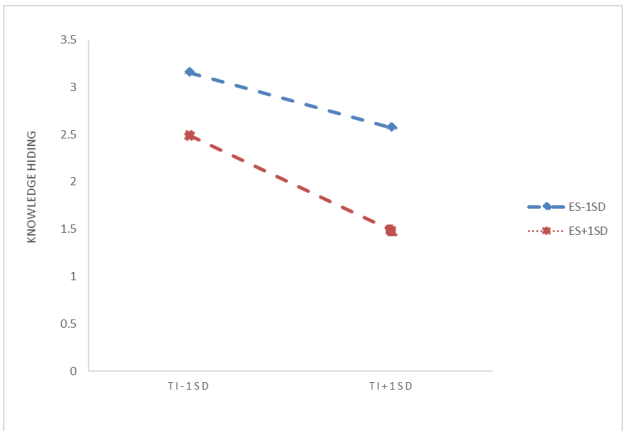


Figure 3: The moderating effect of SE on the relationship between TI and KH

Table 4: Bootstrap results

Path	Moderator	Level	Indirect effect	95% bias-corrected bootstrap CI
CP→JI→KH	ES	Low	0.087	[0.009, 0.169]
		Mid	0.035	[0.034, 0.077]
		High	0.014	[-0.002, 0.053]

Additionally, we also tested the effects of the control variables (see Table 3). The results demonstrated that company scale and employee's age might negatively influence employee's job insecurity and knowledge hiding; employee's education level and tenure might positively affect employee's job insecurity and knowledge hiding.

5. Conclusion

5.1 Theoretical Implications

Our findings contribute to the literature on knowledge hiding research in three ways. First, based on the type of knowledge in the e-commerce workplace, this study detects the perspectives of insecurity feeling towards the job and the time facet of knowledge, which is quite different from previous pieces (Singh, 2019). With investigations, we manifested the knowledge involved in the e-commerce environment mainly as explicit knowledge and tacit knowledge, corresponding to the definition and classification of knowledge (Yang, 2003; Yang, Niven and Johnson, 2019; Chen, Chang and Hsu, 2017). Second, we found that the tacit (or implicit) knowledge in the e-commerce environment will be hidden because the employees are afraid of losing their jobs (advantages) and have a sense of crisis (e.g., being replaced) in the current work. This result also speaks for Darvishmotevali, Arasli and Kilic's (2017) opinion that the feeling of job insecurity will lead to employees' shrewd behavior. Besides, our findings indicate that explicit knowledge with a high level of timeliness is less likely to be hidden because of its benefit for both company and individuals. The result echoes the COR theory (Hobfoll, 1989), and also reflects the technical nature of explicit knowledge in an e-commerce environment (Vakulenko et al., 2019). Third, this paper draws employees' strategy consensus to associate the relationship between knowledge hiding behavior and its antecedents. According to the results, when employees' strategy consensus is strong (weak), the career plateau has a less (more) effect on employees' job insecurity and less (more) effect on employees' knowledge hiding behavior; while, the timeliness of knowledge has more (less) effect on employees' knowledge hiding behavior. The results are consistent with the views of previous scholars that although the company has formulated policies to stimulate employee's performance and OCB (Liu et al., 2016), employees' strategy consensus affects the implementation of the policy (Desmidt and George, 2016). The role of employees' strategy consensus is overlooked by previous research on knowledge hiding. However, it is important and has been attempt by many supervisors in e-commerce firms. They create a vision to guide the change through inspiration and develop incentive policies to encourage knowledge sharing.

5.2 Practical implications

The investigation of the present research appears to tell us that organizational interventions attenuate knowledge hiding behavior in e-commerce firms, while the survey results released some hints of practice. First, firms should pay more attention to collecting the critical knowledge that employees have to equip. Managers can take different measures regarding both types of knowledge so that the knowledge will be exposed from hidden places (Jha and Varkkey, 2018). For example, for explicit knowledge, managers can foster cutting-edge knowledge and technologies for employees by sending them to e-commerce training institutions and business forums regularly, rather than relying solely on internal knowledge sharing. For tacit (implicit) knowledge, as its hardness in expression, it is necessary to arrange brainstorming communication and expressive training for employees to display and share their internal experiences smoothly (Yang, 2003; Yang, Niven and Johnson, 2019; Chen, Chang and Hsu, 2017). Second, since employees' sense of insecurity towards job will lead to hiding tacit knowledge behaviors, managers ought to understand the sources of the psychological phenomenon and eliminate them through job promotion and monetary incentive strategies (Liu et al., 2014b; Liu et al., 2020). Third, since employees' nonconsensus with strategy or management will make them more inclined to hide knowledge when formulating and implementing policies, the company must give full consideration to the employees' awareness and make timely explanations and adjustments. Forth, since employees will be more inclined to hide their knowledge if their cognition with strategy or management is not consensus, the firms should give full consideration to employees' perception, feeling and willingness when formulating and implementing policies.

References

Ateş, N. Y., Tarakci, M., Porck, J. P., van Knippenberg, D. and Groenen, P. J. (2020) "The dark side of visionary leadership in strategy implementation: Strategic alignment, strategic consensus, and commitment", *Journal of Management*, Vol 46, No. 5, pp 637-665.

Brislin, R. W. (1980) "Translation and content analysis of oral and written materials", *Methodology*, pp 389-444.

CAICT (2021) *Report on the development of China's digital* Economy in 2021, China Academy of Telecommunication Research of MIIT, Shanghai.

Chao, G. T. (1990) "Exploration of the conceptualization and measurement of career plateau: A comparative analysis", *Journal of Management*, Vol 16, No. 1, pp 181-193.

Chatterjee, S., Chaudhuri, R., Thrassou, A. and Vrontis, D. (2021) "Antecedents and consequences of knowledge hiding: The moderating role of knowledge hiders and knowledge seekers in organizations", *Journal of Business Research*, Vol 128, No. 5, pp 303-313.

Chen, H. L., Chang, C. Y. and Hsu, W. T. (2017) "Does Board Co-Working Experience Influence Directors' Decisions Toward Internationalization?", *Management International Review*, Vol 57, No. 1, pp 65-92.

Connelly, C. E., Zweig, D., Webster, J. and Trougakos, J. P. (2012) "Knowledge hiding in organizations", *Journal of Organizational Behavior*, Vol 33, No. 1, pp 64-88.

Darvishmotevali, M., Arasli, H. and Kilic, H. (2017) "Effect of job insecurity on frontline employee's performance", *International Journal of Contemporary Hospitality Management*, Vol 29, No. 6, pp 1724-1744.

Desmidt, S. and George, B. (2016) "Do we see eye to eye? The relationship between internal communication and between-group strategic consensus: A case analysis", *Management Communication Quarterly*, Vol 30, No. 1, pp 84-102.

Frone, M. R. (2018) "What happened to the employed during the Great Recession? A US population study of net change in employee insecurity, health, and organizational commitment", *Journal of Vocational Behavior*, Vol.107, No. 8, pp 246-260.

Han, M. S., Hampson, D. P. and Wang, Y. (2021) "Two facets of pride and knowledge hiding: an empirical analysis", *Journal of Knowledge Management*, Vol ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JKM-06-2021-0488

Harviainen, J.T., Lehtonen, M.J. and Kock, S. (2022) "Timeliness in information sharing within creative industries. Case: Finnish game design", *Journal of Documentation*, Vol 78, No. 1, pp 83-95.

Hobfoll, S. E. (1989) "Conservation of resources: A new attempt at conceptualizing stress", *American Psychologist*, Vol 44, No.3, p 513.

Jha, J. K. and Varkkey, B. (2018) "Are you a cistern or a channel? Exploring factors triggering knowledge-hiding behavior at the workplace: evidence from the Indian R&D professionals", *Journal of Knowledge Management*, Vol 22, No.4, pp 824-849.

Liu, M., Liu, Y., Mo, Z., Zhao, Z., Zhu, Z. (2020) "How CSR influences customer behavioural loyalty in the Chinese hotel industry", *Asia Pacific Journal of Marketing and Logistics*, Vol 32 No.1, pp 1-22.

Liu, M., Wong, I.A., Chu, R., Tseng, T.(2014) "Does perceived CSR initiatives enhance customer preference and loyalty in casinos?" *International Journal of Contemporary Hospitality Management*, Vol 26 No. 7, pp 1024-1045.

Liu, M., Wong, I.A., Shi, G., Chu, R., Brock, J. (2014) "The impact of corporate social responsibility (CSR) performance and perceived brand quality on customer based brand preference", *Journal of Services Marketing*, Vol 28, No.3, pp 181-194.

Liu, M., Yan, L., Phau, I., Perez, A., Teah, M.(2016) "Integrating Chinese cultural philosophies on the effects of employee friendliness, helpfulness and respectfulness on customer satisfaction", *European Journal of Marketing*, Vol 50, No.3/4, pp 464-487.

Moorman, C. (1995) "Organizational market information processes: cultural antecedents and new product outcomes", *Journal of Marketing Research*, Vol 32, No.3, pp 318-335.

Pandey, J., Gupta, M., Behl, A., Pereira, V., Budhwar, P., Varma, A., ... and Kukreja, P. (2021) "Technology-enabled knowledge management for community healthcare workers: The effects of knowledge sharing and knowledge hiding", *Journal of Business Research*, Vol 135, No. 10, pp 787-799.

Park, J. and Gabbard, J. L. (2018) "Factors that affect scientists' knowledge sharing behavior in health and life sciences research communities: differences between explicit and implicit knowledge", *Computers in Human Behavior*, Vol 78, No. 1, pp 326-335.

Peng, H. (2013) "Why and when do people hide knowledge?", *Journal of Knowledge Management*, Vol 17, No.3, pp 398-415.

Peng, H. and Pierce, J. (2015) "Job-and organization-based psychological ownership: Relationship and outcomes", *Journal of Managerial Psychology*. Vol 30, No.2, pp 151-168.

Probst, T. M. and Jiang, L. (2017) "European flexicurity policies: Multilevel effects on employee psychosocial reactions to job insecurity", *Safety Science*, Vol 100, No. 1, pp 83-90.

Rapert, M. I., Velliquette, A. and Garretson, J. A. (2002) "The strategic implementation process: evoking strategic consensus through communication", *Journal of Business Research*, Vol 55, No. 4, pp 301-310.

Reisel, W. D., Chia, S. L., Maloles III, C. M. and Slocum Jr, J. W. (2007) "The effects of job insecurity on satisfaction and perceived organizational performance", *Journal of Leadership & Organizational Studies*, Vol 14, No. 2, pp 106-116.

Serenko, A. Bontis, N. (2016) "Understanding counterproductive knowledge behavior: antecedents and consequences of intra-organizational knowledge hiding", *Journal of Knowledge Management*, Vol 20, No. 6, pp 1199-1224.

Shoss, M. K. (2017) "Job insecurity: An integrative review and agenda for future research", *Journal of Management*, Vol 43, No. 6, pp 1911-1939.

Singh, S. K. (2019) "Territoriality, task performance, and workplace deviance: Empirical evidence on role of knowledge hiding", *Journal of Business Research*, Vol 97, No. 4, pp 10-19.

Vakulenko, Y., Shams, P., Hellström, D. Hjort, K. (2019) "Service innovation in e-commerce last mile delivery: Mapping the e-customer journey", *Journal of Business Research*, Vol 101, No. 8, pp 461-468.

Venkatesh, V., Morris, M. G., Davis, G. B. Davis, F. D. (2003) "User acceptance of information technology: Toward a unified view", *MIS Quarterly*, Vol 27, No. 3, pp 425-478.

Xue, J., Mo, Z., Liu, M., Gao, M. (2022) "How does leader conscientiousness influence service employees under serious anxiety", *Journal of Hospitality and Tourism Insights*, Vol ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JHTI-07-2021-0160

Yang, B. (2003) "Toward a holistic theory of knowledge and adult learning", *Human Resource Development Review*, Vol 2, No. 2, pp 106-129.

Yang, B., Zheng, W. and Viere, C. (2009) "Holistic views of knowledge management models", *Advances in Developing Human Resources*, Vol 11, No. 3, pp 273-289.

Yang, W. N., Niven, K. and Johnson, S. (2019) "Career plateau: A review of 40 years of research", *Journal of Vocational Behavior*, Vol 110, No. 2, pp 286-302.

Can bots Support Employees in Lessening Digital Fatigue during e-work: Research Results

Magdalena Zalewska-Turzyńska
Associate Professor Faculty of Management, University of Lodz, Lodz, Poland
magdalena.zalewska@uni.lodz.pl

Abstract: The pandemic situation has obliged organizations to shift all possible tasks to the Internet and to replace on-site work by its remote version. Without a preparation stage, companies were forced to adopt remote working at the individual-level and cloud computing at the organization level simultaneously. As a consequence, the accelerated shift toward digital work forced employees to rapidly learn how to use various ICT tools (which were not necessarily compatible with each other) and how to implement them into a daily routine. The protracted pandemic has led to many employees working from home, especially those doing knowledge-based work, and has often imposed remote work without the on-site option. This has led (and is still leading) to digital fatigue of workers (a phenomenon that negatively affects the performance of both the employee and the organization), the effects of which have already been named and described by scientists. One solution to unburden employees could be by relieving them from everyday, repetitive, and often tedious jobs By delegating these tasks to bots (especially those that may be subject to automation), it will enable employees to deal with more creative and knowledge-based tasks that require attention and do not cause the same level of fatigue and weariness. In this paper, the research question enquires whether there are commonplace digital processes in organizations that can be automated. If yes, then which technologies are used on a regular basis to automate the processes. The conducted literature review helped to distinguish three categories of standard digital processes suitable for automation – Information and Communication Technology (ICT) based processes (written and spoken), Robotic Process Automation (RPA) and processes of searching for specific information. The empirical research was conducted using the CATI questionnaire in 2020 on 400 organizations which use cloud computing for daily routines. The results indicate that the identified processes are indeed subject to automation, and organizations use bots for RPA most (27.5%), and voice chatbots least (3.75%). The use of bots is also shown to be statistically dependent on a company's scope and size.

Keywords: chatbots, digital fatigue, ICT, standard communication, RPA

1. Introduction

The pressures of e-work affect everyone creating and using knowledge in a remote working environment regardless of the sector, which leads to the urgent need for effective solutions to lessening digital fatigue as E-work is characterized by using IT tools.

The Covid pandemic brought about a rise in the degree of remote work instead of on-site work or even its complete substitution. Companies had to undergo an accelerated transition to the cloud and the implementation of cloud solutions in order to survive on the market. That process was sometimes unintended, unprepared and rushed. Some companies did have plans to shift to CC solutions before the pandemic, so in their cases the shift was just implemented faster than planned therefore in those cases it was a thought-through process. Unfortunately, in other cases it was more chaotic. The introduction of any new solution is usually accompanied by more (often detailed) messages in the form of an increased number of instructions and documentation, which the employee has to become acquainted with.

Along with Cloud computing, the communication tools and methods in the form of information and communication technology (ICT) and computer mediated communication (CMC) have become crucial in enabling communication with team members in geographically disperse circumstances. Among ICT tools that cover synchronous and asynchronous communication channels, Coleman (1997) enumerated "electronic mail, bulletin boards, audio/video/data conferencing, automated workflow, electronic voting and collaborative writing". Since the majority of companies were unprepared for the sudden change in communication processes, all the above channels came into usage, overlapping each other and struggling for priority. Moreover, they were not digitally synchronized. As a result, the use of all of these channels, necessity of its integration and the excessive information overload from the messages received led to increased tiredness, so called prolonged fatigue, which, unhealed, caused chronic fatigue (*chronic fatigue syndrome* CFS), and may turn into exhaust (Ostrowska 2020, Jurzysta 2020; Czarnecka, Słocińska 2016).

Evidence suggests (Nadler, 2020, Lee et al. 2021) that one of the diagnosed increased workloads from remote working causing digital fatigue is communication overload. The necessity to be available around the clock on-line, constantly ready to provide communication in various forms (oral or written) and with the use of various and disparate tools (Teams, e-mail, telephone) is having a detrimental impact. If some of the messages could be standardized in form and content for the purpose of automation, then bots could be used to replace employees in the communication of repetitive and time-consuming messages.

The aim of this paper is to diagnose whether companies have standardized communication processes in terms of its content and form as well as to learn what types of bots are being used for these purposes – ITC communication bots, RPA or for search purposes. Moreover, it is worth investigating whether the amount of instructions rose and the detail of the structure increased – as predicted, or did employees experience more decentralization and gain empowerment. The research results presented indicate the directions taken by enterprises, and may inspire further activities and contribute to understanding the phenomenon and support non-manufacturing sectors.

2. Theoretical background

When studying the literature on the development of organizations, apart from the concept of "knowledge sharing" other terms can be found like: "knowledge transfer", "knowledge exchange", "knowledge dissemination", "knowledge diffusion". These are often understood similarly and used interchangeably. Some authors, however, suggest such concepts should be distinguished – the deliberate, targeted and one-way action, aimed at finding a specific application (it is known in advance what knowledge, where from, to whom and for what purpose it is to be passed on) should be described separately to dissemination with no specific purpose (Albrychiewicz-Słocińska 2020; King 2006; Davenport, Prusak 2000). Regardless of the name and intention, it is a phenomenon that occurs through interactions between people by means of various communication channels – direct and indirect. The type of communication channel used affects the quantity and quality of the transferred knowledge, some channels facilitate; others hinder or even prevent the effective transfer of a specific type of knowledge. In a broader perspective, there is an interdependence between communication and knowledge (from a human perspective) – communication is a tool for acquiring, sharing and retrieval of knowledge.

Having acknowledged that the method of communication affects the quality, complexity and quantity of acquired knowledge as well as the possibility of future usage, and pointed out that certain knowledge may require or not require specific channels of communication, methods and tools, we turn to communication patterns in this paragraph. During the Covid pandemic, the communication patterns changed from those dominated by direct forms to those that are mainly indirect. Therefore, the regularly used methods of sharing knowledge (Czarnecka, Daróczi, 2017) also had to be adapted to the prevailing conditions of largely remote work. Immediate questions directed to colleagues with greater seniority is no longer as accessible and easy as before. At the same time, the number of messages that contained instructions, regulations, as well as indications and new ordinances related to the need to adapt to the prevailing new situation of geographical dispersion and its coordinated use has increased dramatically. These possible changes may be categorized in the following way – see Image 1.

specificity of tasks	less instruction but more detailed	more instruction and more detailed
	less instruction and less detailed	more instruction but less detailed
	number of instructions regulations and documents	

Image 1: Possible change of number and specificity of communicated instructions after implementing Cloud Computing

Remote work minimizes real-life communication. Working as a team via instant messaging and video communication does not compensate for the loss of in-person communication for sociable people and the excessive increase in digital communication is detrimental to job performance (Charlampous et al., 2019). The increased number of messages transmitted and their frequency may result in communication overload. In the literature, the concept of digital fatigue has been defined and described, and also suggestions for dealing with it (Leonardi 2021) can be found. It was defined as „a state of mental exhaustion and reduced motivation and concentration due to the overuse of digital devices and platforms" (Korunovska, Spiekermann, 2014). Digital fatigue can be recognized and diagnosed, and there already exist suggestions and proposals for dealing with it

– by self-care e.g. separating work and personal life, to set boundaries and monitor mental exhaustion, planning in times throughout the day for self-care, encourage physical activity (Collins-Pisano, et. al., 2021; McGaughey, et. al., 2021)

There are three main reasons identified for digital communication fatigue: information content repetition, excessive formats and software used and incompatible hardware formats. Receiving an overwhelming number of messages, not all of which carry new information (content repetition), in order to be up to date and not to miss important information, requires employees to read each of them and afterwards assess whether the information is known (repetition), is new or perhaps there is a gap in information needs due to a missing message that was thought to have already been passed on, or should have been passed on (by someone other than expected). At the same time, employees also have to extract the important or urgent messages from the masses of communicated messages. This incoming information is received in various formats (written, voice recordings, pictures), transferred via various applications and sometimes sent to different devices (e.g., information in the form of picture transferred by SMS by the phone, by e-mail to the notebook, or voice message sent via Teams to the computer). This clearly will lead to an increase in exhaustion. A fatigued employee sometimes fails to hear correctly or fails to read carefully (the long list of incoming e-mails) therefore they send queries about items that have already been sent, but missed due to inattentiveness. Repeated inquiries lead to an unnecessary exchange of messages, wastes time, and frustrates the senders having to repeat it, etc. The employee could spend this time on other, more productive activities, resulting in a company's development. Such repetition and time-wasting could easily be eliminated by introducing bots as job support. A bot is a program installed on a PC, server or virtual machine that can perform certain tasks instead of a human being. According to Forrester Research (*Forester*…) by the end of 2021, the number of bots performing administrative, sales and related tasks will reach approx. 4 million.

Since remote workers rely heavily on using Information and Communication Technology (ICT) to communicate and collaborate with colleagues, supervisors, subordinates and clients, chatbots (voice-chat or written-chat) could support them (Adamopoulou, Moussiades, 2020). ICT is defined as "the array of primarily digital technologies designed to collect, organize, store, process and communicate information within and external to an organization" (Ritchie, Brindley 2005, p.206). A chatbot is a type of software that allows people to conduct conversations in natural, human language (Ait-Mlouk, Jiang, 2020), using a text or voice interface. Chatbots are able to lead many conversations at the same time and deliver the necessary information in a few seconds – which is much faster than a customer service representative. Chatbots are more than simple programs that automatically answer frequently asked questions. Increasingly, they are advanced digital assistants who learn and develop their skills based on their interaction with users.

Task-oriented and *conversational* chatbots (Gao, Galley, Li, 2019) are two types distinguished from the vast variety of bots. Task-oriented chatbots are rather basic and focus on performing a single function, they usually answer users' questions according to a specific key based on pre-programmed answers, such as closed-list question sets. They work well when supporting various customer service processes, e.g., interactive FAQ. Conversational chatbots, also known as virtual assistants, simulate a conversation similar to a conversation with another human being. In addition to programmed dialogue scenarios, they also use advanced technologies such as (Bu, et. al., 2022): Natural Language Understanding, machine language processing (*Neuro Linguistic Programming*), Machine Learning, and Sentiment Analysis. They can provide the appropriate answer or fulfill a specific request, they use text and graphic interfaces, audio analysis and video processing. They can be based on automated rules, artificial intelligence, or both. They are better in personalizing communication, they "learn" their interlocutor's communication patterns and can even recognize moods. Thanks to this, they are able to provide answers in line with the context of the conversation and they can anticipate the needs of users or offer them recommendations. They can also be used for instant messaging (Facebook, Messenger) and live chats on a website. The list of advantages is long and include primarily: – 24/7 availability, fluent natural language communication in real time and personalization of communication.

For the purpose of unifying the wide variety of document formats, RPA bots are suitable (Bu, Jeong, Koh, 2022). According to the Institute for Robotic Process Automation and Artificial intelligence, the "Robotic process automation (RPA) is the application of technology that allows employees in a company to configure computer software or a "robot" to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems" (*IRPA&AI*). Therefore, RPA bots may be understood in two ways – as robots doing human tasks and as a software solution. Considering these two

approaches, and having in mind the context of this article (assisting communication whilst doing remote work), it is justified to advocate integrating both approaches in the form of software that handles highly repeatable, laborious and time consuming, multi-series communication activities previously performed by people. This reduces the risk of human error caused by boredom and exhaustion to a minimum and therefore enables the use of human creativity for strategic, unconventional and inventive tasks as a consequence of unleashing such opportunities. In the case of automation of manual office processes, bots can relieve employees from repetitive work in favour of their expert skills.

RPAs are able to automatically log into the system no matter whether it is ERP, CRM or a web page, they go through the entire path for the exploration of individual elements of applications and select information relevant to the task that should be performed from a specific location. It can, for example, edit Excel, Word, PDF, etc. documents, work on files and folders (create, delete, update, move, etc.) support e-mails by extracting data, composing and sending messages, as well as recognize texts in graphic files or execute system commands. And it can repeat the same things unlimited times for different accounts, and then combine the collected information with data from other areas of the system or other systems. Since no special, dedicated solutions is needed, RPAs are used to configure software or log into existing solutions to modify, retrieve, and process data in the same way an employee would do it, but is triggered "manually" or as a hybrid model (*IRPA&AI*).

The advantages of RPAs (Bu, Jeong, Koh, 2022) are that RPA bots usually do not require any special integration with the organization's software, since it uses screen scraping and a physical user interface. Therefore, no change in organizational processes is required. Implementation is easy because setting up RPA bots follows the same rules as creating macros and logs for actions, modern solutions already allow for automatic bot learning based on a review of employees' activities. Despite RPAs ensuring elasticity, they will not substitute for intellectual activities related to cognitive tasks, although they can automate a lot of menial work – thereby allowing automated transfer of documents between different systems which does not take up the time of employed specialists and, thus, automates workflow.

The areas particularly sensitive to robotization are departments where office work focuses on supporting business processes with the use of various software for processing large amounts of data (mainly calculation sheets) and applications as well as using ERP systems, updating data in CRM – e.g. accounting, controlling, Human Resources, sales departments or legal departments.

A different group of bots (considered here a separate category) are devoted to the intentional search for specific information. These are automatically programmed indexing robots and scrapers to retrieve information e.g., from websites (Czarnecki, et. al., 2021). They can monitor, for example, changes to the website, click on links, search for specific terms in the text, and otherwise surf the Internet independently according to requirements. For example, a robot can search for competitors' prices for comparison purposes.

3. Research method and results

The research question formulated was to ask whether there is a possibility of categorizing some of the messages and standardizing them to automate a certain range of communication in order to relieve employees of such a burden. For the purpose of the article, several steps were undertaken. Initially, we established whether there are messages that may be a subject of standardization – either because of form or because of content. This seems to be parallel to the growth of the number of documents, instructions and regulations sent as well as with determining whether the instructions are more or less detailed.

The comparative element of the growth in the amount of documents sent is interesting when assessing the dynamics of the phenomenon, however, in the case of this elaboration, the focus is on relieving the employee from the existing excesses and overloading, rather than determining the amount of this excess over time. When an increase in the amount of instructions occurs, it is assumed that it is better to automate this part of the communication (content), especially since messages may arrive through different channels, and the information contained therein might be transferred in various formats that must then be integrated (manually or RPA). Determining whether instructions are more or less detailed– will in turn qualify whether people have empowerment in the workplace or perform tasks in a very structured and imposed way. The second case anticipates in this paper an automation. Instructions that are better suited for automation in terms of form are

those which can be repeatedly forwarded to different recipients and duplicated, because non-automated ones can become distorted.
Having established the interdependence between the number and specificity of instruction and the possibility of standardization and automation of the form and content of messages, the bots used for this automation may be distinguished – these are RPA, writing and talking chatbots and search-bots.

The research was carried out in 2020 on 400 companies in the manufacturing industry that use cloud solutions in their daily work. In 2020, 18.25% of companies declared a decrease in the number of instructions, regulations and documents, whereas 9.5% of companies noticed an increase. Moreover, 36.00% of companies concluded that assigned tasks are more detailed, with 1.5% declaring the opposite. In comparison, in 2018, 10.00% of companies declared a decrease in the number of instructions, regulations and documents, whereas 20.50% of companies noticed an increase. Moreover, 17.50% of companies judged that assigned tasks are more detailed, with 10.25% declaring the opposite (Zalewska-Turzyńska, 2018). This reveals that the trend had changed within 2 years – with tasks becoming less detailed and burdened with less instructions to be done. Detailed numbers in each of categories are shown below in image 2.

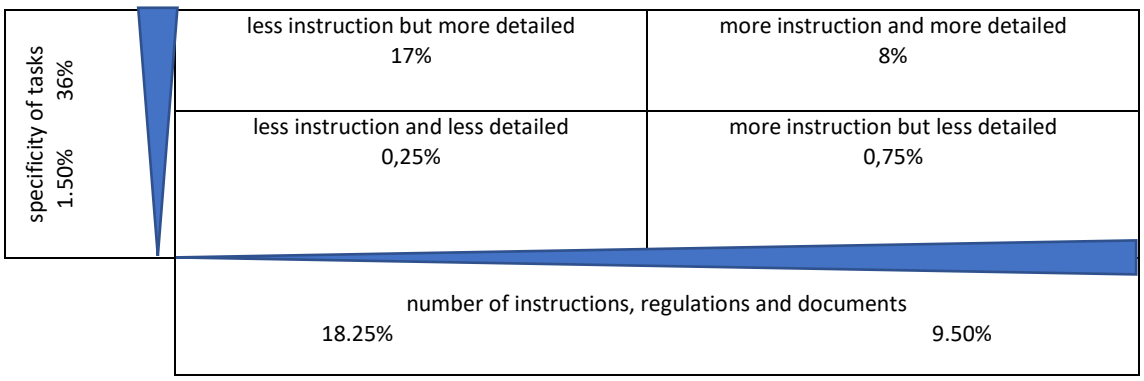
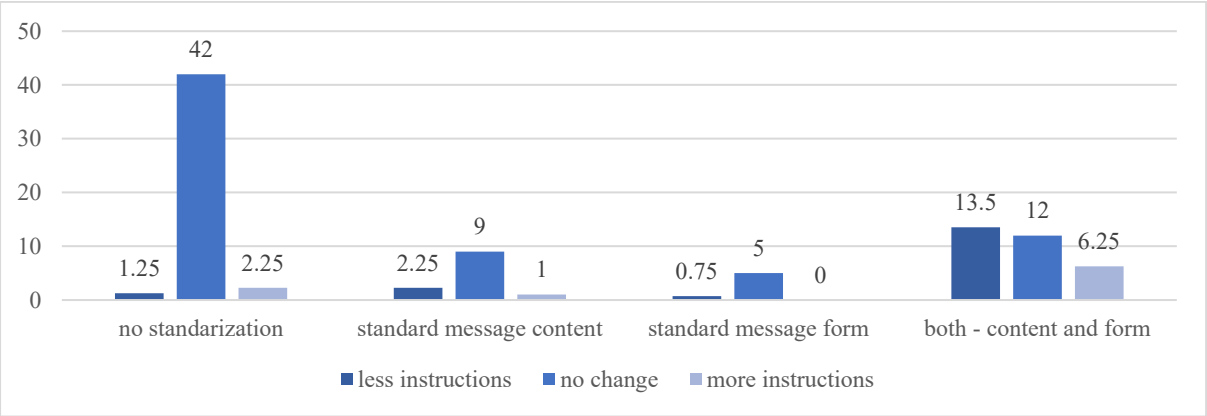


Image 2: Change in communicated instructions after implementing Cloud Computing – research outcomes*

*The categories inside the grid do not sum up in rows and columns to 'external ones' (e.g. in column 17%+0.25%≠18.25%) because of 'no change' category (e.g., the number of instructions changed but specificity not at all)

The amount of instructions was confronted with the possibility of standardization of the content and form of the message. 13.5% of companies that declared a decrease in the amount of received instructions also declared content and form of message standardization. 42% of companies declared a status quo – no change in the number of instructions and in their standardization. Detailed information is presented in Image 3 below.

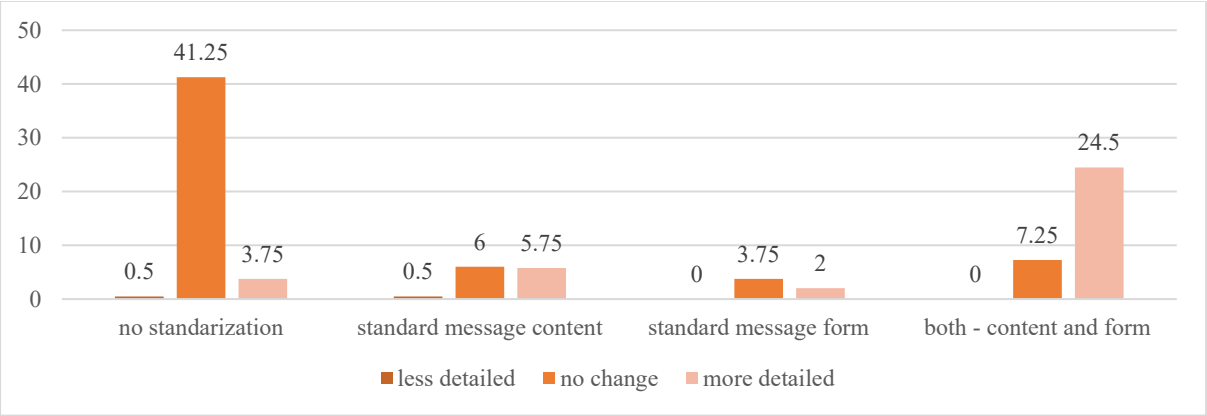


P < 0,001 V-Kramer < 0,001

Image 3: Number of instructions versus message standardization in %

41,25% of companies that declared no change in specificity, declared no standardization at the same time, whereas 24,5% of companies declared more detailed task specification and standardization of content and form. These outcomes seem to be logical – if no change in task specificity occurred no standardization occurred, i.e.,

there was no change at all. At the same time, more instructions followed the need for and the actual introduction of content and form standardization. Interestingly, there are also groups of companies of which 6% introduced standardization of message content and 3.75% of different companies declared standardization of message form, although they declare no change in task specificity,. This information is presented in Image 4 below



P < 0,001 V-Kramer < 0,001

Image 4: Specificity of tasks versus message standardization in %

Because of the limited size of this elaboration, the data are presented in synthetic form in the two tables shown below – Table 1 shows details related to the size of researched companies, Table 2 with scope.

Content standardization most frequently is declared as being implemented by medium companies (20.75%), but less frequently (3.5%) by micro companies. Form standardization is most often declared by medium companies (17.50%).

Organizations most commonly use bots for RPA (27.5%), and least for voice chatbots (3.75%). Looking at the data in terms of company size, writing bots are used most by medium companies (13.75%) of all researched companies, and least frequently used are voice bots in large companies (0.25%).

Table 1: Size of company versus standardization and automation of communication in %

	Size of company					
	Micro	**Small**	**Medium**	**Large**	**overall**	**Chi-squared Pearson/ V Kramer**
Standardized content	3.50	9.00	20.75	10.75	44.00	,001
No standard content	10.50	14.00	24.00	7.50	56.00	,001
Standardized form	3.25	7.50	17.50	9.25	37.50	,009
No standard form	10.75	15.75	27.00	9.00	62.50	,170
RPA	3.00	4.50	11.75	8.25	27.50	,001 / ,001
Writing Bots	0.50	6.00	13.75	2.25	22.50	<,001 / <,001
Voice Bots	0.75	1.75	1.00	0.25	3.75	,095 / ,095
Search Bots	3.00	1.00	5.00	1.50	10.50	,010 / ,010

In terms of content, national companies used content standardization most (11.25%), whereas international companies used standard form (25.25%). Looking at the data in terms of company scope, national and international companies use writing bots most (both equally 11.25%). None of the regional companies declared using writing bots. Search bot usage does not show statistical dependence in relation to the size of the enterprise.

Table 2: Scope of company versus standardization and automation of communication in %

	Scope of company				
	regional	**national**	**international**	**overall**	**Chi-squared Pearson/ / V Kramer**
Standardized content	2.50	11.25	3.25	44.00	<,001
No standard content	2.25	28.00	25.75	56.00	<,001
Standardized form	2.50	9.75	25.25	37.50	<,001

No standard form	2.25	29.75	35.50	62.50	<,001
RPA	2.50	4.25	20.75	27.50	<,001 / <,001
Writing Bots	0.00	11.25	11.25	22.50	,009 / ,009
Voice Bots	0.25	3.25	0.25	3.75	<,001 / <,001
Search Bots	0.25	5.25	5.00	10.50	,293 / ,293

There is no statistical dependence between message standardization and chat bots and search bots. If the bots are being used, it is for standardization of both content and form of the messages. RPA is declared to be used in 19.25% of researched companies to standardize communication content and form, whereas writing bots in 12.25% of companies for the same purpose. Detailed information is presented below in Images 5 and 6.

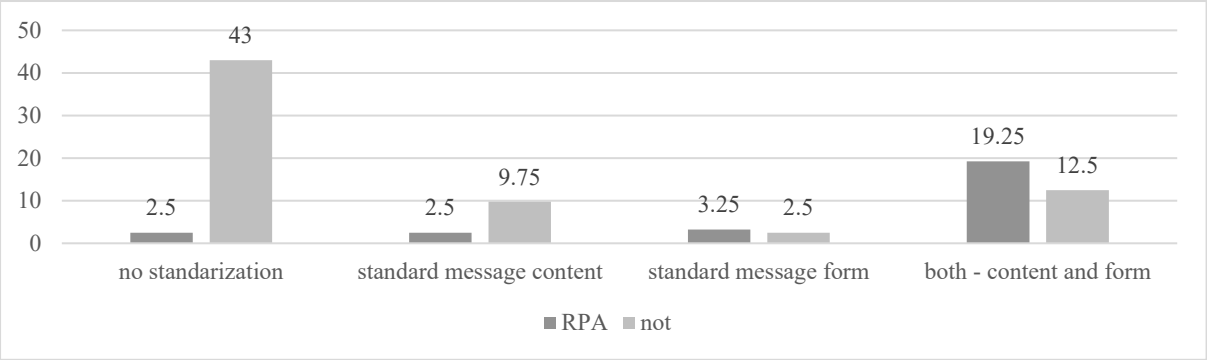


Image 5: Standardization versus RPA bots

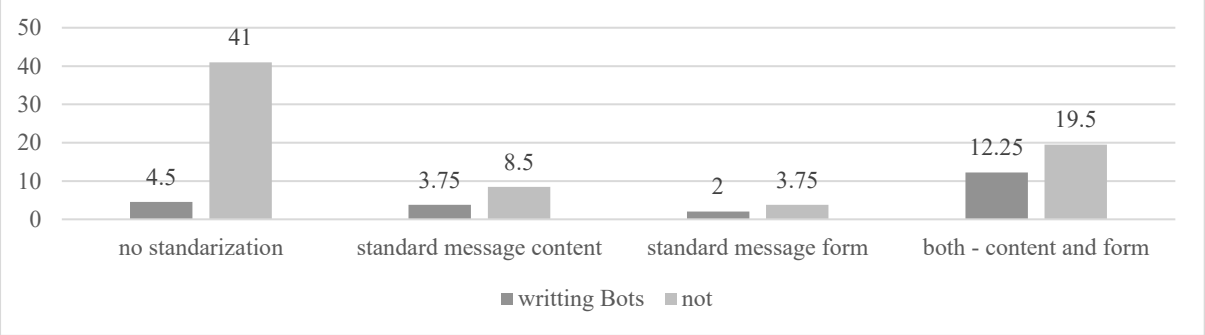


Image 6: Standardization versus writing bots

For companies which say the amount of instructions grew, the most popular are writing bots and RPA (both by 5%), whereas for those companies which issued less instructions the same solutions are being implemented, but more eagerly (11.25% for writing bots and 10.75% RPA). Search bots are not used in any of these two cases. Search bots are used by companies that declared no change in the amount of instructions (10.5%).

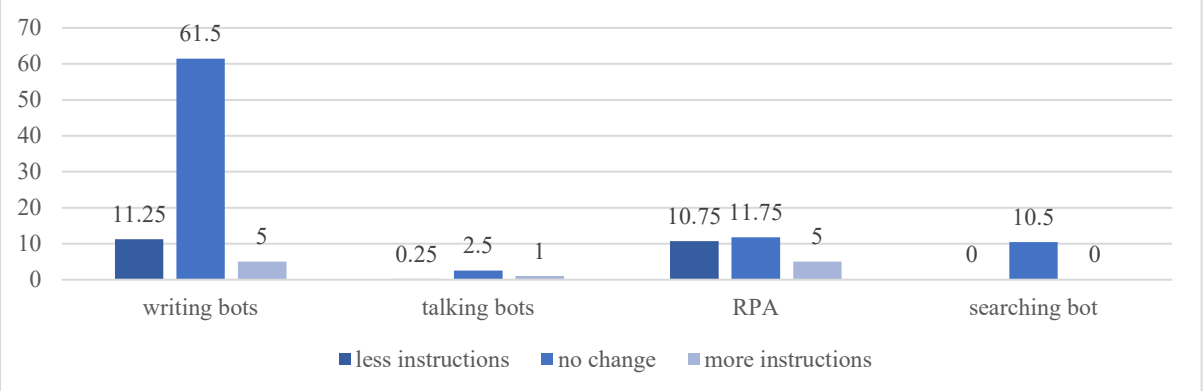


Image 7: Instructions quantity versus types of bots used

When the task became less detailed, bots were almost not used, but when tasks were judged as more detailed, the usage of bots rose – RPA 19.25%, writing 15.25%, talking and search equally 2.25%. Companies that declared

no change in the specificity of tasks also introduced bots to everyday routine, this time RPA and search equally 8.25%, writing bots 7%, talking bots 1.25%.

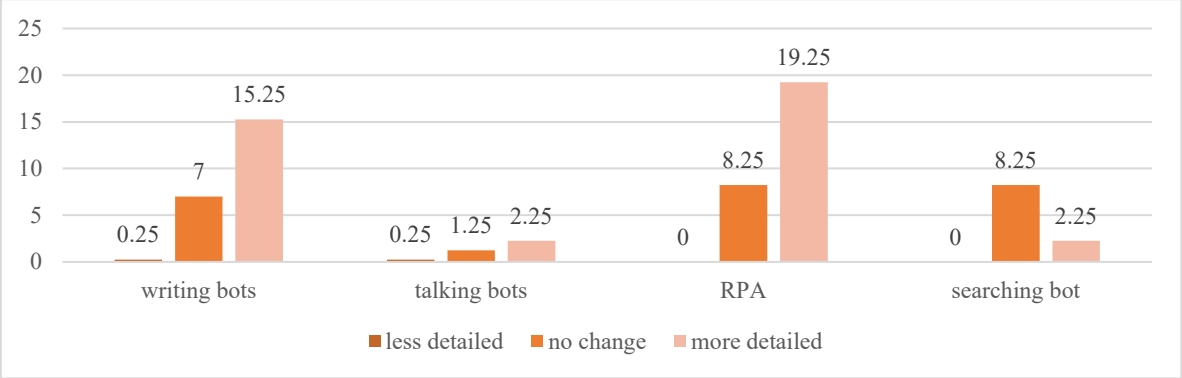


Image 8: Specificity of tasks versus types of bots used

4. Conclusion

1. The amount of instructions, regulations and documents was said to have risen in 9.50% of the companies researched, while it dropped in 18.25%. The specificity of tasks given to employees was declared as less detailed in 1.5% of researched companies, while 36% more detailed. The change in the amount of instructions was expected to be high in the unstable situation of lock downs and remote work, however, the numbers are far below 50%, which was surprising.
2. Companies more frequently declared that they did not use standardization than use it, but if they did standardize they standardized content more eagerly than form (44% content standardization to 37.50% form). It was expected that the form of communication is easier to be standardized than content, whereas research showed the opposite.
3. Medium companies responded that they used both content and form communication standardization most (20.75% and 17.50% respectively). Large companies were expected to use standardization most but perhaps they had standardized communication earlier, therefore there was not much left to standardize.
4. If companies introduce RPA bots they usually made the most use of it standardizing both message content and form. The same is true for writing bots.
5. When the specificity of tasks rises, companies eagerly use all types of bots. In the case of the number of instructions, the dependence is not so obvious.
6. Organizations use bots for RPA most (27.5%), and voice chatbots least (3.75%) for the tiring, repetitive work of combining different types of messages from different sources and files.

The evidence suggests that by implementing bots to do repetitive, boring and tiring jobs, employee's time can be devoted to more developing and innovative tasks.

References

Adamopoulou, E. and Moussiades, L. (2020) An overview of chatbot technology. *IFIP International Conference on Artificial Intelligence Applications and Innovations*, pp. 373-383. Springer, Cham.

Ait-Mlouk, A. and Jiang, L. (2020) KBot: a Knowledge graph based chatBot for natural language understanding over linked data. *IEEE Access*.

Albrychiewicz-Słocińska A. (2020) *Organizational Knowledge as an Element of the Innovation Climate in the TOP 500 Polish Enterprises*, [in:] Proceedings of the 21st European Conference on Knowledge Management (ed.) Garcia-Perez Alexeis, Simkin Lyndon, European Conference on Knowledge Management, Coventry.

Bu, S., Jeong, U. A. and Koh, J. (2022) Robotic process automation: A new enabler for digital transformation and operational excellence. *Business Communication Research and Practice*, *5*(1), 29-35.

Charlampous, M., Grant, C.A., Tramontano, C. and Michailidis, E. (2019) Systematically reviewing remote e-workers' well-being at work: A multidimensional approach. *European Journal of Work and Organizational Psychology*, 28(1), 51-73.

Coleman, D. (1997) Groupware: Collaborative Strategies for Corporate LANS and Intranets. Upper Saddle River, Prentice Hall

Collins-Pisano, C., Johnson, M., Mois, G., Brooks, J., Myers, A., Muralidharan, A., Storm, M., WrightM., Berger N., Kasper A., Fox A., MacDonald S., Schultze S. and Fortuna, K. (2021). Core Competencies to Promote Consistency and Standardization of Best Practices for Digital Peer Support: Focus Group Study. *JMIR Mental Health*, *8*(12).

Czarnecka A. and Daróczi M. (2017) E-learning as a method of employees' development and training, [In] Daróczi M, Robak E, Vinogradov S (eds.), Management, organizations and society, Agroinform Kiadó, Budapest.

Czarnecka A. and Słocińska A. (2016) *Problemy kształtowania zaangażowania zdalnych pracowników*, [in:] *Wyzwania wynikające z uwarunkowań polityki kadrowej przedsiębiorstw* (eds.) Robak Elżbieta, Skolik Sebastian, Wydawnictwo Wydziału Zarządzania Politechniki Częstochowskiej, Częstochowa.

Czarnecki, C., Hong, C. G., Schmitz, M. and Dietze, C. (2021) Enabling Digital Transformation Through Cognitive Robotic Process Automation at Deutsche Telekom Services Europe. *Digitalization Cases Vol. 2*, Springer, Cham. pp. 123-138

Davenport T.H. and Prusak L. (2000) Working Knowledge. How Organizations Manage What They Know, *Harvard Business School Press*, Boston Massachusetts.

Enríquez, J. G., Jimenez-Ramirez, A., Dominguez-Mayo, F. J. and Garcia-Garcia, J. A. (2020) Robotic process automation: a scientific and industrial systematic mapping study. *IEEE Access*.

Gao, J., Galley, M. and Li, L. (2019) *Neural approaches to conversational AI: Question answering, task-oriented dialogues and social chatbots*. Now Foundations and Trends.

Jurzysta, D. (2020) Standardy pracy zdalnej: co wpływa na efektywność home office?. *Personel i Zarządzanie*, (12), 68-71.

King W.R., Knowledge sharing, [w:] D.G. Schwartz (red.), Encyclopedia of Knowledge Management, Herslen, London 2006, s.493x.

Lee, S., Zhou, Z. E., Xie, J. and Guo, H. (2021) Work-related use of information and communication technologies after hours and employee fatigue: the exacerbating effect of affective commitment. *Journal of Managerial Psychology*.

Korunovska J. and Spiekermann S. (2014) The importance of interface complexity and entropy for online information sharing, Behaviour & Information Technology, 33:6, pp.636-645.

McGaughey, F., Watermeyer, R., Shankar, K., Suri, V. R., Knight, C., Crick, T., Hardman J., Phelan D. and Chung, R. (2021). 'This can't be the new norm': academics' perspectives on the COVID-19 crisis for the Australian university sector. *Higher Education Research & Development*, 1-16.

Nadler, R. (2020) Understanding "Zoom fatigue": Theorizing spatial dynamics as third skins in computer-mediated communication. *Computers and Composition*, *58*.

Ostrowska, I. (2020) Dla kogo home office? Kompetencje, które warunkują gotowość do pracy zdalnej. *Personel i Zarządzanie*, (12), pp.33-35.

Ritchie, B. and Brindley, C. (2005) ICT adoption by SMEs: implications for relationships and management. *New technology, work and employment*, *20*(3), pp.205-217.

Zalewska-Turzyńska M. (2018) *Impact of implemented cloud technology on the structure centralization and formalization in manufacturing companies – research results*, „Economic and Social Development", pp.95-103.

IRPA&AI Institute. The Automation of Knowledge Work will be This Decade's Engine of Growth. [on-line] https://irpaai.com/definition-and-benefits/

Forester [on-line]: https://www.forrester.com/report/The-RPA-Market-Will-Reach-29-Billion-By-2021/RES137229

New Perspectives for Knowledge Management in Inter-Organizational Networks and Relations in Agribusiness

Cinthya M. S. Zanuzzi[1], Eduardo Giugliani[2], Denilson Sell[1] and Paulo M. Selig[1]
[1]Federal University of Santa Catarina, Florianopolis, Brazil
[2]Pontifical Catholic University of Rio Grande does Sul (PUCRS), Porto Alegre, Brazil
cinthyamsz01@gmail.com

Abstract: Inter-organizational networks appear in the literature as an alternative to collaborative arrangements to help the agribusiness sector in obtaining a competitive advantage and for the promotion of innovation. Obtaining complementary knowledge is one of the main reasons for the emergence of these networks. In this way, knowledge management can help in the creation and transfer of knowledge in a collaborative way between the network participants. However, there is a gap in the literature when it comes to studies of inter-organizational relations and knowledge management, especially in relation to networks in the agribusiness sector. In this context, the present study aims to deepen the studies by addressing: a) how scientific research has worked on networks and inter-organizational relations in agribusiness; and b) the role of KM as an element of viability of this arrangement model. In order to answer these questions, a literature review was carried out through a systematic search in the databases Web of Science and Scopus, in order to verify how the researches are discussing the topic. As a result, the potential contribution of intensifying studies involving KM as an element of enhancing the capabilities of inter-organizational network participants is highlighted, and that the absorptive capacity presents itself as an important theory to explain how organizations manage to explore new innovative knowledge.

Keywords: Inter-organizational network, inter-organizational relations, agribusiness, knowledge management, business

1. Introduction

The process of globalization and digital transformation has had significant effects on the competitiveness and sustainability of companies. While the industrial economy valued vertical integration, the knowledge economy is stimulated by the formation of inter-organizational relations and network business arrangements (Franco and Esteves, 2020).

Different forms of organization have therefore emerged in the agribusiness sector (Detoni et al., 2020). In fact, the characterization of new collaborative business models in this sector, such as inter-organizational networks and relationships is verified in the literature (Wiśniewska and Paluszak, 2019). These networks emerge as a strategic option in the face of the challenges of the sector.

Inter-organizational networks have also been occurring in organizational studies as an innovation strategy and obtaining complementary knowledge (Abbade, 2015, Balestrin and Verschoore; Reyes Jr, 2010). According to Franco and Esteves (2020), knowledge resource management is achieved through an open and collaborative process and is no longer an individual and endogenous process dominated by a single organization. In this way knowledge management (KM) can have a crucial role so that knowledge can be created and transferred collaboratively, through interactive processes of the participants of a network (Ortiz, Donate, and Guadamillas, 2017).

Although the theme of an inter-organizational network has deepened at the present time, a gap in research can be seen when it comes to studies of inter-organizational relations and KM, especially considering networks in the agribusiness sector (Franco and Esteves, 2018; Wiśniewska and Paluszak, 2019).

In this context, the present study aims to deepen the studies by addressing: a) how scientific research has worked on networks and inter-organizational relations in agribusiness; and b) the role of KM as an element of viability of this arrangement model. This is achieved through a literature review aimed at synthesizing the most relevant studies, to verify how the article's topics are being discussed and explored in the studies .

2. Theoretical Foundation

2.1 Networks and inter-organizational relations

Inter-organizational networks can be defined as a group of three or more autonomous, geographically distributed organizations (Müller-Seitz, 2012), which establishes mutual exchange relationships (Manser et al.,

2016). Its origins may be due to the pressure of different factors, such as: reduction of costs of commercial transactions, specialization, reputation improvement, innovation strategy, space for knowledge creation and learning, sustainability (environmental, economic, and social), and cultural and digital transformation (Abbade, 2015; Wegner, 2019, p 186).

Inter-organizational networks are supported by two main dimensions: the relational level, between the participants, and the structural level (Franco and Esteves 2020). Regarding the relational dimension, the literature describes it as: vertical (e.g. between buyers and sellers/suppliers), horizontal, strategic alliances, joint ventures, consortia, clusters, franchises, industrial districts, technological hubs, hub, central purchasing, cooperation networks, innovation networks, and virtual business communities (Grandori and Soda, 1995; Hoppen; Klein and Rigoni, 2017).

As for the structural dimension, for Castells (1999) the performance of networks depends on the following fundamental attributes: a) connectivity (the structural capacity to facilitate communication); and b) coherence (shared interests between the objectives of the network and its participants). Grandori and Soda (1995) add that governance is also fundamental, since it establishes the rules of operation and ethical assumptions to be observed by the participants. According to Balestrin and Verschoore (2010), inter-organizational networks have the ability to facilitate joint actions and resource transactions to achieve organizational objectives, such as knowledge. For Dalkir (2005), recognizing that the competitiveness of organizations is linked to the robustness of their knowledge assets, makes KM an organizational objective.

2.2 Knowledge management

The knowledge economy based on the valuation of intangible assets points to the importance of managing the organizational knowledge process, as such knowledge is capable of creating competitive value (Edvinsson, 2013). Thus, KM presents itself as a process through which the organization perceives and generates value, through its intellectual and knowledge assets (Uriarte, 2008).

KM can be understood by different epistemologies and for the present study we adopted the cognitivist view. Where knowledge is understood as a fixed and representable entity (data), which can be stored in databases, it can be shared in an organization (Venzin; Krogh and Roos, 1998). Thus, KM can be seen as a process that involves the creation, transfer, integration and application of knowledge (Alavi and Leidner, 2001). These processes, managed in an integrated way, allow the development of initiatives and strategies to create, share, transform, and apply knowledge to maximize organizational effectiveness, growth (Sveiby, 1998), and innovation (Papa; Chierici; Ballestra; Meissner and Orhan, 2021), organizational performance (Andreeva and Kianto, 2011).

The present study focuses on KM in the agribusiness sector and is based on Zanuzzi's research *et a*l (2020), which highlight that KM practices and processes collaborate with agribusiness managers in the identification, creation, use, and knowledge storage, which is considered a necessary input for the sustainable development of the sector, assisting in its digital transformation. Thus, alternative sources of knowledge are important to raise the dynamic capacity of creation and use of knowledge among farmers and managers of the sector (Vieira Filho and Da Silveira, 2016). Networks are a means of obtaining complementary knowledge to assist in the reconfiguration of the participants' capacities and the strategic renewal of the organization.

3. Methodology

The research methodology is exploratory and descriptive, the review was elaborated according to the scoping review methodology, seeking the contribution of interorganizational networks and relationships and KM in agribusiness. The technical procedure was performed following the protocol of Cronin, Ryan and Coughlan (2008) of systematized search, which consists of five steps. The protocol steps are described in Table 1.

Chart 1: Steps of the systematic literature review protocol developed for the study.

Protocol steps	Article development
1.Formulation of the research question	How has scientific research worked in inter-organizational networks and relationships in agribusiness? What is the role of KM as an element to make this arrangement model viable?
2.Establishment of inclusion and exclusion	1. Scientific papers and conference papers; 2. Articles in English;

criteria	3. Publication period: 2011 to 2022; 4. With the use of boolean operators, presence of words: "Inter-organizational networks" OR "inter-firm networks" AND "agriculture" OR "agribusiness" OR "agroindustry" OR "food system" AND "knowledge management" 5. With more than one quote. 6. Databases: Web of Science (Core Collection / All field) and Scopus a Social Science. 7. Date of searches: April 2022
3.Selection and access to literature	According to the previous item, the search took place from the Web of Science (Core Collection / All field) and Scopus to Social Science databases. Applying the established inclusion and exclusion criteria.
4.Quality assessment of the literature included in the review	Previous reading of the studies selected in the previous step to verify if they include information that helps in answering the research question.
5. Analysis, synthesis, and description of the results	Careful analysis and synthesis of the articles selected in the fourth stage and preparation of tables 4 and 5 with the results. In this last phase, each article considered important to answer the objective question of the research was analysed in detail.

Source: adapted from the protocol of Cronin, Ryan, and Coughlan (2008).

In the first search performed in both databases, the keywords "inter-organizational networks" OR "inter-firm networks" AND "agriculture" OR "agribusiness" OR "agroindustry" OR "food system" AND "knowledge management" were used and no article was found. So the search was adapted as follows:
Search 1: keywords used: "inter-organizational networks" OR "inter-firm networks" AND "knowledge management". The results are presented in Chart 2:

Chart 2: Summary of the search for articles of number 1

Database	Number of articles	Application of selection criteria
Scopus	57	14
WoS	20	5
Total	77	19

Source: prepared by the authors.

In this search, 19 articles were found. Right after the selection criteria was applied, it was verified that 3 articles were duplicated, therefore 16 articles remained. After that, the article's abstracts were read and 7 articles were selected for full reading, as they were related to the research question.

Search 2: keywords used were: "inter-organizational networks" OR "inter-firm networks" AND "agriculture" OR "agribusiness" OR "agroindustry" OR "food system". The results are shown in Chart 3:

Chart 3: Summary of the search for articles of number 2

Database	Number of articles	Application of selection criteria
Scopus	9	6
WoS	11	8
Total	20	14

Source: prepared by the authors.
In this second search 14 articles were found. After applying the selection criteria, 3 duplicate articles were removed, therefore 11 articles remained, of which the abstracts were read and 7 articles were selected for complete reading, as they were related to inter-organizational networks and relations in agribusiness.

The organization of the articles' data and all the analyses were carried out in *Microsoft Excel* and in the text editor *Microsoft Word.*

4. Results and Discussions

4.1 Inter-organizational networks and relations in agribusiness

In the context of agribusiness, the literature presents numerous theories that contribute to the analysis of the different forms of organization of the sector. Some authors indicate that agribusiness can, and should, be seen

as a business network approach (Wiśniewska; Paluszak, 2020). The integration of this approach enables organizational interdependencies within the network, adoption of different coordination mechanisms, and as sources of resources (Lazzarini; Chaddad; Cook, 2001).

The reading of the articles made it possible to map and analyze the scientific production on inter-organizational networks and relations of agribusiness. In total, 7 articles were identified in the systematic search and were read in full. A summary of the articles is presented in Chart 4.

Chart 4: Summary of selected articles in the systematic search

Article title, year of publication, type of study	**Purpose of the article**	**Results**
NETWORK STRUCTURE IN SUSTAINABLE AGRO-INDUSTRIAL PARKS Nuhoff-Isakhanyan et al.(2017). Case study	To explore the structures of inter-organizational network ties that can improve the perception of sustainability performance in agro-industrial parks.	The results show that organizations in agro-industrial parks have improved sustainability performance; reputation; economic performance, and innovation performance. They also show that a structure of decentralized formal ties combined with interdependence has a positive influence on perceptions of improving sustainability. Decentralization of the network is important for organizations to avoid dependence on a central participant.
The role of inter-organizational relations and networks in agribusiness: the case for the Polish fruit and vegetable industry Wiśniewska-Paluszak and Paluszak (2020) Case study	To recognize and evaluate the distinguishing features of network relationships, which lead to better defined networks in agribusiness.	Different theoretical approaches of analysis of social networks and inter-organizational relations have allied themselves to the contemporary context of agribusiness. The study confirms the hypothesis that inter-organizational network relationships have distinct and complex attributes dependent on network objectives, which define the categorization of the agribusiness networks. The most important results of the study show the importance of the network for the exchange of knowledge and information, standardization and implementation of quality standards, and adaptation and adjustment to market changes. The study highlights the fragility of the correlations for: resources, innovation, and social relations in the network.
Brokering Rural Community Food Security: An Organizational Network Case Study in Central Appalachia ***Engle (2021) Case study***	To analyze whether the establishment of rules for the network functioning and sustainable production brings food security to the participants of the network.	The establishment of rules and practices help in increasing organizational capacity, community membership, and to build relationships. The benefits outweigh the costs, yet undermine the community's food security mission by marginalizing some participants who did not adhere to the rules.
Rural inter-firm networks as a basis for multifunctional local system development: Evidence from an Italian Alpine Area	To contribute to a greater understanding of the usefulness of Social Network Analysis (SNA) in the collection of information for the planning of rural development agendas.	The results show the difference between knowledge networks and business networks: companies know each other very well, especially those located in the same city, however business ties between them are less frequent. It shows the need to strengthen relations. In this case an awareness network can be seen as the basis for strengthening relational assets and strengthening social capital.

Article title, year of publication, type of study	**Purpose of the article**	**Results**
Bassia; Zaccarin and DeStefano (2014) Case study		The use of SNA can provide information on existing conflicts between local participants, identify marginalized groups, and provide guidance to policymakers to involve participants in project planning.
Cooperation in tradition or tradition in cooperation? Networks of agricultural entrepreneurs Dias and Franco (2018) Case study	Understand the inter-organizational networks of agricultural enterprises.	The results show that inter-organizational networks of agricultural enterprises have played a key role in the development of agricultural activities, through horizontal and vertical networks and collaboration with third parties. The spatial relationship between farms is the main determinant for cooperation in agricultural production. The analysis of cooperation relationships shows that in horizontal networks the collaboration with third parties is present in all categories, except for relationships related to new products, where vertical networks with customers predominate.
Small and Medium-Sized Enterprises' (SME) Preference for Innovation Networks: A Choice Experimental Approach (Lefebvre et al. 2014) **Case study**	Evaluate the network preferences of SMEs in terms of aligning network attributes.	SMEs with previous collaborative experience with other participants are better able to develop and benefit from new relationships in the network. Food SMEs have a preference for innovation networks made up of manufacturers and chain members, rather than research institutes. This is probably because they provide resources for radical innovations and due to the challenges inherent in the management and exploitation of knowledge. They also prefer networks where information is shared confidentially between the network partners, thus affecting the decision of the SME to join the network.

Source: prepared by the authors.

Networks of inter-organizational relationships are considered arrangements where participants cooperate to acquire external intangible resources (Wiśniewska-Paluszak and Paluszak, 2020), often motivated by costs. By participating in these networks, organizations aim to improve sustainable performance, reputation, and economic and innovation performance (Nuhoff-isakhanyan et al., 2017).

However, in the context of agribusiness, the participation of organizations in inter-organizational networks to obtain innovation does not present a consensus among the authors. The results of this study show adverse positions: Lefebvre et al. (2014) presents as a result of his research that participants prefer networks that support them to build their networks of partnerships (relationship), rather than networks that offer support for the development of innovations.

Wiśniewska-Paluszak and Paluszak (2020) identify that innovation is the network attribute with the lowest correlation with the objective of belonging to the network. For the authors, agribusiness networks need to increase their investments to improve relationships in networks aiming at shared resources and innovation.

Still on innovation, recent studies by Long Cheng et. al (2021) demonstrate that the participation of agribusiness companies in an inter-organizational cooperation network becomes essential to enhance innovation. The authors also highlight the need to invest in actions of network relationships that leads to innovation, such as trust.

It should be noted that the results of research on inter-organizational agribusiness networks highlight the difficulty in the innovation process by the network participants, especially when it comes to SMEs and farms. Some studies attribute the difficulties of innovation to cognitive and organizational differences, lack of confidence, type of culture, and the organization business model, among others. Lefebre et al. (2014) also highlight the need to coordinate the risk of opportunistic partners and the occurrence of unintentional knowledge leakage.

4.2 Inter-organizational networks and relations and KM

The analyzed articles suggest that KM plays a crucial role in the development of competitive advantage and innovation, where knowledge is the key resource. They also point out that the acquisition of external knowledge is crucial for the reconfiguration of the capacity and strategic renewal of the organization (Lavi, 2006) and that inter-organizational networks are a means to obtain the external and complementary knowledge through their KM processes and practices.

This study identified that the analyzed papers include more frequently the concepts of transfer, creation and acquisition of knowledge, individual and inter-organizational learning, intellectual capital (being the relational the most cited in the articles), and absorptive capacity. In order to identify the scientific contributions on KM in networks and inter-organizational relations, a chart with a synthesis of the findings of the 7 articles is presented (full reading, plus the abstracts of the other articles). Chart 5 presents the contributions of articles on how KM is studied in inter-organizational networks and relationships.

Chart 5: contributions of articles on inter-organizational networks and relations and KM

INTER-ORGANIZATIONAL NETWORKS AND RELATIONS AND KM		
KM perspectives	Knowledge transfer, creation and acquisition; co-creation of knowledge; Inter-organizational learning; Absorptive capacity; Intellectual capital; (mainly relational**)**	**Articles:** Del Giudice and Maggioni (2014); Morgan; Fellen and Finnegan (2014); Papa; Chierici; Ballestra; Meissner and Orhan (2021); Martins (2016); Ortiz,Donate and ,Guadamillas (2017); Franco and Esteves (2020); Bagheri, Kusters, Trieneken and Van Der Zandt (2016); Ye, De Moortel and Crispeels, (2020); Kolloch and Reck (2017); Lage and Alturas (2012); Carneiro-Da-Cunha; Macau and Alssabak (2013); Huber; Nöhammer and Stummer (2011); Barbeira; Franco; and Haase (2012); Poorkavoos; Duan and Edwards (2011); Cruz-Gonzalez, Lopez-Saez, Navas-Lopez and Delgado-Verde (2014).
Motivation to join inter-organizational networks and adoption of KM	Innovation, Competitive advantage, Value creation New capabilities	
Critical success factors	Connectivity (structured communication channels and information and communication technology— ICT— use); Network governance and management adoption; Network structure (formal and informal); Commitment of participants aligned with the network objective; Relational capabilities; Leadership commitment; trust and identity;Adoption of KM practices.	

Source: prepared by the authors (2022)

The findings of the articles allow us to identify the KM potential and the difficulties related to its implementation in inter-organizational networks. Below we highlight those that we consider important for the purpose of the study.

According to Del Giudice and Maggioni (2014), KM presents a crucial role so that the knowledge that is dispersed in the networks can be transferred to the participants. Thus, the knowledge is created and transferred in a collaborative way, through interactive processes involving the network participants (Ortiz, Donate and Guadamillas, 2017). For Franco and Estevan (2020) these processes should establish and maintain relationships between participants in order to integrate and lead interdisciplinary teams in the search for reciprocal and cooperative actions oriented to network results.

Most of the results are related to the ability of organizations to recognize the value of knowledge embedded in their inter-organizational network (Ortiz, Donati, Guadamillas, 2017). For the authors, organizations with greater

ability to identify this value will be the most likely to design better strategies to acquire and integrate such knowledge into their bases.

Being that the different capacities of organizations may be related to the effects of the absorptive capacity of companies that participate in inter-organizational networks. Absorptive capacity comprises how companies can recognize the value of given information, and assimilate and apply this knowledge commercially (Zahra and George, 2002). For Castrillón (2016) the absorptive capacity of companies is a determining element to explain how companies manage to exploit new knowledge.

Both knowledge and innovation depend on resources and capabilities internal and external to the organization (Capó-Vicedo, Expósito-Langa and Molina-Morales, 2008). Inter-organizational relationships generate opportunities to share these resources and access to new technologies (Zancan et al., 2013) and specialized knowledge dispersed in different organizations (Manser et al., 2016). Thus, investing in the relationships between the inter-organizational network participants is fundamental.

Inter-organizational relationships have distinct and complex attributes, dependent on different dimensions of analysis (Wiśniewska-Paluszak and Paluszak, 2019). A study by Lavfvre et al. (2014) presents the following dimensions: structural (hierarchy, density, and connectivity; cognitive (shared common interests and intermediation); and relational (trust, identity, and norms).

These dimensions are widely studied and substantiated by the theory of intellectual capital. Franco and Esteves (2020) highlight the importance of relational capital in inter-organizational networks, in order to keep the participants motivated and to create an environment of trust, thus establishing transparency and respect among them. Structural capital is part of the findings of Wegner (2019) for the author the inter-organizational relations in networks depend on: geographic concentration of the participants, formality of the relationship, and concentration of power.

Another finding of the articles deals with KM practices used in inter-organizational networks. Martins (2016) describes KM practices used in an organizational network formed by SMEs to identify, access, and leverage new knowledge. The author identifies as practices: meetings with customers and suppliers; dialogue with the government (establishing research and technology transfer policies); membership in sectoral associations; immersion in scientific and technological parks; entities supporting entrepreneurship; and development of human resources and relations with universities.

Finally, most of the analyzed articles deal with the benefits of adopting KM in inter-organizational networks, but Cruz-Gonzalez, et al. (2014) mention that, despite the benefits of knowledge and external learning, studies leave aside the associated costs and the cognitive limits for the acquisition and assimilation of external knowledge.

5. Final Considerations

The present study sought to map and analyze the scientific production involving business and management models based on inter-organizational networks and relations in agribusiness. Among the motivations identified in the analyzed studies, it was verified that inter-organizational networks and relationships emerge as an alternative of collaborative arrangement to help the sector in meeting market requirements, obtaining competitive advantage, and promoting innovation.

The formation of networks and collaborative arrangements is motivated by different factors, including obtaining complementary knowledge, which is highlighted in the analyzed literature. It is through the relationships of the participants in a network that knowledge is created and transferred in a collaborative way. Therefore, investing in actions to promote inter-organizational relations is fundamental according to most of the analyzed studies.

One of the findings that stands out in this research is the lack of emphasis in the studies on the ability of organizations involved in agribusiness networks to innovate. Some studies attribute this difficulty to cognitive differences of the network participants, lack of confidence, low intellectual capital, and the organizations' type of culture.

In this sense, the potential contribution of the intensification of studies involving KM is highlighted as an element of potentialization of the inter-organizational networks' participants. The research presents different concepts of KM that have already been explored, such as transfer, creation, and acquisition of knowledge, intellectual

capital, and absorptive capacity. The absorptive capacity appears in the analyzed studies as an important theory to explain how organizations manage to explore innovative knowledge.
Finally, the analysis of KM in inter-organizational networks still constitutes a practical challenge. In this sense, there is a lack of empirical studies exploring KM with the aim of improving the capabilities of organizations and promoting their innovative performance. Therefore, it is recommended for future studies, to conduct research on inter-organizational agribusiness networks and KM in different continents, such as Latin America, since most of the networks studied were concentrated in Europe.

References

Abbade, E. B. (2016). Interorganizational Alignment of Strategic Orientations in Supply Chains. *Revista de Negócios*, *20*(2), 15-30.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, 107-136.

Andreeva, T., & Kianto, A. (2011). Knowledge processes, knowledge-intensity and innovation: a moderated mediation analysis. *Journal of knowledge management*.

Bagheri, S., Kusters, R. J., Trienekens, J. J., & van der Zandt, H. V. (2016). Classification framework of knowledge transfer issues across value networks. *Procedia CIRP*, *47*, 382-387.

Balestrin, A., Verschoore, J. R., & Reyes Junior, E. (2010). O campo de estudo sobre redes de cooperação interorganizacional no Brasil. *Revista de Administração Contemporânea*, *14*, 458-477.

Barbeira, M., Franco, M., and Haase, H. (2012). Knowledge sharing in networks within the healthcare sector: measuring knowledge management capabilities. In *Proceedings of the 13th European Conference on Knowledge Management (ECKM)* (pp. 37-47).

Bassi, I., Zaccarin, S., and De Stefano, D. (2014). Rural inter-firm networks as basis for multifunctional local system development: Evidence from an Italian alpine area. *Land Use Policy*, *38*, 70-79.

Capó-Vicedo, j.; Expósito-Langa, m.; Molina-Morales, F. X. (2008). Improving SME competitiveness reinforcing interorganisational networks in industrial clusters. International Entrepreneurial Management Journal**,** v. 4, p. 147-169.

Carneiro-da-Cunha, J. A., Macau, F. R., & Alssabak, N. A. M. (2013). International inter-organisational religious knowledge transfer. *International journal of networking and virtual organisations*, *13*(3), 282-295.

Castells, M. (1999) A era da Informação: economia, sociedade e cultura. São Paulo: Paz e terra, 411-439.

Castrilló, M. A. G. (2016). Capacidad dinámica de absorción: estudio de caso. *Orinoquia*, *20*(1), 97-118.

Cheng, L., Zhang, S., Lou, X., Huang, J., Rao, F., and Bai, R. (2021). How Does TieStrengthDispersionwithinInter-Organizational Networks AffectAgriculturalTechnologicalInnovation? Evidencefrom China. *Land*, *10*(7), 717.

Cronin, P., Ryan, F. and Coughlan, M. (2008). Undertaking a literature review: a step-by-step approach. *British journalofnursing*, *17*(1), 38-43.

Cruz-González, J., López-Sáez, P., Navas-López, J. E., & Delgado-Verde, M. (2014). Directions of external knowledge search: investigating their different impact on firm performance in high-technology industries. *Journal of Knowledge Management*.

Dalkir, K. (2005). The knowledge management cycle. *Knowledge management in theory and practice. Oxford: Elsevier*, 25-46.

Del Giudice, M., and Maggioni, V. (2014). Managerial practices and operative directions of knowledge management within inter-firm networks: a global view. *Journal of Knowledge Management*.

Dentoni, D., Bijman, J., Bossle, M. B., Gondwe, S., Isubikalu, P., Ji, C., ... & Vieira, L. (2020). New organizational forms in emerging economies: bridging the gap between agribusiness management and international development. *Journal of Agribusiness in Developing and Emerging Economies*.

Dias, C., and Franco, M. (2018). Cooperation in tradition or tradition in cooperation? Networks of agricultural entrepreneurs. *Land use policy*, *71*, 36-48.

Engle, E. W. (2021). Brokering Rural Community Food Security: An Organizational Network Case Study in Central Appalachia. *Rural Sociology*, *86*(4), 837-863.

Franco, M., and Esteves, L. (2020). Inter-clustering as a network of knowledge and learning: Multiple case studies. *Journal of Innovation & Knowledge*, *5*(1), 39-49.

Grandori, A., and Soda, G. (1995). Inter-firm networks: antecedents, mechanisms and forms. *Organization studies*, *16*(2), 183-214.

Hoppen, N., Klein, A. D. C. Z., & Rigoni, E. H. (2017). Sociomaterial practices: challenges in developing a virtual business community platform in agriculture. *BAR-Brazilian Administration Review*, *14*.

Kolloch, M., & Reck, F. (2017). Innovation networks in the German energy industry: An empirical analysis of inter-organizational knowledge transfer. *International Journal of Energy Sector Management*.

Lage, E., and Alturas, B. (2012, October). Factors Influencing Information Sharing in Four SME Networks in Portugal-A Coordination Perspective. In *KMIS* (pp. 178-183).

Lazzarini, S., Chaddad, F., and Cook, M. (2001). Integrating supply chain and network analyses: the study of netchains. *Journal on chain and network science*, *1*(1), 7-22.

Lefebvre, V. M., Raggi, M., Viaggi, D., Sia-Ljungström, C., Minarelli, F., Kühne, B., and Gellynck, X. (2014). SMEs' preference for innovation networks: A choice experimental approach. *Creativity and Innovation Management*, *23*(4), 415-435.

Manser, K., Hillebrand, B., Woolthuis, R. K., Ziggers, G. W., Driessen, P. H., & Bloemer, J. (2016). An activities-based approach to network management: An explorative study. *Industrial Marketing Management*, *55*, 187-199.

Martins, J. T. (2016). Relational capabilities to leverage new knowledge: Managing directors' perceptions in UK and Portugal old industrial regions. *The Learning Organization*.

Müller-Seitz, G. (2012). Leadership in interorganizational networks: a literature review and suggestions for future research. *International Journal of Management Reviews*, *14*(4), 428-443.

Nuhoff-Isakhanyan, G., Wubben, E. F., Omta, O. S., and Pascucci, S. (2016). Network structure in sustainable agro-industrial parks.

Ortiz, B., Donate, M. J., and Guadamillas, F. (2017). Relationships between structural social capital, knowledge identification capability and external knowledge acquisition. *European Journal of Management and Business Economics*.

Papa, A., Chierici, R., Ballestra, L. V., Meissner, D., and Orhan, M. A. (2020). Harvesting reflective knowledge exchange for inbound open innovation in complex collaborative networks: an empirical verification in Europe. *Journal of Knowledge Management*.

Poorkavoos, M., Duan, Y., and Edwards, J. (2011). Understanding inter-firm networks and types of innovation in SMEs: A social network perspective. In *12th European Conference on Knowledge Management* (pp. 772-779). Academic Publishing.

Shih, D. H., Lu, C. M., Lee, C. H., Parng, Y. J. M., Wu, K. J., and Tseng, M. L. (2018). A strategicknowledge management approach to circular agribusiness. *Sustainability*, *10*(7), 2389.

Sveiby, K. E. (1998). Knowledge Works: Managing Intellectual Capital at Toshiba.

Uriarte, F. A. (2008). *Introduction to knowledge management: A brief introduction to the basic elements of knowledge management for non-practitioners interested in understanding the subject*. Asean Foundation.

Venzin, M., Von Krogh, G., and Roos, J. (1998). Future research into knowledge management. *Knowing in firms: Understanding, managing and measuring knowledge*, 26-66.

Vieira Filho, J. E. R. V., and Da Silveira, J. M. F. J. (2016). Competências organizacionais, trajetória tecnológica e aprendizado local na agricultura: o paradoxo de Prebisch. *Economia e Sociedade*, *25*, 599-630.

Wegner,D. (2019). Redes, Alianças e Parcerias: Ferramentas e práticas para a gestão da cooperação empresarial. Porto Alegre: EST Edições.

Wiśniewska-Paluszak, J. A. and Paluszak, G.T. (2019).The Role of Inter-Organisational Relations and Networks in Agribusiness: The Case for the Polish Fruit and Vegetable Industry. International Journal on Food System Dynamics, v. 10, n. 2, p. 176-194.

Ye, Y., De Moortel, K., & Crispeels, T. (2020). Network dynamics of Chinese university knowledge transfer. *The Journal of Technology Transfer*, *45*(4), 1228-1254.

Zahra, S. A. and George, G. (2002). The net-enabled business innovation cycle and the evolution of dynamic capabilities. *Information systems research*, *13*(2), 147-150.

Zancan, C., dos Santos, P. D. C. F., & da Cruz, N. J. T. (2013). Mecanismos de coordenação na formação de redes de cooperação: associação dos produtores de vinhos finos do vale dos vinhedos (Aprovale). *Revista de Ciências da Administração*, *15*(36), 193-209.

Zanuzzi, C. M. D. S., Selig, P. M., Pacheco, R. C. D. S., and Tonial, G. (2020). Digital transformation and Brazilian agribusiness: an analysis of knowledge management in the sector. In *Knowledge, People, and Digital Transformation* (pp. 85-101). Springer, Cham.

A new Critical risk on the Block: Cyber Risks as an Example of Technical Knowledge Risks in Organizations

Malgorzata Zieba[1], Susanne Durst[2] and Martyna Gonsiorowska[3]
[1]Division of Management - Gdansk University of Technology, Poland
[2]School of Business and Governance, Department of Business Administration, Tallinn University of Technology, Estonia
[3]Student of the Faculty of Management & Economics, Gdansk University of Technology, Poland
mz@zie.pg.gda.pl
susanne.durst@taltech.ee
martynagon@gmail.com

Abstract: The breakout of the COVID-19 pandemic has intensified the appearance of many additional technical knowledge risks in organizations. Cyber risks in particular are becoming a great challenge for organizations. At the same time, academic research on cyber risks, their costs, consequences and ability of overcoming them is still scarce and fragmented. In order to fill this gap, the paper is aimed to identify different types of cyber risks that organizations face and to examine the organizations' ability to handle those risks. The paper presents research results from a sample of 60 organizations, addressing questions such as: (i) What are the costs of cyber risks the organization has faced? (ii) What is the company ability to address these risks?, and (iii) What is the organization doing to minimize the impact of such risks? Data was collected by means of a questionnaire. This research study has allowed to identify the state of the art concerning cyber risks, which can bear severe consequences for organizations. The findings clearly show that not all organizations suffer from the same level of cyber risks but it is much related to their field of operations. Consequently, also the ability to manage these cyber risks is quite diversified among the examined companies. Research results are limited to a sample of 60 organizations and thus the findings should be taken with caution. The study provides useful insights for managers and owners of organizations in need of dealing with the cyber threats/attacks and other technical knowledge risks threatening their organizations. The paper is enriched with a number of sample solutions that they may apply to mitigate those risks.The paper lays the ground for a better understanding of technical knowledge risks, primarily cyber risks, to which organizations are increasingly exposed today. As such, the paper offers food for thought for researchers dealing with the topic of technical knowledge risks and organizational risk management in general.

Keywords: cyber risks, technical knowledge risks, preventive actions, knowledge management

1. Introduction

Knowledge management has been traditionally perceived as a means for organizations to achieve better performance (Inkinen, 2016; Schiuma, 2012), become more innovative (Ferraresi, 2012; Inkinen et al., 2015) or satisfy their customers better (Gibbert et al., 2002), just to name a few examples. In relation to this, knowledge has been considered a valuable resource that needs to be managed, shared, disseminated, etc. (McCann & Buckner, 2004). So far, little attention has been paid to potential risks related to knowledge, although there are some publications available examining some selected knowledge risks, such as knowledge hiding and hoarding (Butt, 2020a, 2020b; Silva de Garcia et al., 2020), knowledge waste and loss (Ferenhof et al., 2015; Ferenhof et al., 2016); or knowledge spillovers (Fernandes & Ferreira, 2011; Rodriguez, 2014).

Although the obvious efforts, in general, the area of knowledge risks, their appearance in organizations, as well as handling them by organizations is still underexplored and there are few publications that present results from studies among organizations (Durst & Zieba, 2020; Zieba, 2020). There are also different kinds of knowledge risks that can be identified in organizations, namely human knowledge risks (e.g. knowledge hiding, unlearning, forgetting), operational knowledge risks (e.g. knowledge waste, risks related to knowledge gaps, knowledge outsourcing risks) and finally, technological knowledge risks (e.g. risks related to cybercrime, risks related to social media).

Taking the above into account, there is a need for more research concerning knowledge risks, also their technological type (e.g. risks related to cybercrime). That is why, the following research questions have been formulated: How well do organizations manage their cyber risks? What is the cost of cyber incidents faced by them? What is their ability to identify, mitigate and overcome these risks? These questions will be answered by the analysis of the study among 60 employees of Polish and Swedish companies.

The paper is organized in the following way. First, an introduction to technical knowledge risks, their forms and threats related to them is provided. Next, the research method is presented, followed by a discussion of the results of the study on cyber risks. Finally, the present paper concludes with a discussion and conclusion section.

2. Technical knowledge risks

Knowledge risk constitutes a new term that is increasingly discussed in the literature. The concept of knowledge risk indicates that although knowledge has always been recognized as something valuable and positive, there are also potentially negative aspects related to knowledge and risks arising from inadequate knowledge management in organizations (Borch, 2022). Knowledge risks has been defined as "a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can affect the functioning of an organization on any level" (Durst & Zieba, 2019, p. 2). Compared to other risks, risks associated with knowledge are (more) difficult to address and, thus, manage. This means a particular challenge for organizations that have no or underdeveloped management systems (Temel & Durst, 2021).

Durst and Zieba (2019) proposed to divide knowledge risks into human knowledge risks, technological knowledge risks, and operational knowledge risks to visualise different types of knowledge risks and their links. This categorization may also help to start a better discussion on the topic of knowledge risks. According to these authors, technological knowledge risks, which is the focus of the present paper, may be the result of the increasing use of various (digital) technologies. While technological risk has received increasing attention over the past few years, the literature is still very scarce. The Global Risks Report 2019, defines technological risks as adverse consequences resulting from technological developments. The report lists and describes risks such as cyber-attacks, data theft, and the collapse of critical information infrastructure (Varonis Data Lab, 2019). These risks are also relevant to knowledge management. Durst and Zieba, in their knowledge classification, assigned risks related to digitalization, old technology, cybercrime, and social media to the technological knowledge risk category (2019). Risks related to cybercrime refer to being exposed to threats of malicious software that destroys or locks the IT system of organizations (Perlroth et al., 2017). Hacker attacks may be considered a sub-form of this risk describing incidents where outsiders are trying to break into the IT systems to get access to confidential information. Possible consequences can be business disruptions or even a halt of the organization's operations. Cyber risks (incidents) rank, according to a report of Allianz, as the most important business risk (Allianz Risk Barometer, 2020), and it has been observed that cybercriminals have taken advantage of the pandemic to deploy ransomware against critical infrastructure and healthcare institutions (Interpol, 2020). Recently, Cybersecurity Ventures reported that the cost of cybercrime globally is expected to be 6 trillion US dollars, and it is expected to increase as high as 10.5 trillion US dollars in 2025.

The potential for all technological risks is further increased due to digitization, the radical changes associated with infrastructure development provide a venue for cyber-attacks but also amplify their potential damage (World Economic Forum, 2019). Any over-reliance on technology and ignoring the human factor can be detrimental to an organization as well (Durst & Zieba, 2019), especially since people are still the weakest link when it comes to cybersecurity and are the cause of successful cyberattacks (Accenture Security, 2019).

3. Research method

To answer the research questions provided in the introduction section, a research tool was prepared and tested among managers and educators in the field of management studies. As the examined topic has not been previously researched, it was not possible to rely on the existing tools and questionnaires. Thus, new items were developed or existing ones from related areas (such as risk management) were adjusted for the purpose of the study. Apart from the parts related to knowledge risks and their management, supplementary demographic data were collected, such as the year of foundation, type of organization, location, or number of employees hired in the company.

After the construction of the questionnaire, it was pretested to check the order of questions, their comprehensibility, and appropriateness to be answered in a certain period (max. 30 minutes). The questionnaire was carefully pretested with two management professors and two respondents from companies to check if the questions are understandable and express the planned outcome.

After making improvements for better clarity and cohesion, the questionnaire was sent through Qualtrics software to 6000 Polish and 6000 Swedish companies of various sectors and of various sizes. The e-mail

addresses of the companies to be conducted were provided by a professional company that offers such services. In the first stage of the survey, 57 responses were collected and they are presented in this paper. Additionally, some of the questions were not answered by all the respondents, therefore, the particular number of responses can be different between the questions. The presented findings constitute a part of a larger survey, and, therefore, only some examined aspects are presented in this paper to examine the research questions and fulfil the aim of the study.

4. Empirical findings

The following presents some descriptive initial findings of the study.

Companies were asked to specify the mean cost of all cyber incidents (in EUR) their company suffered over 12 months. 38% of companies could not specify the cost, 22% claimed that they had 0 costs related to the cyber incidents, 16% of companies reported a cost in the range 1-10000EUR, 9% in a range 10001-20000EUR, and 7% estimated their cost between 20001-30000EUR. 5% of companies reported that their cost exceeds 40000EUR, and 3% estimated their cost between 300001-40000EUR.

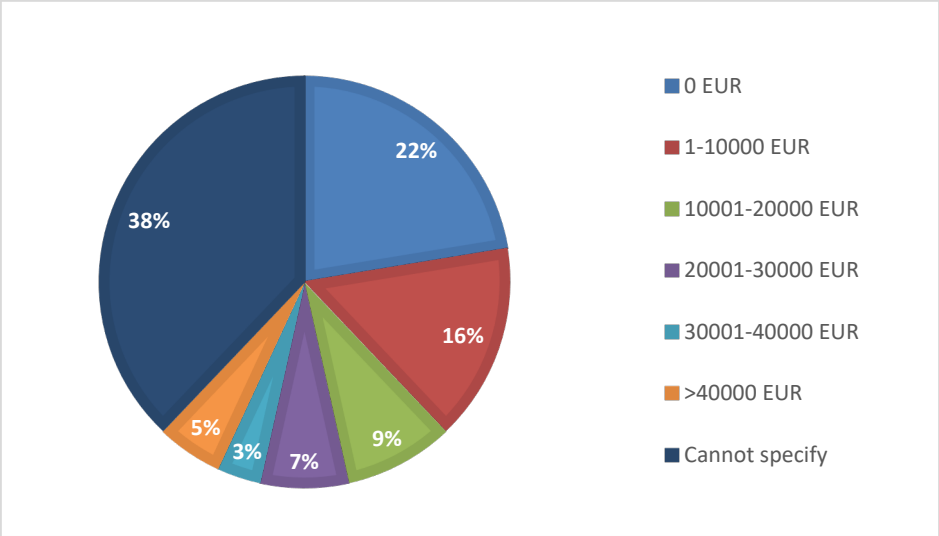


Figure 1: Declared mean cost of all cyber incidents (in EUR) their company suffered for 12 months.

Furthermore, companies were asked to specify the mean cost of the largest single cyber incident (in EUR) their company suffered over 12 months. 41% of companies could not specify the cost, 22% claimed that they had 0 costs related to the cyber incidents, 21% reported a cost in the range 1-10000EUR, 7% in the range 10001-20000EUR. 5% of companies reported that their cost exceeds 40000EUR, 2% estimated their cost between 20001-30000EUR, and 2% between 300001-40000EUR.

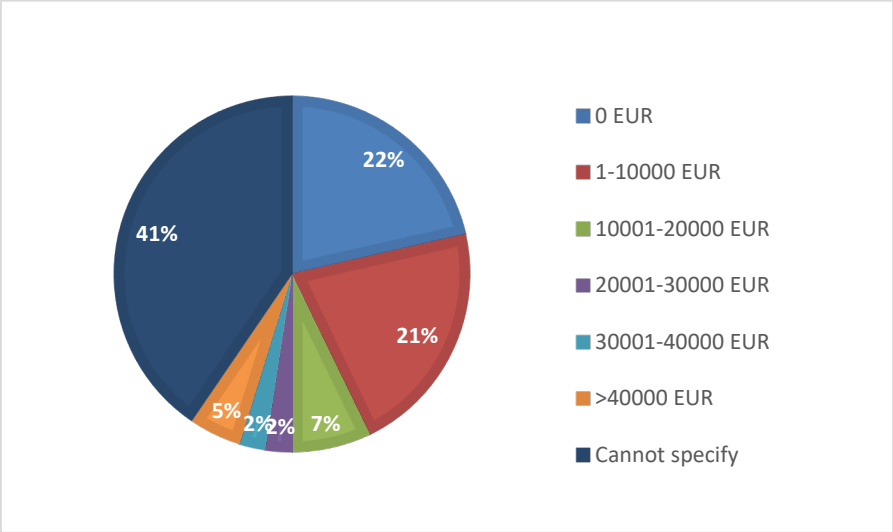


Figure 2: Declared mean cost of the largest single cyber incident (in EUR) their company suffered over 12 months

In addition, companies were asked to assess their ability to address cyber risks. Most (56%) rated themselves intermediate, 24% as experts, 11% as novices, and 9% did not know how to assess themselves.

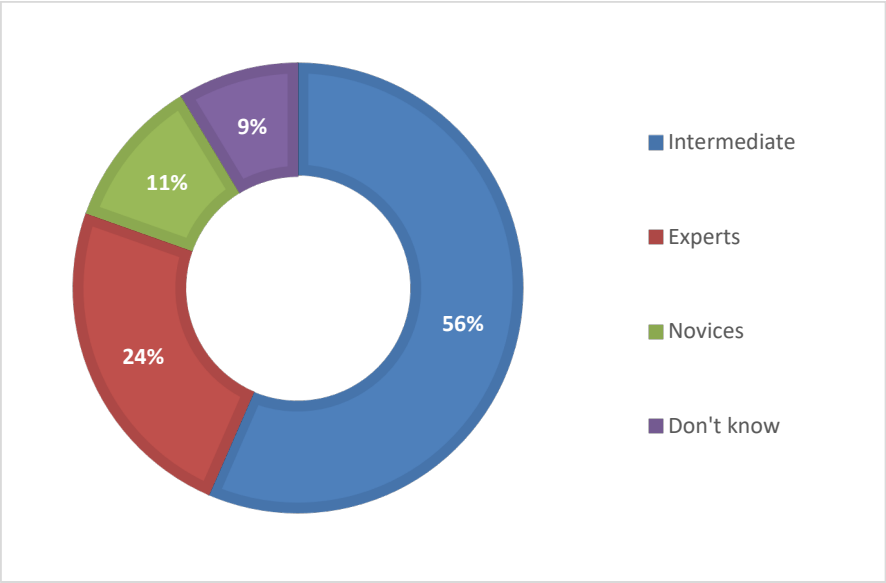


Figure 3: Declared ability to address cyber risks

Companies were also asked to assess the priority of cyber risks among the organization's risk management priorities. More than half of companies (55%) consider cyber risk in the top five, 21% recognize the risk of cybercrimes, but do not rank it in the top five of their risk management priorities. 13% of the companies claimed that cyber risk in their hierarchy has low priority, 7 % did not know how to assess the risk, and only 4 % of the respondents recognized cyber risk as the number one risk.

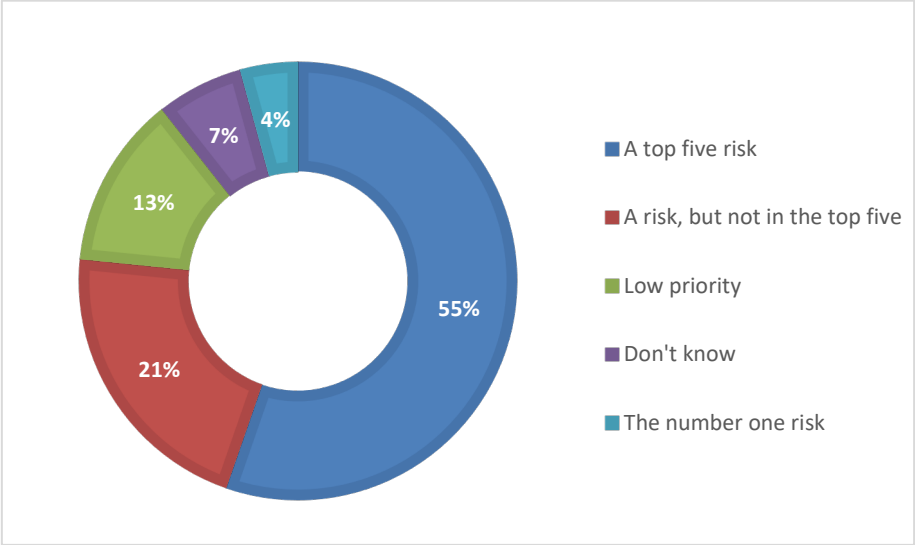


Figure 4: Declared position of cyber risk among the organization's risk management priorities

When asked about the confidence of an organization regarding identifying and assessing cyber risks, 35 % of companies answered that they feel fairly confident, 30% highly confident, 20% not at all confident, and 15% did not know.

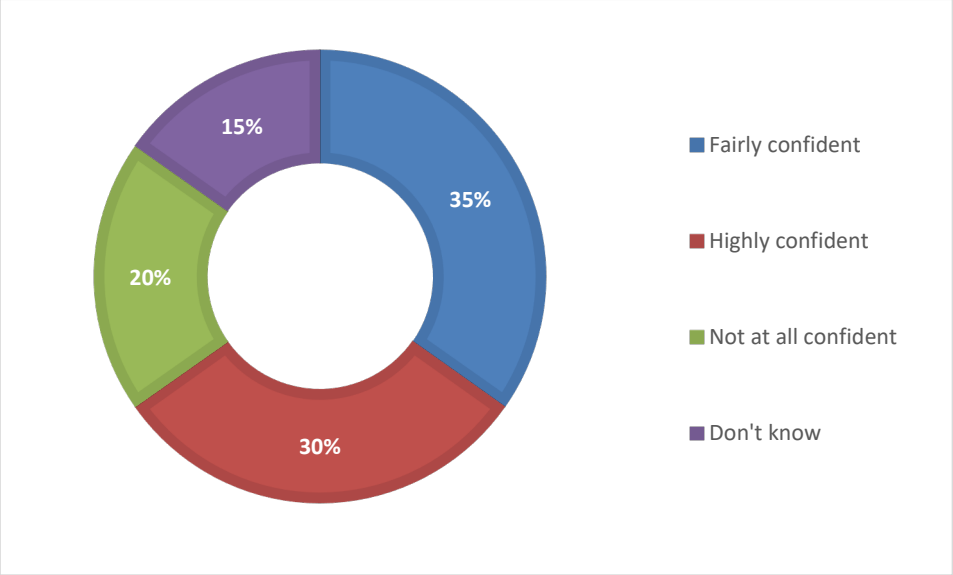


Figure 5: Declared confidence regarding identifying and assessing cyber risks

Respondents were also asked to assess the confidence of the organization in mitigating and preventing risks. 40 % of companies feel fairly confident with this activity, 30% are highly confident, 17% are not at all confident, and 13% did not know how to answer the question.

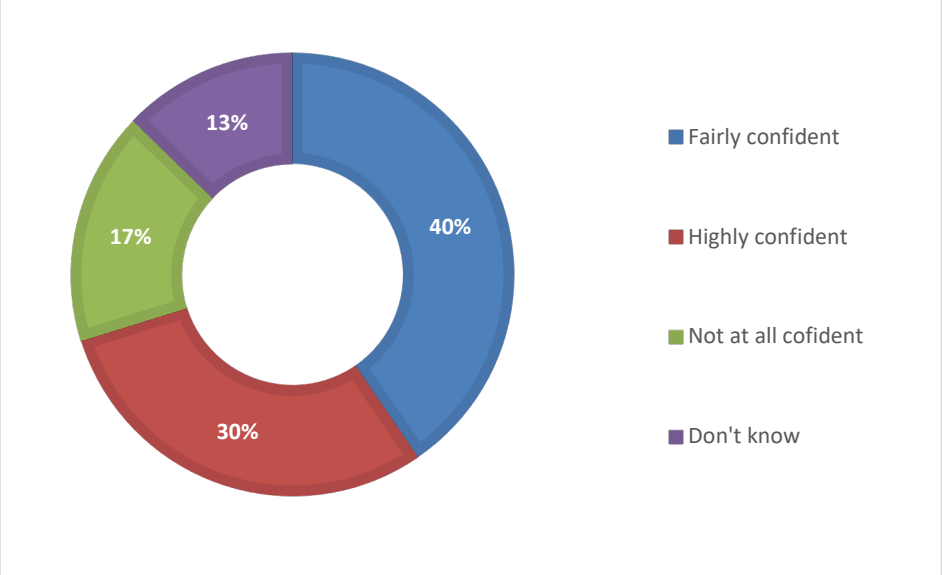


Figure 6: Declared confidence regarding mitigating and preventing cyber risk

When asked about, the confidence of an organization regarding respond to cyber risks and recovering from them, almost half of the companies (47%) claimed that they are fairly confident, 25% claimed highly confident, 15% did not know how to answer, and 13% claimed that they are not at all confident.

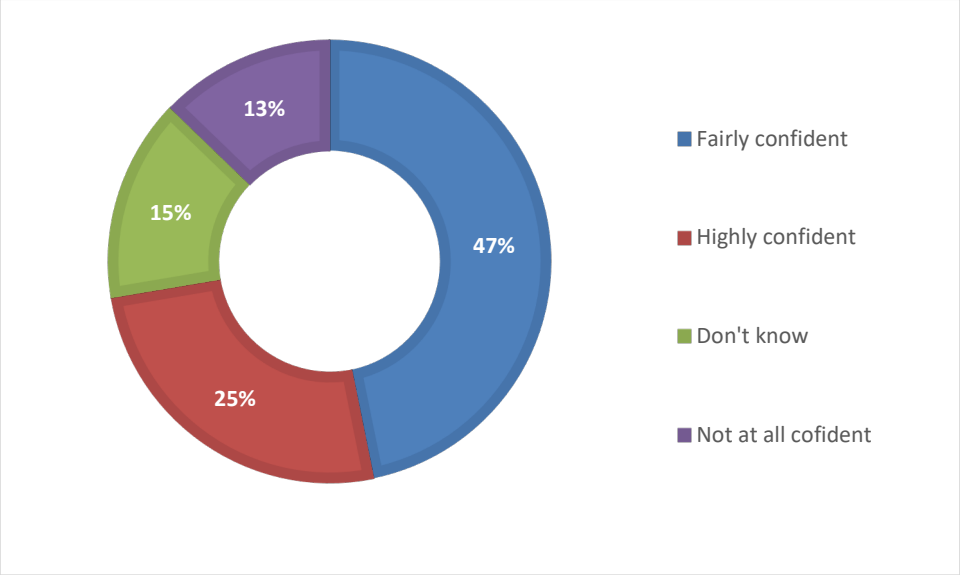


Figure 7: Declared confidence regarding responding to cyber risk and recovering from it

5. Discussion

What is quite interesting and surprising is that more than one third of the examined companies were not able to provide the declared mean cost of all cyber incidents (in EUR) their company suffered for the last 12 months, as well as the declared mean cost of the largest single cyber incident (in EUR) their company suffered over 12 months. This situation can result from several factors. First, it is possible that their companies do not measure the costs of such cyber incidents or that this kind of information is kept secret by the management. Second, ever the cost of such cyber incidents might be difficult to be estimated and calculated, for example how to measure the cost of an employee having their social media account hacked. Third, employees themselves might be reluctant to inform their superiors about potential incidents due to the fear of receiving reprimand or even being fired. All those factors are worth further examination and the implementation of some mechanisms in organizations to overcome potential threats, for example by supporting the knowledge sharing culture and blame-free reporting.

As far as the declared ability to address cyber risks is concerned, most companies declared themselves intermediate, while only one fourth as experts. This might indicate that there is still a lot to be done in organizations to become better experts in fighting cyber risks and there is a need for more knowledge absorption on how it can be done.

At the same time, examined companies seemed to understand the importance and significance of cyber risks and the majority of them indicated these types of risks as one of the top five risks. Additional more than one fifth declared it is an important risk, but out of top five. This can show an increasing awareness of the threats related to cyber risks that is noticeable in companies – perhaps they have already noticed those risks and their potential severity, yet they have not introduced any special measures to examine their impact. This may be consistent with the picture presented above of the increasing threats from cybercrime noticed by organizations examining it.

Examined companies also indicate high confidence in identifying, assessing, mitigating, preventing, responding, and recovering from cyber risks. Around two thirds of the examined companies declared that they are fairly or highly confident with regards to these risks. This might be a bit too optimistic picture, especially when analyzed together with the indicated lack of knowledge on the cost of cyber-attacks. Perhaps companies are over confident now, as they have not experienced severe attacks yet and they will modify their approach either by being less confident or keeping the confidence level, but also upskilling in the area of cyber risks and their handling.

Taking into account the fact that organizations have been facing cyber risks, as well as other technical risks, it is important to provide them with some ways to handle those risks. Examples of such ways as: application of

protection mechanisms (e.g. installation and actualization of anti-virus software; keeping the software updated; password management application, etc.); crucial data duplication in various locations; support from professional agencies in case of high risk faced by an organization; up-date of technologies, when required and advised (Durst and Zieba, 2020).

6. Conclusions

This paper provides some information on cyber risks and their management in organizations. More precisely, it describes insight into cyber risk management in Polish and Swedish organizations of different sectors and sizes. Based on a diverse sample that included 60 organizations from both countries, the findings show that cyber risks have become a key risk that organizations must deal with. Regarding the perception of the organization's competences and skills to manage this type of risk, the findings suggest differences between the surveyed organizations that could possibly be attributed to the nature of the company's activity.

This study naturally has several limitations that can be drawn into future research avenues. First of all, the study of preliminary character and more responses are needed to present a broader picture. Second, the cultural differences have not been taken into consideration here due to the place limitation; however, they may constitute a natural area of future examination. Third, the study presented here is just a part of the larger research undertaking and therefore, does not present the full picture of the knowledge risks in organization. It is though important to note that the limitations of the paper are a good starting point for future explorations and studies. Future studies could examine the execution of both qualitative and quantitative studies (even mixed methods approaches) to identify and examine relevant cyber risks and their influence on business sustainability in particular types of companies (e.g. knowledge-intensive organizations vs. production companies). Researchers could also design and investigate longitudinal research projects to study the potential contribution of applied KRM to various operations and outcomes of organizations (e.g. innovativeness, agility, etc.).

Acknowledgements

The study was supported by a research grant from the National Science Centre (Poland) in the context of a research project 'Knowledge risks in modern organizations' (No. 2019/33/B/HS4/02250).

References

Accenture Security (2019). The Cost of Cybercrime: Ninth Annual Cost of Cybercrime Study. *Ninth Annual Cost of Cybercrime Study*, 18. Retrieved from https://www.accenture.com/_acnmedia/PDF-96/Accenture-2019-Cost-of-Cybercrime-Study-Final.pdf#zoom=50

Allianz Risk Barometer,(2020). Identifying the major business risks for 2020. url: https://www. agcs. allianz. com/content/dam/onemarketing/agcs/agcs/reports. *Allianz-Risk-Barometer-2020. pdf*.

Borch, C. (2022). Machine learning, knowledge risk, and principal-agent problems in automated trading. *Technology in Society*, *68*(January), 101852. https://doi.org/10.1016/j.techsoc.2021.101852Butt, A. S. (2020a). Consequences of top-down knowledge hiding: a multi-level exploratory study. *VINE Journal of Information and Knowledge Management Systems*. https://doi.org/10.1108/VJIKMS-02-2020-0032

Butt, A. S. (2020b). Mitigating knowledge hiding in firms: an exploratory study. *Baltic Journal of Management*, *15*(4), 631–645. https://doi.org/10.1108/BJM-01-2020-0016

Interpol (2020). The International Criminal Police Organization. https://www.interpol.int/How-we-work/COVID-19

Cybercrime Magazine (2020). *Cybercrime To Cost The World $10.5 Trillion Annually By 2025* https://cybersecurityventures.com/cybercrime-damage-costs-10-trillion-by-2025/

Durst, S., & Zieba, M. (2019). Mapping knowledge risks: towards a better understanding of knowledge management. *Knowledge Management Research and Practice*, *17*(1), 1–13. https://doi.org/10.1080/14778238.2018.1538

Durst, S., & Zieba, M. (2020). Knowledge risks inherent in business sustainability. *Journal of Cleaner Production*, *251*, 119670. https://doi.org/10.1016/j.jclepro.2019.119670

Ferenhof, H.., Durst, S., & Selig, P. M. (2016). Knowledge Waste and Knowledge Loss ? What is it all about? *Navus Revista de Gestão e Tecnologia*, *5*(4), 38–57. https://doi.org/10.22279/navus.2016.v6n4.p38-57.404

Ferenhof, H., Durst, S., & Selig, P. (2015). Knowledge Waste in Organizations: a Review of Previous Studies. *Brazilian Journal of Operations & Production Management*, *12*(1), 160–178. https://doi.org/10.14488/BJOPM.2015.v12.n1.a15

Fernandes, C., & Ferreira, J. J. (2011). Knowledge Spillovers and Knowledge Intensive Business Services: An Empirical Study. *Economic Policy*, *2116*, 0–26. https://doi.org/10.1227/01.NEU.0000349921.14519.2A

Ferraresi, A. a. (2012). Knowledge management and strategic orientation: leveraging innovativeness and performance. *Journal of Knowledge Management*, *16*, 688–701. https://doi.org/10.1108/13673271211262754

Gibbert, M., Leibold, M., & Probst, G. (2002). Five Styles of Customer Knowledge Management, and How Smart Companies Use Them To Create Value. *European Management Journal*, *20*(5), 459–469. https://doi.org/10.1016/S0263-2373(02)00101-9

Inkinen, H., Kianto, A. & Vanhala, M. (2015). Knowledge Management Practices and Innovation Performance in Finland. *Baltic Journal of Management*, *10*(4), 432–455.

Inkinen, H. T. (2016). Review of empirical research on knowledge management practices and firm performance. *Journal of Knowledge Management*, *20*(2).

McCann, J. E., & Buckner, M. (2004). Strategically integrating knowledge management initiatives. *Journal of Knowledge Management*, *8*, 47–63. https://doi.org/10.1108/13673270410523907

Perlroth, N., Scott, M., & Frenkel, S. (2017). *Cyberattack Hits Ukraine Then Spreads Internationally (Published 2017)*. The New York Times. https://www.nytimes.com/2017/06/27/technology/ransomware-hackers.html

Rodriguez, M. (2014). Innovation, knowledge spillovers and high-tech services in European regions. *Engineering Economics*, *25*(1), 31–39. https://doi.org/10.5755/j01.ee.25.1.3207

Schiuma, G. (2012). Managing knowledge for business performance improvement. *Journal of Knowledge Management*, *16*(4), 515–522. https://doi.org/10.1108/13673271211246103

Silva de Garcia, P., Oliveira, M., & Brohman, K. (2020). Knowledge sharing, hiding and hoarding: how are they related? *Knowledge Management Research and Practice*, *00*(00), 1–13. https://doi.org/10.1080/14778238.2020.1774434

Temel, S., & Durst, S. (2020). Knowledge risk prevention strategies for handling new technological innovations in small businesses. *VINE journal of information and knowledge management systems*.

Varonis Data Lab. (2019). *2019 Global Data Risk Report From the Varonis Data Lab*. 28.

World Economic Forum. (2019). Global Risks Report 2019. In *Geneva Switzerland*.

Zieba, M. (2020). Knowledge Risk Management in Companies Offering Knowledge-Intensive Business Services. In S. Durst & T. Henschel (Eds.), *Knowledge Risk Management* (pp. 13–31). Springer.

Knowledge Management, Including the Cybernetic Theory of Human Character

Izabela Ziebacz
Department of Social Policy, Social Work and Tourism, Faculty of Social Science, Jan Dlugosz University, Czestochowa, Poland
i.ziebacz@ujd.edu.pl

Abstract: Man and his functioning in an organization are of interest to specialists in various fields, including psychology, management, but also technicians who, despite the progress in their own disciplines, are not able to effectively solve the problem of human reliability in the process of knowledge management in an organization. The problem is insufficient knowledge about people. On the other hand, the demands placed on employees today are constantly increasing. They are expected to be more and more active, entrepreneurial, creative, and have a higher and higher level of many skills, such as: handling information, interpersonal communication, and making effective decisions. However, can all employees meet these requirements and what factors and mechanisms decide about compliance? These are questions that cannot be answered unequivocally based solely on past professional experience. Correct answers constitute forecasts that allow to predict how individual units will behave in various types of professional situations in the future. These deliberations are complemented and developed by the globally pioneering character's cybernetics theory as described by Prof. Mazur. The aim of the work is an attempt to test, in organizational conditions, the correlation between employees' knowledge and their cyber character, in order to check the compliance between the places occupied in the organization and their individual predispositions (character). The use of the cybernetic character theory, in connection with the elements of knowledge about organization and management, can be a tool for making optimal management decisions. The originality of the work is based on the combination of the cybernetic theory of characters with the mathematical apparatus using C.A. Shannon's information entropy.

Keywords: knowledge management, HRM, adult learning, entropy

1. Introduction

The third millennium brings dynamic changes in the global economy and rapid transformations in all areas of enterprise activity, forcing permanent improvement of the ways of functioning. The problem most companies face is how to deal with the new age of information, the age of knowledge (Turriago-Hoyos et al., 2016). Having knowledge resources, their dissemination and use becomes a strategic factor that determines the competitiveness of a modern organization, and the quick and effective use of knowledge is often a condition for the existence and survival of enterprises (Nowak, 2011). In addition, the uncertainty of the environment means that enterprises must constantly recognize what changes are taking place on an ongoing basis, and even in advance, draw conclusions that justify their own existence and development. In this context, the words of Peter Drucker, one of the most outstanding thinkers and theoreticians of the 20th century management, are still valid: "traditional resources, such as labour, land and capital become more of an obstacle rather than a driving force for the development of a company, and what is a key factor in creativity, in all areas of life, is the knowledge " (Drucker, 2002; 1999). A manifestation of this state of affairs is the development of the knowledge-based economy as a paradigm of sustainable development, stimulating knowledge management (Drucker, 1998).

Knowledge management is based on the assumption that each employee has the knowledge that enables the improvement of the functioning of the organization. The collective wisdom composed of the individual knowledge of employees and their experiences becomes the same resource that can be used and ensure competitiveness in relation to other organizations (Lendzion et al., 2005). An individual, similarly to an organization, has the best chance of surviving on the market only when he/she learns faster compared to the progression of changes in his/her environment (Kianto et al, 2016). The indisputable condition of flexibility are competences, which, according to M. Armstrong, characterize individuals who "meet the expectations regarding the achievement of specific results, are able to use their knowledge, skills and personality traits to achieve goals and standards assigned to their roles" (Armstrong and Taylor, 2016). Against this background, we can see an intensified educational expansion, the consequence of which is the societal awareness of the need for permanent development and the acquisition of a wide range of numerous competences (Supermane, 2018). Only this approach gives the individual a chance of adaptation to a rapidly changing environment – given that the employers' expectations of flexible professional adaptation are projected on employees (to the point of inflicting pressure), are greater today than ever before. (Zgrzywa – Ziemak, 2009). Considering this, changes in

the labour market require adequate developments in the knowledge management of the organizational and professional adaptation of adults. (Knowles et al., 2009). For this reason, it is important to take into account the andragogical perspective, which is the basis of knowledge management (and staff development) in the enterprise. The area of interest of this scientific discipline is focusing on the biological, social, economic and cultural determinants of adult didactics, enabling understanding of the process of transforming the individual's potential into a real ability to function efficiently in all social and organizational roles (Jarvis, 2012). On the other hand, models of an organization that are able to constantly adapt to new environmental conditions and changes in mutual relations are sought (Inken, 2016; Zouaria et all, 2018). And here comes the problem that contemporary organizations grapple with, which is "knowledge escape". Information, knowledge and competences are closely related to specific activities of the company, organizational units or even selected employees, and the rest of the organization has no idea about their existence. As a result, enormous amounts of time and effort are wasted on learning. There are no formal solutions to manage knowledge resources, update and share information about organizational potential. Enterprises do not have mechanisms that would protect against uncontrolled outflow of knowledge (Mierzejewska, 2005). This problem is especially prominent in Polish enterprises. The departure of a key employee is associated with the loss of not only knowledge and experience, but also of the key contacts. Knowledge management should therefore not only aim to protect the organization against such phenomena, but also to guarantee the effective use of intellectual capital and knowledge remaining in the organization, and as a result, improving innovation leading to a competitive advantage. (Grudzewskiego and Hejduk, 2004). Therefore, the most important processes in this understanding of knowledge management will be the systemic transfer of knowledge between employees and management, taking into account the dynamic nature of this process. Such solutions will allow to allocate knowledge resources at the right time and place. This allocation will be also effective from the point of view of professional adaptation.

The aim of this article is to present the proprietary model of knowledge management in the organization, taking into account the nature of employees in terms of cybernetics. The compatibility between professional adaptation and individual predispositions (cybernetic character) were examined. The study was conducted on employees of a company from the construction and installation industry, on a 10-person sample. As part of the research procedure a following thesis was formulated:
T (1): Character testing is an essential element in the knowledge management process.

2. Literature review

To begin with, there are some concepts which need clarification. Namely, knowledge is not the same as information. Knowledge is giving meaning and sense to information and its effective use in practice (Drucker, 1999). Information, in turn, is the basis of both knowledge and innovation (Donate and Pablo, 2015; Costa and Monteiro, 2016). Without information, there is no knowledge. In turn, knowledge in an enterprise can and must be managed (Brdulak, 2005). And so, knowledge management emerged as a response to the need of identification of determinants which influence the productivity of knowledge workers and knowledge-based organizations. This was associated with an attempt to formalize the processes related to the management of intellectual assets in organizations and organizational systems. The idea was to design such work systems where creative, well-educated employees would work efficiently and efficiently (Sahibzada et al., 2020). The year 1987 is thought of as the beginning of the concept of knowledge management. The first conference in the United States entitled "*Managing the knowledge assets into the 21st century"* was held then and the so-called Konrad Group, which initiated research on *intellectual capital management* was established in Sweden (Plvalin and Jylhca, 2017). The concept of knowledge management was developed by Karl Wiig (1997) in the second half of the 1990s, and popularized further by Japanese, Ikujiro Nonaka. In 1995, Nonaka and Hirotaka Takeuchi, published a book entitled *The knowledge - creating Company - How Japanese Companies Create the Dynamics of Innovation*. At present, there are three leading directions in the development of the concept of knowledge management. The first one is a result of research of mentioned Japanese, Nonaki and Takeuchi, who developed the "knowledge spiral" model, which was transformed in later years into a systemic approach to knowledge management. Nonaka and Takeuchi emphasize the importance of using "silent" knowledge (contained in the minds of employees) for the company's success (Nonaka et al., 2000). The second direction developed on the basis of the so-called the resource approach well-known from strategic management, whose main task is the thesis that only the knowledge contained in the so-called key skills or competences can ensure a sustainable competitive advantage, and the long-term development (Kianto et al., 2019;). Finally, the last, third direction of knowledge management development was created on the basis of practical experience of consulting companies (Wenger, 2002). In this model, three knowledge management processes are distinguished: the process of

knowledge codification; knowledge transfer process; knowledge creation process; The creators are T.H. Davenport and L. Prusak (1998).

From the beginning of the concept, the question was whether it was possible to manage something such as knowledge? Knowledge cannot be managed in the classical sense of the word. However, it can be managed to facilitate its creation, transmission and use. Therefore, the term knowledge management is only a general approximation (Dalkir and Liebowitz, 2011; Hejduk, 2005). Unfortunately, it has not been possible to work out a more precise definition so far. There is currently no definition of knowledge management that is generally accepted in both management theory and practice (Chatzoudes et al., 2015). This is due to the great popularity of this category and, as a result, the excess of various concepts and theories.

An effective approach to the issues of knowledge management requires combining the concept of human resources management with process management. For this purpose, it is necessary to examine and monitor the professional adaptation of the staff (Wilsz, 2005). Hence, this research assumed a purposeful study of the professional adaptation of the diagnosed employee resource in the context of the concept of permanent individual personality traits. This concept gives a clear picture of this phenomenon, enables the insight into its mechanisms and its forecasting. The basis of this concept is the cybernetic theory of characters, developed by prof. M. Mazur - a forgotten genius (Pawlak, 2020).

Marian Mazur's cybernetic character theory can be useful wherever tasks should be assigned to employees, who thanks to individual features and predispositions, can perform them best (i.e. in every institution, organization and in every enterprise). In the model of the autonomous system, Mazur distinguished properties that play an important role in the control processes taking place in it. Among them, he distinguished properties independent of environmental influences and rigid properties, which he assigned to the parameters of character. Character was defined as a set of rigid steering properties. Due to the treatment of rigid control properties as parameters of character, it follows that character cannot be processed (Mazur, 1999). According to Mazur's theory, the following character parameters are the most important: width, tolerance, susceptibility and dynamism (Mazur 1999). Susceptibility is the difference between the impassable dynamism and the dynamism closest to the limit of the dynamism of character. This means that a person with freedom of choice will choose situations that fall within the tolerance limits. He/she will be able to deal with forced situations within the limits of his susceptibility.

On the other hand, outside the limits of susceptibility, he will not come to terms with any situation, regardless of the consequences. Thus, tolerance and susceptibility mark the farthest limits of dynamism within which the acceptance of stimuli (ie, the existence of approval sufficient to trigger a decision and a reaction) is possible. Therefore, it is possible to extract a parameter of the character defined as width, which is the sum of the tolerance and susceptibility. Character dynamism refers to how an autonomous system converts energy. Since the dynamism factor changes with time, dynamism is a variable parameter of character. Each person has their own domain (of five types, distinguished and described by Mazur) (Table 1).

Table 1: Manifestations of character dynamism in the cybernetic approach

No.	the domain of character	Characteristics
1	endodynamism	very pronounced negative dynamism
2	endostatism	quite pronounced negative dynamism
3	statism	dynamism close to zero
4	exostatism	quite clear positive dynamism
5	exodynamism	Very clear positive dynamism

Source: Mazur 1999.

Knowing what character we are dealing with in an employee, we can predict the behaviour of a given person and entrust them with tasks that they will perform best. In addition, the forecast of the competency adaptation will become possible.

3. Research metodology

The roots of knowledge management lie in information theory, therefore the analysis of research data was carried out using the C.A. information entropy method. Shannon in reference to the cybernetic character theory of M. Mazur (1976). Measurement of competencies by the entropy method answers the question - whether the employee competency resources at the disposal of a given company have the right structure, are optimally used

in the desired areas and how to translate this information into a useful managerial tool. The method presented in this paper is qualitative and quantitative. This method can be used as an internal tool of the organization and can be integrated with the management information system. As a tool, it can be implemented in any type of enterprise. The stages of the research procedure are presented in Figure 1.

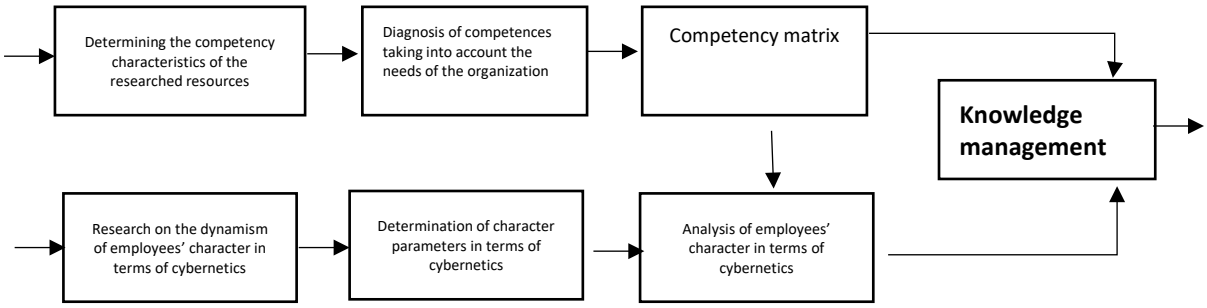


Figure 1: Research model

Source: Author own's elaborations.

3.1 Examination of competencies as organizational needs

The competency model proposed by T. Oleksyn was used in the study. The model includes 10 competences enumerated according to the specific organizational needs, such as: knowledge, experience and skills, entrepreneurship, professionalism, cooperation, assertiveness, intelligence, discipline, communicating, knowledge.

The level of intensity of a given competence was determined by assigning requirement of each competence a numerical value ranging from <1 to 5>. In the study, the arithmetic mean formula was used. Then the matrix was created. The matrix is a space that reduces the multidimensional nature of competence to two dimensions (Gierszewska and Romanowska 1998), which are competences and their averaged intensities. In the presented matrix (Table 3), the lines are the numerical values of the intensity of competences (in the context of the entire resource). The columns create a competency profile for each employee separately, expressed in numerical values. The obtained competence matrix is the starting point for statistical analysis using the entropy method.

Table 3: Competency matrix: average values of competences

No competence	employee code									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**11**
1	3,57	3,86	3,86	3,71	3,86	3,43	2,29	3,57	3,71	3,86
2	3,67	3,33	3,33	3,33	3	2,33	2	3	4	4
3	3,4	3,8	3,6	4	3,2	2,4	2,4	3,6	4,2	4,2
4	4,67	4,5	4,17	4	3,17	2,83	2,17	4,17	4,5	4,33
5	4	4	3,5	3	3	3,5	2	4	4	4
6	4,25	5	4,75	4,5	4,75	3,5	3	4,5	4,25	5
7	4,67	5	4,67	5	4	4	4	5	5	5
8	4,67	5	5	4,67	4	2,33	2,67	4,67	4,67	5
9	4	4,67	4,33	5	4,33	3	3	4,67	4,33	5
10	4,2	4,8	4,2	4,4	4,2	3,6	1,4	4,2	5	4,8

Source: Author own's elaborations

In order to determine the competency characteristics of the researched pool of employees, the entropy distribution was determined for all competencies (Table 4) – according to the following formula:

$$H = -\sum_{i=1}^{n} p_i log(p_i)$$

where:

$P_i = \frac{p_i}{\sum}$ *- the probability of the intensities of all features that make up a given competence*

At this stage of considerations, only the mathematical distribution of the assigned numerical values for individual competences is analysed. From that moment on, we do not compare the numerical values of competences assigned to individual employees, but the probability of their occurrence. This will allow them to be assessed according to the probability of their occurrence. On this basis, the diversity and priority of competences are determined.

Table 4: Competency entropy distribution

No competence	employee code									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**11**
1	0,092175	0,092766	0,096059	0,093604	0,101626	0,105933	0,095246	0,091806	0,090983	0,091264
2	0,093686	0,084887	0,088028	0,087772	0,087739	0,084616	0,087902	0,082625	0,095101	0,093205
3	0,089539	0,091912	0,092221	0,097778	0,091197	0,08616	0,097859	0,092261	0,097817	0,095896
4	0,107322	0,101326	0,100395	0,097778	0,090688	0,095046	0,092289	0,100436	0,101716	0,097596
5	0,09847	0,094722	0,090694	0,082341	0,087739	0,107102	0,087902	0,098089	0,095101	0,093205
6	0,101902	0,10738	0,107871	0,104468	0,113647	0,107102	0,110662	0,104787	0,098482	0,105784
7	0,107322	0,10738	0,106887	0,110578	0,103662	0,1149	0,127503	0,110901	0,107778	0,105784
8	0,107322	0,10738	0,110859	0,106608	0,103662	0,084616	0,103909	0,106929	0,103836	0,105784
9	0,09847	0,103443	0,102537	0,110578	0,10824	0,098297	0,110662	0,106929	0,099532	0,105784
10	0,101228	0,105021	0,100802	0,103179	0,106472	0,108738	0,07023	0,100843	0,107778	0,103435
∑	0,997436	0,996218	0,996353	0,994684	0,994669	0,992511	0,984163	0,995605	0,998123	0,997735
%	99,74%	99,62%	99,64%	99,47%	99,47%	99,25%	98,42%	99,56%	99,81%	99,77%
redundacy	0,002564	0,003782	0,003647	0,005316	0,005331	0,007489	0,015837	0,004395	0,001877	0,002265

Source: Author own's elaborations

Entropy as a measure of non-uniformity is a function of a certain sequence of data, which can be expressed as the sum of the products of the probabilities, the occurrence of a given sign and the number of its occurrences in the sequence of data (where p (i) is the probability of occurrence of the sign (i) in a given data set, and the number (i) is the number of its occurrences in this sequence) (Table 5). Unravelling the knowledge linked to the proposed concept is based on the measurement of the uneven distribution of certain competencies in a group of employees. Therefore, we are interested in the numerical determination of the degree of non-uniformity of the distribution of each competency value. Figure 2 presents the distribution of the competency entropy of the researched resource.

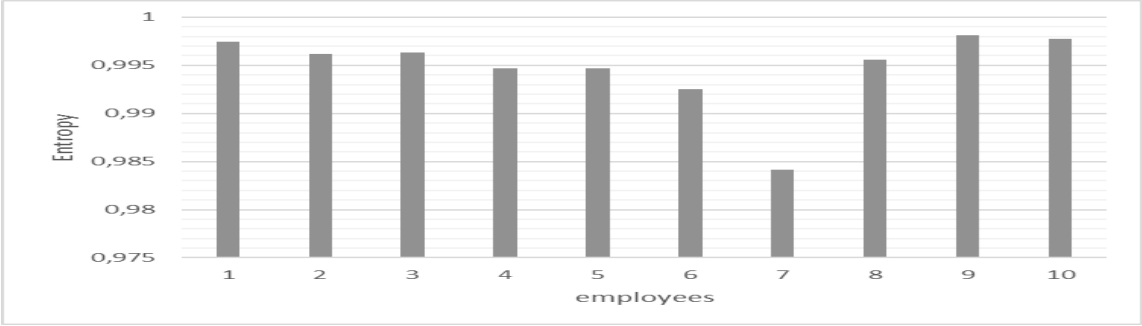


Figure 2: Competence entropy distribution

Source: Author own's elaborations

3.2 Competency matching study taking into account M. Mazur's cybernetic character theory

Mazur's theory gives rise to detailed statements about the influence of individual characters to various situations and phenomena. Knowing them allows for the proper management of representatives of any character. Examples of character manifestations are presented in Table 5.

The study of the dynamism of the character of employees was carried out on 10 employees with the use of a questionnaire of detailed manifestations of the dynamism of characters. The synthetic results are presented in Table 6 and Figure 3. Relative redundancy - 1 - (H / N) Relative redundancy (can be expressed as a percentage).

Table 5: Detailed manifestations of character dynamism (selected examples)

No.	manifestations of character dynamism / Categories	Exodynamism (A)	Exostatism (AA)	Statisim (B)	Endodstatism (C)	Endodynamism (CC)
1	attitude to the rules	capriciousness - ambivalence	individualism	principle	flexibility	arbitrary – extremism
2	receiving information	gullibility	agility	literal	Suspicion	Distrust
3	deciding (anticipating)	carelessness (impulsiveness)	recklessness (improvisation)	straightforwardness (schedule)	providence (plan)	cunning (program)
… 35	…					

Source: Mazur,1999, op.cit.

Table 6: Summary table of the results of the character dynamism research in numerical form

Employees No.	A/AA	B	C/CC
1	**17**	6	12
2	11	11	**13**
3	7	17	10
4	14	13	8
5	**11**	**14**	10
6	**21**	**9**	5
7	**18**	**5**	12
8	**18**	**13**	4
10	**16**	**14**	5
11	**7**	**22**	6

Source: Author own's elaborations

On the basis of the character dynamism determined by means of the character dynamism test, the character widths (L) and the tolerance (T), and then also the susceptibility (M) were established, according to the formula: L = T + M, as independent variables.

The width of the character can be large (broad character) or small (narrow character). Tolerance can be high (tolerant) or low (intolerant). Low susceptibility (hard character), high susceptibility (soft character).

Table 7: Character parameters in the form of calculated entropy

	character parameters					Class of charakter	Descroption
employee number	susceptibility (M)	Dynamism [log C/A)	Width (L)	Tolerance (T)	Tolerance %	Endodynamism	tolerant non-susceptible (hard)
1	0,034102	-0,151268	0,477121	**0,443019**	92,85%	Exodynamism	tolerant non-susceptible (hard)
2	0,001393	0,072551	0,477121	**0,475728**	99,71%	Exzodynamism	tolerant non-susceptible (hard)
3	0,027014	0,196295	0,477121	0,450107	94,34%	Endodynamism	tolerant non-susceptible (hard)
4	0,011675	-0,243038	0,477121	0,465446	97,55%	Endodynamism	tolerant non-susceptible (hard)
5	0,004514	-0,041393	0,477121	0,472608	99,05%	endodynamism	tolerant non-susceptible (hard)
6	0,071614	-0,623249	0,477121	0,405507	84,99%	endodynamism	tolerant non-susceptible (hard)
7	0,04848	-0,176091	0,477121	0,428641	89,84%	endodynamism	tolerant non-susceptible (hard)
8	0,061179	-0,653213	0,477121	0,415942	87,18%	endodynamism	tolerant non-susceptible (hard)
9	0,004514	-0,146128	0,477121	0,435309	99,05%	endodynamism	tolerant non-susceptible (hard)
10	0,041812	-0,505150	0,477121	0,397843	91,24%	endodynamism	tolerant non-susceptible (hard)

Source: Author own's elaborations



Figure 3: Width, tolerance, susceptibility and dynamism of character

Source: Author own's elaborations

Table 8: Character parameters in the cybernetic approach

employee No.	width	Tolerance	Relative situational entropy*		Relative tolerance	
1	0,477121	0,928525	0,997429	<1	1,074208	>1
2	0,477121	0,99708	0,996204	<1	0,999121	<1
3	0,477121	0,943381	0,99634	<1	1,056137	>1
4	0,477121	0,97553	0,994656	<1	1,019606	>1
5	0,477121	0,99054	0,994641	<1	1,00414	>1
6	0,477121	0,849903	0,992454	<1	1,167726	>1
7	0,477121	0,898391	0,983908	<1	1,095189	>1
8	0,477121	0,871774	0,995586	<1	1,142023	>1
9	0,477121	0,99054	0,998119	<1	1,007651	>1
10	0,477121	0,912366	0,99773	<1	1,093563	>1

Source: Author own's elaborations

Thanks to tolerance a person is able to distinguish situations which agree with his/her character from all possible situations. Table 9 contains linguistic descriptions of matching the diagnosed cybernetic character parameters of the employees with the organizational situations.

Table 9: Linguistic description of the match of "characters" to the organization

Employees No.	Description
1, 3-10	Organizational situations are within the breadth but exceed the tolerance range – not agreeable with the character and only because of the susceptibility these are sometimes accepted by the employee. Actions depend on the pressure exerted, and the pressure is adjusted to the resistance
2	Organizational situations are within the tolerance of the employee and are agreeable with his/ her character, these are the situations he is striving for, so all pressure will be unnecessary in this case.

Source: Author own's elaborations

Based on Table 9, we can see that among the researched human resources, only employee No. 2 shows an optimal fit to the organizational function. Other employees do not perform tasks in the organization in accordance with their individual predispositions, therefore their allocation in the organization is not optimal.

4. Discussion

The lack of understanding of the breadth of character and its components is, as a rule, a source of harmful and at least unnecessary friction in human relations based on the dependence of one people on another. The underlying cause of this friction is that superiors most often unconsciously treat subordinates as if they had an unlimited breadth of character (L = 1). And which relies solely on the susceptibility of L = M. According to this principle, superiors exert pressure on them to cause a specific behavior of their subordinates, and by applying sufficient pressure they believe that it can cause any behavior of the subordinate. The mistake of such a belief results from the failure to distinguish between the following types of situations: 1) situations within human

tolerance are compatible with the character of a person - these are situations that a person strives for (practicing a beloved profession, studying his favorite discipline, etc.), any pressure is unnecessary here, because without it, a person takes actions in accordance with his character and even greater than the required one . 2) the situation within the width of the character, but exceeding the tolerance range, is inconsistent with his character and only thanks to his susceptibility they are sometimes accepted by him, in such situations his actions depend on the pressure applied, adjusted to the resistance. 3) situations that do not fit into the breadth of a person's character, are contrary to his character, he cannot be forced to take actions causing his opposition and all pressure is ineffective; in fact, managers hate such situations, about adapting work to character, they don't want to hear, they follow the principle where there is no pressure, no steering, and where there is no steering, managers are superfluous. Therefore, when a subordinate's work gives him pleasure, his supervisor is dissatisfied, he starts to think about how to make this work difficult for him, e.g. by making excessive demands; interfering with the details of work, subjecting a subordinate to meticulous control, setting unrealistically short deadlines for completing tasks, or finally assigning to work unpleasant for the employee; all this tends to provoke resistance from the subordinate and then the use of pressure becomes justified. the supervisor regains his well-being, so his person has become indispensable to the organization.

The research procedure was completed by a comparative analysis of the "characters of employees" (linguistic version) - Table 9, with the organizational needs presented in the table in terms of the best fit to organizational needs.

References

Armstrong M. and Taylor S. (2016), *Zarządzanie zasobami ludzkimi*, Warszawa Wolters Kluwer.

Brdulak J. (2005), *Zarządzanie wiedzą a proces innowacji produktu*, Oficyna Wydawnicza Szkoły Głównej Handlowej, Warszawa.

Chatzoudes, D., Chatzoglou, P. and Vraimaki, E. (2015), "The central role of knowledge management in business operations: developing a new conceptual framework", *Business Process Management Journal, Vol. 21 No. 5, pp. 1117-1139.*

Costa, V. and Monteiro, S. (2016), "Key knowledge management processes for innovation: a systematic literature review", *VINE Journal of Information and Knowledge Management Systems, Vol. 46 No. 3, pp. 386-410.*

Dalkir, K. and Liebowitz, J. (2011), *Knowledge Management in Theory and Practice*, MIT press, Cambridge.

Davenport T. and Prusak L. (1998), *Working Knowledge. How Organisations Manage What They Know*, Harvard Business School Press, Boston 1998.

Donate, M.J. and de Pablo, J.D.S. (2015), "The role of knowledge-oriented leadership in knowledge management practices and innovation", *Journal of Business Research, Vol. 68 No. 2, pp. 360-370.*

Drucker, P. (1999), *Społeczeństwo postkapitalistyczne*, PWN, Warszawa

Drucker, P. (2002), *Managing in the next society*, New York, NY: Truman Talley Books.

Drucker, P. (1999), "Knowledge-worker productivity: the biggest challenge", *California Management Review, Vol. 41 No. 2, pp. 79-94.*

Drucker, P.F. (1998), "Management's new paradigms", *Forbes Magazine, Vol. 10 No. 2, pp. 98-99.*

Gierszewska G., Romanowska M. (1998), *Analiza strategiczna przedsiębiorstwa*, PWE, Warszawa [in:] Lendzion J. P. and Stankiewicz – Mróz A. (2005), *Wprowadzenie do organizacji i zarządzania*, Wolters Kluwer Kraków.

Grudzewski W.M. and Hejduk I. (2004), *Zarządzanie wiedzą w przedsiębiorstwach*, Difin, Warszawa.

Inkinen, H. (2016), "Review of empirical research on knowledge management practices and firm performance", *Journal of Knowledge Management, Vol. 20 No. 2, pp. 230-257.*

Jarvis P. (2012), „Globalizacja, wiedza i uczenie się przez całe życie", *Teraźniejszość – Człowiek– Edukacja*, 2(58).

Kianto, A., Vanhala, M. and Heilmann, P. (2016), "The impact of knowledge management on job satisfaction", *Journal of Knowledge Management, Vol. 20 No. 4, pp. 621-636.*

Kianto, A., Shujahat, M., Hussain, S., Nawaz, F. and Ali, M. (2019), "The impact of knowledge management on knowledge worker productivity", *Baltic Journal of Management, Vol. 14 No. 2, pp. 178-197.*

Knowles M.S., Holton E.F., Swanson A.R. (2009). *Edukacja dorosłych – podręcznik akademicki*, Warszawa Wyd. Naukowe PWN.

Mazur, M. (1999). *Cybernetyka i charakter*. Wyższa Szkoła Zarządzania i Przedsiębiorczości im. Bogdana Jasińskiego w Warszawie.

Mazur, M. (1983). Homeostaza społeczna [in:] Pecherski M. and Tudrej J., *Procesy samoregulacji w oświacie. Problemy homeostazy społecznej*. PWN.

Mazur, M. (1981), „Zagadnienie prawdy w nauce", *Zeszyty Naukowe Stowarzyszenia PAX, 1(30), 79–92.*

Mierzejewska B. (2005), "Społeczności praktyków. Efektywne tworzenie i wykorzystywanie wiedzy w organizacji", *E-mentor 1/18.*

Nonaka, I. and Takeuchi H. (1995), *The knowledge creating company*, Oxford University Press.

Nonaka, I., Toyama, R. and Konno, N. (2000), "SECI, Ba and leadership: a unified model of dynamic knowledge creation", *Long Range Planning, Vol. 33 No. 1, pp. 5-34.*

Nowak A.W. (2011), *Podmiot, system, nowoczesność*, Wydawnictwo Naukowe Instytutu Filozofii UAM, Poznań.

Wachowiak P.(ed.) (2005), *Pomiar kapitału intelektualnego przedsiębiorstwa*, Oficyna Wydawnicza SGH, Warszawa.

Oleksyn T. (2017), *Zarządzanie kompetencjami. Teoria i praktyka*, Wolters Kluwer, Warszawa.

Palvalin, M., van der Voordt, T. and Jylhca, T. (2017), "The impact of workplaces and self-management practices on the productivity of knowledge workers", *Journal of Facilities Management, Vol. 15 No. 4, pp. 423-438.*

Sahibzada, U.F., Cai, J., Latif, K.F. and Sahibzada, H.F. (2020), "Knowledge management processes, knowledge worker satisfaction, and organizational performance", *Aslib Journal of Information Management, Vol. 72 No. 1, pp. 112-129.*

Supermane, S., Tahir, L.M., Ahmad, J., Ali, M.F. and Udin, A. (2018), "The development of knowledge management competency model", *International Information Institute (Tokyo). Information, Vol. 21 No. 3, pp. 895-906.*

Turriago-Hoyos, A., Thoene, U. and Arjoon, S. (2016), "Knowledge workers and virtues in Peter Drucker's management theory", *SAGE Open, Vol. 6 No. 1, pp. 1-9*.

Wenger E., McDermott R. and Snyder W. (2002), *Cultivating Communities of Practice. A guide to managing knowledge*, Harvard Business School Press.

Wiig, K. (1997), "Knowledge management: an introduction and perspective", *The Journal of Knowledge Management, Nr 1, September.*

Wilsz J., (2009), *Teoria pracy. Implikacje dla pedagogiki pracy*, Impuls, Kraków.

Wilsz J. (2005), *Właściwości sterownicze osób wykonujących zawody prawnicze pożądane ze względu na efektywne funkcjonowanie zawodowe* [in:] Plewka C., *Edukacja, tradycje, rzeczywistość, przyszłość*, Oficyna Wydawnicza CDiDN, Szczecin.

Wyrozębski P., (2009) „Modele kompetencyjne w zarządzaniu projektami", *„E-mentor" nr 2(29), Warszawa*.

Vinas-Bardolet, C., Torrent-Sellens, J. and Guillen-Royo, M. (2018), "Knowledge workers and job satisfaction: evidence from Europe", *Journal of the Knowledge Economy, Vol. 1 No. 2, pp. 1-25.*

Zgrzywa – Ziemak Z., Kamiński R. (2009), *Rozwój zdolności uczenia się przedsiębiorstwa*, Difin, Warszawa.

Zouaria M.B., Dakhli S.B. and Zouari M.B (2018), "A Multi-Faceted Analysis of Knowledge Management Systems", Procedia Computer Science 138 (2018) 646–654.

Pawlak A, (2020) "The forgotten Genius. Prof. Marian Mazur and the Polish School of Cybernetics", *E-Mentor 5/87 Warszawa.*

Innovation Management and Usage of Knowledge Transfer in Tourism Enterprises

Zbigniew Zontek and Ewa Lipianin-Zontek
University of Bielsko-Biala, Faculty of Management and Transport, Department of Management, Bielsko-Biala, Poland
zzontek.ath@gmail.com
ezontek.ath@gmail.com

Abstract: This paper presents an overview of issues related to the role of the chosen aspects of knowledge management in tourism enterprises. The development of tourism and achieving positive effects from it is primarily supported by the possession of tourism assets and attractions. However, to fully absorb them, it is necessary to create innovations in tourism enterprises and regions. Undertaking this subject is justified by the need to transfer the current knowledge in the field of innovation to the tourism sector. The paper aims to demonstrate the determinants of tourism enterprises' innovation, with particular emphasis on the importance of knowledge and its transfer. The primary, quantitative research presented in the paper was conducted in Poland among tourism enterprises. 1200 tourism enterprises were tested, extracted from the population of over 12000 units placed in official databases. The main scientific goals of the study were: to recognise and empirically verify the conditions of innovation management in Polish tourism enterprises, to identify external and internal determinants affecting the formation of innovation in these enterprises and to assess the effects of introduced innovations. The study established a research hypothesis: Internal factors such as the involvement and creativity of employees in the creation and transfer of knowledge have a significant impact on the innovation of tourism enterprises. The presented results indicate that the main drivers of innovation are exogenous factors and come especially from customers' expectations, willingness to use external sources of financing and benchmarking focused primarily on foreign enterprises. The impact of human resources and knowledge management processes on these processes is varied, and in the case of these determinants of innovation, the relatively largest impact was noted in the case of: knowledge transfer within the enterprise, efficient human resources management, creativity of employees and the creation of new knowledge resources in the company. The paper points to the need to change the approach of managers of tourism enterprises, to include roles attributed to employees in finding innovative solutions and transfer of the new knowledge. For this purpose, companies should develop these resources in terms of their quantity and quality.

Keywords: tourism enterprises, determinants of innovation, knowledge transfer

1. Introduction

Creating innovation in tourism means creating new tourism products, processes, information systems and other forms of innovation. In order to achieve the effects of innovation processes in tourism, it becomes necessary to support, which should concern new knowledge, increase the effectiveness of innovation and links between the main market players. In order to stimulate the transfer, commercialization and diffusion of new knowledge to the tourism economy, important tasks are also attributed to institutions supporting the development of innovation in tourism. These tasks include mainly: research and development activities, consulting, training, information and promotional activities.

The ability to create knowledge and to transfer it and transform into innovative products and technologies is an important source for the well-being of societies. The main subject of influence are tourism enterprises, especially small and medium-sized (Buhalis and Cooper 1998), which bear the risk of innovation. The factor conditioning the innovation of these enterprises is primarily the creation in their environment a climate favourable to innovation. It is important to support the development of their internal resources, because there is a close relationship between entrepreneurs and their creativity and innovation, as a result of their entrepreneurial features.

The subject of this paper are considerations on the endogenous determinants of innovation management in tourism enterprises. Internal conditions are material, capital and human resources of the enterprise, as well as knowledge and its internal transfer focusing on experience, skills and the ability to apply innovations (Horng et al, 2016; Tsai et al, 2015; García-Villaverde et al, 2017). Appropriate management systems (Sigala, 2018), motivations (Horng et al, 2016), organizational culture (Hjalager, 2010) and institutional solutions (Trott, 2008) favour the usefulness of these innovative sources. The effect of the analysis of all determinant, should be the knowledge and processes of its accumulation in the enterprise (Qinxuan et al, 2016; Nieves et al, 2014; Nieves and Diaz-Meneses, 2016).

Tidd, J. and J. Bessant (2013) suggest that innovation is a management concept, in the sense that it obliges managers to choose the right forces and resources and decide how to distribute and coordinate them. Thus the innovation process should be organized and managed in an integrated manner. Innovation management issues devote much attention.

2. Knowledge and innovation

The activity of modern tourism enterprises is characterized by their striving for innovation in the area of creating value for the client. This activity results in the need to search for and implement new solutions, that enable enterprises to maintain or improve their market position. Innovation applies to all areas of life – from new solutions for economic or social life to new currents of thought and culture. The key role of innovations in economic development it to drive force of modern economies, which gives the opportunity to achieve better competitive ability.

The concept of innovativeness in personal approach indicates that it is the ability and motivation of entrepreneurs to constantly search for the results of research and development works, new concepts, ideas and inventions, and the ability to use them in innovations improving the functioning of the organization. The innovation of the organization is associated with participation in the innovation process, effective knowledge management and its practical application, as well as the ability to build network connections and exploit the synergistic effects of this cooperation (Dolińska, 2010; Gao et al, 2018).

Knowledge has special role in the creation of innovation, as the most important source of development, as well as an important factor of innovation dynamics and building a competitive advantage. Knowledge should be treated as a specific resource of the company, which, as it is being used, is growing, but is also rapidly becoming obsolete. Knowledge management should be focused on initiating and implementing innovative processes (Herrera, 2015).

An important aspect of knowledge management, from the point of view of innovation, is to minimize the gap between “static knowledge” and “active knowledge”. Companies can minimize the differences between knowledge learned and used, by encouraging knowledge sharing and transfer (He and Wong 2004; Inkinen et al, 2015). Appropriate use of knowledge is favoured by management based on leadership, in a creative environment and focused on adapting to change. The active use of knowledge in the enterprise leads to a higher level of its transformation and exploitation, and as a consequence to an increase in innovativeness. Knowledge and its proper use in an innovative enterprise becomes the key capital (Zahra and George 2002; Andreeva and Kianto (2012). The knowledge should be treated furthermore as the specific effect of innovation (Oslo Manual, 2005, p.22). Therefore knowledge is an important medium for the diffusion of innovation as part of the innovation process.

Nieves et al. (2014) suggest that enterprise developing innovation need at least three important knowledge-based resources: employee knowledge, organizational collective knowledge and ability of managers to build external social relationships in order to obtain external knowledge. Souto (2015) states that ‘human resources play a prominent role in knowledge generation, assimilation, and application’. That’s why employees with a high level of education and inter-organisational training program create an environment, which stimulates innovation. Also T. Tang (2016) points to two proactive managerial skills, important from the point of view of managing a knowledge in tourism enterprise: the ability to scan the environment in search of opportunities and to build social capital.

The advancement of emerging ICT technologies (information communication technology) has made significant impact on innovation and knowledge transfer in enterprises, including tourism enterprises. Huang et al (2021) researched qualitatively AI applications in the tourism and hospitality, and diffusion of innovations. They concluded that AI adoption susceptibility in this industry are varied depending on the type of AI. Search & booking engines, virtual agents and chatbots rank high in the adoption susceptibility. Tussyadiah (2020) has made a multi-faceted review of research works related with Intelligent automation in tourism industry, and indicated several forms of automation in tourism experiences. Some of them are dedicated to knowledge acquisition and transfer, like connected recommender systems, predictive analysis, information search and evaluation, smart environments activity and Machine learning and self-learning. Tsaih & Hsu (2018) connected the AI with the smart tourism concept. The rapid development of the ICT allowed to made several concepts

operational in tourism: artificial intelligent, cloud computing, mobile device, big data mining and social media cause computing.

Contemporary management of enterprises is based largely on the formal acquisition of knowledge, and its use in business, in current and strategic operations (Kianto et al, 2019). Formal departments and operational groups within many organisations seem not to be the only way to successfully create, spread and use the knowledge. However, informal communities - within the enterprise, with their informal knowledge management processes may expand the possibilities.

3. Methodology

This empirical study is based on primary sources and was carried out using a diagnostic survey, based on a questionnaire. The questionnaire consisted of eight tabular questions with a five-point scale of answers. The questions concerned: the types and number of implemented innovations, the sources and effects of innovation activity, the role of internal components of innovation, the areas of future activity, the success factors, and the barriers to innovation.

The spatial scope of research concerns the territory of Poland. All regions were selected for research, regardless of the rank of tourism functions in their economic activity. This is due to the fact that there are some potentially attractive tourism areas in Poland, but with poor tourism development. The study population was made up of enterprises providing tourist services in Poland and placed in online databases. The survey covered tourism enterprises conducting service activity in the field of: accommodation; restaurants and other forms of eating place; services related to culture, entertainment and recreation, tourist transport services, and tour agents, tour middlemen and tour operator activities. The population of 12073 tourism enterprises was identified, using a lists made on the basis of the following Polish databases: for accommodation base - Central List of Hotel Facilities; for enterprises providing tourist transport services – National Electronic Register of Road Transport Companies; for services related to culture, entertainment and recreation – Register of Sport Infrastructure, Registries of foundations and cultural institutions, and for tour agents, tour middlemen and tour operator activities – Central Register of Tourism Organizers and Entrepreneurs Facilitating the Purchase of Related Tourist Services. A representative research sample was selected randomly – a total of 1,200 test units were proportionally selected from the aforementioned company lists. This provided a similar structure of the research sample relative to the population. Questionnaires were sent via traditional mail, electronic mail or handed directly to the headquarters of the surveyed tourism enterprises. The data were collected in 2017. In the course of the research, 361 correctly filled questionnaires were returned, which accounted for 30.1% of the research sample.

Among the surveyed tourism enterprises, the majority were enterprises offering accommodation services (40%). The second largest group of enterprises was conducting food-related services (23%). Tour agents, tour middlemen and tour operators accounted for 18% of enterprises that correctly completed the survey, while tenderers of transport services - 10%. Services related to culture, entertainment and recreation were represented by 8% of respondents. In the case of six questionnaires, none of the above areas of activity was declared. The profile of the enterprises, which returned questionnaires is relatively similar to the research sample composition. From the point of view of the size of the enterprise, the largest group of respondents who returned the survey were microenterprises (44%). The next largest group were enterprises employing from 10-49 employees (36.5%). Medium-sized enterprises accounted for 16.9% of respondents. The study involved three large companies, and 6 respondents did not declared the size of their enterprises. Also in this case, the profile of enterprises that returned completed questionnaires was relatively similar to that of the research sample.

Table 1: Types of implemented innovations

Specification	yes		no	
	amount	in %	amount	in %
product innovations	175	48,48%	186	51,52%
process innovations	124	34,35%	237	65,65%
organizational innovations	98	27,15%	263	72,85%
marketing innovations	193	53,46%	168	46,54%
other innovations	11	3,05%	-	-

Source: Prepared on the basis of own research results

The key feature of the surveyed enterprises, significant from the point of view of the research objectives, is their innovative activity during the 3 years preceding the survey, according to the Oslo Manual (2005) methodology. From among the surveyed enterprises, 53.5% implemented marketing innovations in these period. 48.5% of respondents declared the implementation of product innovations. Every third respondent implemented process innovation, while 27% of respondents declared implementation of organizational innovations.

The research applied a large approach to innovation definition. Therefore, it is important to divide introduced innovations into radical innovations (which are a novelty on the market served by a tourism enterprise) and incremental innovations (regarding significant improvements of solutions already existing on the market and/or in the enterprise). The most often implemented innovations among new solutions were marketing innovation (27,7%), 19.8% of respondents implemented radical product innovations, while process and organizational innovations accounted for less than 7% of indications.

Table 2: Number of implemented innovations

Specification	new in the market			significant improvement			not implemented
	1-2	3-4	5 and more	1-2	3-4	5 and more	
product innovations	13,2%	5,4%	1,2%	36,0%	13,6%	2,9%	27,7%
process innovations	5,0%	1,7%	0,0%	33,9%	10,3%	0,4%	48,8%
organizational innovations	3,7%	2,9%	0,0%	24,0%	9,1%	0,8%	59,5%
marketing innovations	15,7%	8,7%	3,3%	31,0%	17,4%	3,7%	20,2%
other innovations	0,8%	0,0%	0,0%	3,7%	0,0%	0,0%	95,5%

Source: Prepared on the basis of own research results

In the case of incremental innovations, marketing and product innovations were also most frequently indicated. The percentage of enterprises implementing them is similar counted respectively at 52% and 52.5%. Processes were relatively often the subject of implemented innovations (44.6%), while implementation of significantly improved organizational innovations was less frequently declared (35%). Respondents most often declared the implementation of 1-2 innovations in all analysed categories.

Two main groups of respondents were distinguished among the surveyed tourism enterprises. Enterprises implementing innovations during the three years preceding the survey - constituted the first group. This group accounted for 242 enterprises. The second group (119 enterprises) were those enterprises which did not introduce any innovations in this period. This group included mainly young enterprises, only existing in the market for a few years, which, it may be assumed, implemented innovations in connection with the launch of operations and have relatively modern equipment and technologies. It can be assumed that this had a significant impact on the assessment of their own innovativeness. The surveyed group of respondents also included enterprises that didn't recognize introduced changes and implemented novelties as the innovations. The above-mentioned groups of respondents were respectively: 67% of enterprises introducing innovations during the 3 years preceding the survey, and 33% of respondents didn't declared that innovations were implemented in their companies during this period.

4. Selected survey results and discussion

4.1 The impact of the studied business components on achieving positive results

Respondents regarded the aspects related to location as the most important factor of their success (Table 3 and Figure 1), because for 45% of the surveyed enterprises, the very favourable location of economic activity had a key impact on the success of their business ventures, with a mean of 3.96. On the other hand, the respondents have not ascribe the same importance to the uniqueness of the environment and natural and anthropogenic advantages (mean 3.27).

The increasing competitiveness of the tourism market, and high expectations of tourists in relation to the services offered, affect the perception of enterprises by the need to raise the standard and quality of services offered. Respondents indicated a large impact of this factor on achieving positive business results (mean 3.93). They also attributed high importance to prices appropriate to the quality of the services offered (3.58) and a diverse and permanent offer (3.48). High rankings attributed to these factors also result from the attachment of enterprises to traditional measures of attractiveness of their offer.

Table 3: The impact of the studied components on business results

What is the impact of the following components on achieving positive business results in your enterprise?	I strongly disagree / I strongly agree				
	1	**2**	**3**	**4**	**5**
Location	6%	7%	16%	25%	45%
uniqueness of the environment and anthropogenic values	11%	16%	28%	25%	20%
varied but stable offer	3%	20%	24%	31%	22%
prices consistent with quality	5%	19%	16%	35%	26%
constant improvement of the standard, quality of services	5%	7%	17%	31%	40%
service innovations - constant improvement of the offer by introducing innovative services	9%	18%	22%	28%	24%
introduction of marketing innovations	13%	9%	32%	23%	23%
introduction of technological innovations (e.g. new devices, equipment, IT technologies)	12%	20%	31%	22%	14%
introduction of process innovations (changes in techniques, ways of providing services, software)	16%	16%	31%	23%	14%
introduction of organizational innovations - new management methods	15%	13%	27%	34%	11%
cooperation with other organizers of tourist stay	14%	27%	28%	20%	10%
efficient human resources management system	11%	12%	24%	37%	16%
the ability to acquire and transfer knowledge	11%	16%	28%	27%	17%
using the knowledge of external institutions (universities, associations, etc.)	22%	27%	33%	10%	9%
other factor?.....	0%	0%	0%	1%	1%

Source: Prepared on the basis of own research results.

Among particular types of innovations, respondents most often pointed to product innovations as those that contributed to their success - for 24% of respondents they were of key importance (mean 3.39). In the next place there were innovations in the field of marketing (3.33) and related information gathering skills (3.22). Organizational innovations (3.12) are slightly less significant for respondents. Respondents also attributed less importance to technological innovations (3.05). This is in some contradiction with the previously analysed responses to the question about the areas of future expected innovations, where respondents paid great attention to the use of internet and mobile communication techniques. Process innovations, usually associated with quite large financial outlays, have contributed to the achieved effects also in a relatively low degree (mean 3.03). Higher scores of this answer were attributed mainly by medium and large enterprises. This may indicate that larger business entities with a high degree of competitiveness are approaching issues related to the standardization of service processes. This outcome is also influenced by the fact that this group includes those entities which, as a source of innovative ideas provided the acquisition of patents, licenses and other forms of obtaining innovative solutions.

The level of enterprise innovation depends on the motivation of its management and employees, to look for opportunities to use the results of scientific research and inventions in order to implement them. Meanwhile, not many respondents attributed the effects of their activities, to the use of the knowledge of external institutions (mean 2.57). A relatively low impact on the results of operations, in the opinion of the surveyed enterprises, had interaction with other market players (2.84). An important direction of supporting innovation processes is to stimulate the relations of enterprises with the economic environment, institutions supporting the development of tourism and scientific and research units. Public entities and organizations should increase and diversify their offer addressed to tourism enterprises. The inclusion of appropriate innovation support institutions is a complex process, because these institutions act as a specific partner, creating a new quality of thinking and management. Where cooperation already exists, it should be ensured that it is focused on achieving real innovative effects.

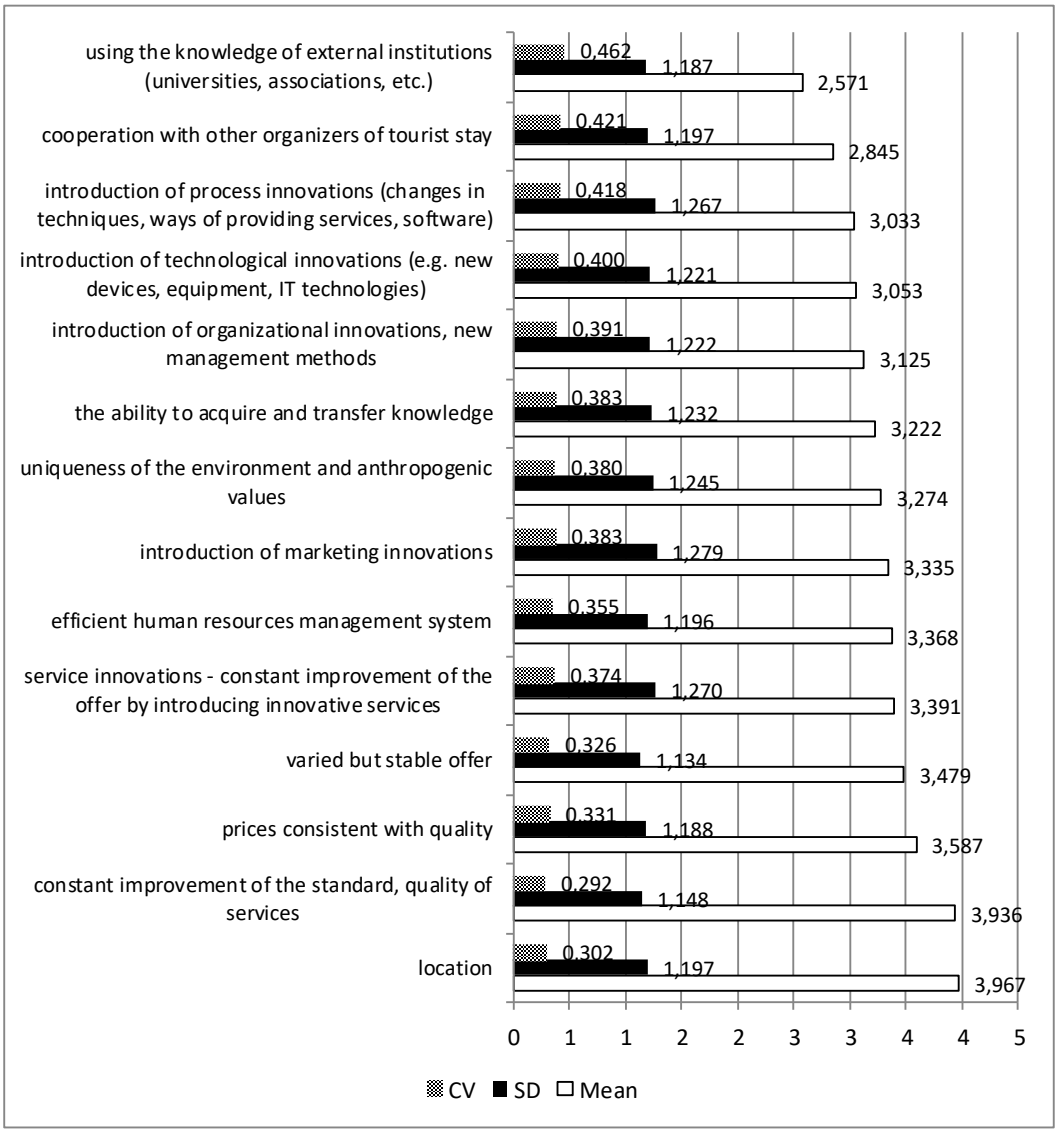


Figure 1: Mean, standard deviations (SD) and coefficient of variation (CV) values for the impact of the studied components on business results

Source: Prepared on the basis of own research results.

The degree of compliance of answers in the case of respondents' opinions on the impact of individual components on the effects of business activity is diversified. Compliance is higher in the case of issues assessed as more important (location, continuous improvement of the standard and quality of services, prices adequate to quality and a diverse but permanent offer). The coefficient of variation ranged from 0.29 to 0.33 for these factors. Compliance clearly decreases with the decrease in the assessment of the importance of individual factors, and the highest coefficient of variation occurred for assessments of "using the knowledge of external institutions". Indeed, this conditioning was indicated as significant mainly by larger enterprises.

4.2 Human resources and knowledge management aspects as the antecedents of innovation

An important aspect of research into the innovation of an enterprise is the analysis of the antecedents of undertaken innovative activity. The results showed that the sources of innovation were, for the most part of respondents, selected elements of the market environment. The surveyed representatives of enterprises most often indicated the suggestions of clients as a source of innovative activities (34% of respondents totally agreed with this statement) and searching for inspiration among foreign enterprises (36%). In the case of internal innovation sources, 17% of respondents indicated full compliance with the impact of efficient human resources management on the formation of innovation (with a high percentage of "rather yes" answers - 38%). In the case of creativity and qualifications of employees, the respondents indicated primarily their average impact (43% and

39% respectively). The undoubted consequence of such a distribution of responses is the low role of creating new knowledge resources in the enterprise (only for 11% of respondents this factor was of the highest importance). Noteworthy is the importance assigned to another component of knowledge management - the transfer of knowledge in a tourism enterprise. For this determinant of innovation, 26% of respondents assigned the highest meanings, and for 34% it was a significant factor.

The results of research concerning particular aspects of the internal environment in the light of the emergence of innovations are presented in Table 4 and Figure 2. Respondents assigned the highest importance to the appropriate level of human resources, information and other means (mean amounted to 4.12), as well as the knowledge of employees (4.02) and efficient transfer of knowledge in the enterprise (3.81). The remaining components of knowledge gathering and it's management, as respondent declared, had a smaller impact on innovative activity: for knowledge gathering and conducting the research, the mean was 3.49, and the importance of an efficient storage, sharing and information system was the component with the lowest impact on innovation (2.85).

Table 4: The impact of internal environment components on the innovation of enterprises

Which of the following internal environment components affects the innovation of your enterprise?	I strongly disagree / I strongly agree				
	1	**2**	**3**	**4**	**5**
the proper climate for innovation (incentives, acceptance, tolerance of failures, etc.)	0%	12%	39%	33%	16%
pro-innovative incentive system	5%	8%	27%	41%	19%
sharing of responsibilities	13%	23%	36%	20%	8%
clear, transparent communication	7%	17%	26%	33%	17%
the ability to use knowledge, skills and personal characteristics of employees	9%	14%	30%	34%	14%
building good relationships at work	10%	20%	31%	26%	12%
employees' knowledge	5%	7%	13%	31%	45%
honesty, keeping promises	6%	11%	28%	31%	24%
respect for otherness / acceptance of new ideas	10%	20%	22%	24%	24%
creative employees, open to new products	7%	11%	20%	32%	30%
adequate level of human resources, information and other resources	3%	8%	9%	36%	45%
the ability to gather knowledge and conduct research	2%	7%	36%	47%	7%
efficient system of information storage, sharing and usage	6%	24%	52%	14%	3%
efficient transfer of knowledge within the enterprise	5%	16%	8%	34%	37%
other factor?.....	0%	0%	1%	2%	0%

Source: Prepared on the basis of own research results.

The creativity of employees (mean 3.69) and the pro-innovation incentive system (3.63) had a relatively high significance for the innovation of the surveyed enterprises. However, the analysis of other components related to the incentive system indicates that the respondents believed their impact on innovation was lower. This situation is particularly visible in the case of: building good relationships at work (3.1) and sharing responsibilities (2.87). Such a distribution of responses indicates that the surveyed enterprises that implemented innovations paid a higher attention to the state of human resources and their quality than to the human resources management. Such a situation may in the long term disturb the internal sources of innovation, in the face of recently observed difficulties of enterprises in acquiring qualified employees.

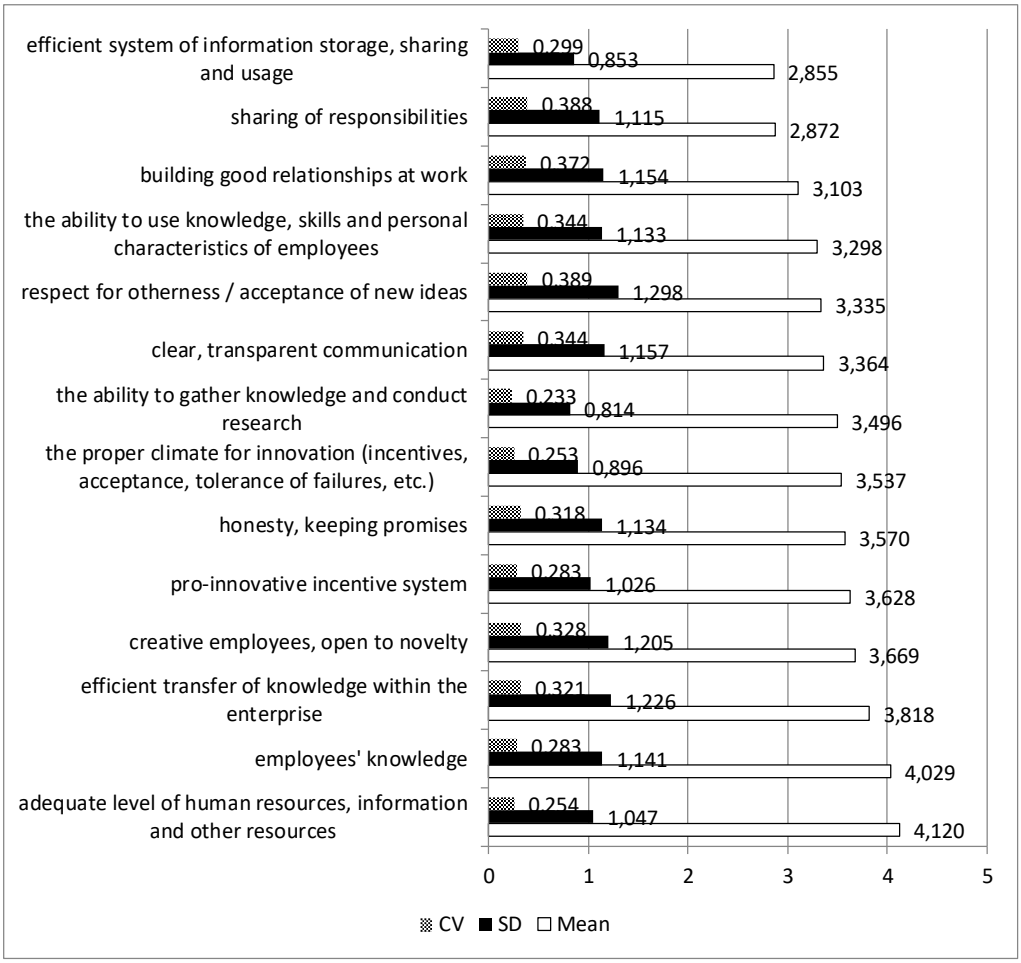


Figure 2: Mean, standard deviations (SD) and coefficient of variation (CV) values for the impact of internal environment components on the innovation of enterprises

Source: Prepared on the basis of own research results.

The degree of compliance of respondents' answers in the case of individual environmental components is variable. In the case of answers regarding: adequate level of human resources; knowledge gathering skills; an appropriate climate for innovation high compliance has been noted (CV below 0.3). The other parameters tested were moderate compliance.

5. Conclusions

Endogenous antecedents of creativity and innovation can be observed via a combination of two main factors: the personal qualities and skills of managers and employees, as well as the knowledge resources and the efficient management of them. Human resources fundamentally influence innovation. It can be treated both as a factor of creating innovation, and as a factor of dissemination of knowledge. Every employee whose creative abilities are accepted and motivated to creativity contributes to the development through innovation. This assumption focuses on the fact that human capital can not only be treated as accumulating knowledge, because innovation is the result of creation, dissemination and acceptance of new values.

The results allowed to verify the hypothesis partially, because internal antecedents of innovation influenced the innovation of researched enterprises in certain respects. The results of the conducted research have shown that the main sources of innovation are exogenous factors - obtaining customers' opinions and conducting marketing research, seeking inspiration among foreign enterprises, and the attention of residents gathered in the place of operation of the surveyed enterprises, are the key sources of innovation for the surveyed tourism enterprises. The majority of respondents do not approach the human resources in their organizations responsibly enough, treating them through the prism of operating activities. Respondents paid significant attention to the quality of

human resources, personal characteristics that favour innovation, while less important for them were activities developing them, such as: creating a climate for innovation, pro-innovative motivational system, etc.

Therefore, it is necessary to transform social awareness, especially entrepreneurs, towards the preparation of human capital capable of functioning in a knowledge-based economy. The area requiring support should be training, exchange of personnel between enterprises and the R&D sphere, joint creation of education programs and promotion of entrepreneurship. Recommendations for tourism enterprises should emphasize the need to increase the role of employees in the creation of innovations, in the use of their qualifications and creativity.

References

Andreeva, T., Kianto, A. (2012) "Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance", *Journal of Knowledge Management*, Vol 16, No. 4, pp 617-636.

Buhalis, D., Cooper, C. (1998) "Small and medium sized tourism enterprises at the destination", in: E. Laws, H. W. Faulkner, G. Moscardo (Ed.), *Embracing and managing change in tourism: International case studies*, pp 329-351.

Dolińska, M. (2010) *Innowacje w gospodarce opartej na wiedzy*, Warszawa, PWE.

Gao, T., Chai, Y. and Liu, Y. (2018) "A review of knowledge management about theoretical conception and designing approaches", *International Journal of Crowd Science*, Vol. 2 No. 1, pp 42-51.

García-Villaverde, P. M., Elche, D., Martínez-Pérez, Á., & Ruiz-Ortega, M. J. (2017), "Determinants of radical innovation in clustered firms of the hospitality and tourism industry", *International Journal of Hospitality Management*, No. 61, pp 45-58.

He, Z. L., & Wong, P. K. (2004) "Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis", *Organization Science*, Vol 15, No., pp 481-494.

Herrera, M. E. B. (2015) "Creating competitive advantage by institutionalizing corporate social innovation". *Journal of Business Research*, 68(7), pp 1468-1474.

Hjalager, A. M. (2010) "A review of innovation research in tourism", *Tourism Management*, Vol 31, No. 1, pp 1-12.

Horng, J. S., Tsai, C. Y., Yang, T. C., & Liu, C. H. (2016) "Exploring the relationship between proactive personality, work environment and employee creativity among tourism and hospitality employees", *International Journal of Hospitality Management*, No. 54, pp 25-34.

Huang, A., Chao, Y., de la Mora Velasco, E., Bilgihan, A. and Wei, W. (2021) "When artificial intelligence meets the hospitality and tourism industry: an assessment framework to inform theory and management", *Journal of Hospitality and Tourism Insights*, Vol. ahead-of-print No. ahead-of-print.

Inkinen, H.T., Kianto, A., Vanhala, M. (2015) "Knowledge management practices and innovation performance in Finland", *Baltic Journal of Management*, Vol 10, No. 4, pp 432-455.

Kianto, A., Shujahat, M., Hussain, S., Nawaz, F., Ali, M. (2019) "The impact of knowledge management on knowledge worker productivity", *Baltic Journal of Management*, Vol 14, No. 2, pp 178-197.

Nieves, J., Diaz-Meneses, G. (2016) "Antecedents and outcomes of marketing innovation: An empirical analysis in the hotel industry", *International Journal of Contemporary Hospitality Management*, Vol 28, No. 8, pp 1554-1576.

Nieves, J., Quintana, A., Osorio, J. (2014) "Knowledge-based resources and innovation in the hotel industry", *International Journal of Hospitality Management*, No. 38, pp 65-73.

Oslo Manual (2005) *The Measurement of Scientific and Technological Activities. Guidelines For Collecting and Interpreting Innovation Data*, OECD and Eurostat.

Qinxuan G., Jiang W., Wang G. G. (2016) "Effects of external and internal sources on innovation performance in Chinese high-tech SMEs: A resource-based perspective", *Journal of Engineering and Technology Management*, Vol 40, pp 76-86.

Sigala, M. (2018) "Implementing social customer relationship management: A process framework and implications in tourism and hospitality", *International Journal of Contemporary Hospitality Management*, Vol. 30, No 7, pp 2698-2726.

Souto, J. E. (2015) "Business Model Innovation and Business Concept Innovation as the Context of Incremental Innovation and Radical Innovation", *Tourism Management*, Vol 51, pp 142-155.

Tang, T. W. (2016) "Making innovation happen through building social capital and scanning environment", *International Journal of Hospitality Management*, Vol 56, pp 56-65.

Tidd, J., Bessant, J. (2013) *Managing Innovation: Integrating Technological, Market and Organizational Change*, Chichester, Wiley.

Trott, P. (2008). *Innovation management and new product development*, Prentice Hall, Pearson Education, Harlow.

Tsai, C. Y., Horng, J. S., Liu, C. H., & Hu, D. C. (2015) "Work environment and atmosphere: The role of organizational support in the creativity performance of tourism and hospitality organizations", *International Journal of Hospitality Management*, No. 46, pp 26-35.

Tsaih R.-H., Hsu, C. C. (2018) "Artificial intelligence in smart tourism: A conceptual framework", in "Proceedings of The 18th International Conference on Electronic Business" ICEB, Guilin, China, December 2-6, pp. 124-133.

Tussyadiah, I. (2020), "A review of research into automation in tourism: Launching the Intelligence and Robotics in Tourism Annals of Tourism Research Curated Collection on Artificial", *Annals of Tourism Research*, No 81, 102883.

Zahra, S. A., George, G. (2002) "Absorptive capacity: A review, reconceptualization, and extension", *Academy of Management Review*, Vol 27, No. 2, pp 185-203.

PhD Research Papers

Explaining Knowledge Intensive Firms' Performance Through Internal Factors: Evidence from an IT Consulting firm

Asmaa Abid-Baudin
Université de Bourgogne & Université Hassan 1er
Asmaa_abid@etu.u-bourgogne.fr

Abstract: Our research contributes to knowledge-intensive firms research streams. We propose an explanation of their performance based on organizational design theory and the resource-based view. Through a case study on an IT consulting firm in France, we examined the impact of a coherent organizational architecture and a cognitive asset on the performance of the firm. The results show a complementarity between a coherent organizational design and a meticulously formed and maintained human resources asset to explain the performance of an IT consulting firm.

Keywords: knowledge intensive firms, organizational performance, organizational design theory, resource-based view, IT consulting firm

1. Introduction

The information technology (IT) sector has played an important role in the emergence of the knowledge age where information must be processed and shared as quickly as possible (Khalil & Khalil, 2020). Among the important actors of the field, we find IT consulting firms considered as a knowledge-intensive firm (KIF) (Muller and Doloreux, 2009). The information system is at the center of IT consulting firms' activities. They guide their clients towards high-performance IT solutions, provide them with expertise on their information system or support for end users through an implementation of interactive computer interfaces or mobile applications. Therefore, the success of their consulting projects depends heavily on knowledge, which explains the importance of its management (Khalil & Khalil, 2020). More specifically, it is tacit knowledge (Nonaka, 1994) or specific knowledge (Jensen and Meckling, 1992), which is relevant to decision-making, and on which depends the firm's performance. Being personal and context specific, it refers to the meaning given by a combination of information and beliefs specific to everyone. In complex organizations, fragments of specific knowledge are possessed by various dispersed agents (Fama and Jensen, 1983) who are the only ones aware of its importance (Hayek, 1986), thus explaining the high cost of its transfer. By what mechanisms do we make such knowledge available to decision-makers? How does the firm acquire such knowledge and how does it increase? Although there are studies on KIF and performance management ((e.g Khalil & Khalil, 2020; Berraies & Bchini, 2019; Greenwood et al., 2005; Løwendahl and Fosstenløkken, 2001), we propose to explain performance by combining the organizational design theory and the resource-based view, two complementary theories having as a common point: the central element of knowledge. Our choice to combine both theories aims to go beyond their restricted conceptualizations of the firm and to contribute to the literature on KIF.

2. Theoretical model

2.1 Organizational design theory

Organizational performance is a multidisciplinary research field that can be defined according to the researcher's academic orientations and choices. It can be defined in terms of value creation (Charreaux, 1998). From a traditional financial perspective, it reflects the rent received by shareholders (Charreaux and Desbrières, 1998). In other terms, to which extent a company has been able to create or is able to create more value for its shareholders than its competitors? According to the organizational design theory, a firm is performant if the agency costs resulting from intra-firm cooperative relations are minimized (Jensen and Meckling,1976). To achieve this, the theory proposes a coherence between three blocks described by (Brickley et al., 1997) as the three legs of the stool. The first block of the organizational design theory concerns the delegation of management decision-making rights. These are the rights of decision initiation, ratification, implementation, and monitoring (Fama and Jensen, 1983), (Brickley et al., 2003). They can be grouped into two categories: decision management rights (initiation and implementation) and decision control rights (ratification and monitoring). To achieve better performance, a firm must be able to decentralize management rights to the agents holding the specific knowledge (Jensen and Meckling, 1992), (Brickley et al., 1997), (Brickley et al., 2001), (Brickley et al., 2003). In our case, given their specific knowledge, teams of consultants hold the rights to manage the projects, therefore, our first hypothesis is:

H1: The delegation of management decision rights to teams of consultants positively influences the performance of an IT consulting firm.

However, in the presence of opportunistic agents with limited rationality, decentralizing management decision-making rights to consultant teams carries risks. To minimize them, (Jensen and Meckling, 2009) advocate the use of disciplinary mechanisms in the form of a performance evaluation system. It represents the second block of the organizational design theory. This system can include subjective and objective assessments of both individuals and sub-units of an organization such as divisions or departments. A collective and objective assessment is advantageous in environments dominated by project logic and where the imperative of collaboration makes individual assessment sensitive. In this case, the consultants will be inclined to work in the interest of the principal since their evaluation would depend on the collective performance of their teams, hence our second hypothesis is:
H2: Along with delegation of management decision rights to teams of consultants, the use of collective criteria to evaluate consultants' performance positively influences the performance of an IT consulting firm.

Given the context of IT consulting projects, a post-project evaluation is not sufficient because of the commitments and delivery deadlines made with the client and the technological and budgetary means involved. Frequent monitoring of results seems to be one way to ensure that software development teams remain focused on achieving their objectives (Kirsch, 1997) in (Maruping et al., 2009); (Henderson and Lee, 1992), (Nidumolu and Subramani, 2004). Checkpoints should therefore be set up throughout the project, complementing the decentralization of decision rights to the consultants, hence our third hypothesis is:
H3: Along with delegation of management decision rights to teams of consultants, the frequent use of formal mechanisms to evaluate consulting projects, positively influences the performance of an IT consulting firm.

Alongside this formal mechanism, we postulate three types of informal controls favored by the social environment: corporate culture, social control by peers and transparency of information. By insisting on elements of culture, firms using this type of control cultivate the values and norms valued by their employees (Dreesen et al., 2020; Berrebi-Hoffmann, 2006; Alvesson and Kärreman, 2004), hence our fourth hypothesis is:
H4: Along with delegation of management decision rights to teams of consultants, the use of corporate culture as an informal control mechanism positively influences the performance of an IT consulting firm.

This environment leads also to mutual surveillance and to phenomena of reputation and sanction by the group in the case of non-conformity with the norms and values shared by all (Berrebi-Hoffmann, 2006). Through peers who are the best qualified to observe the behavior and evaluate the performance of their colleagues, management obtains information on the agents at low cost (Fama and Jensen, 1983). Therefore, our fifth hypothesis is:
H5: Along with delegation of management decision rights to teams of consultants, the use of social peer control as an informal control mechanism positively influences the performance of an IT consulting firm.

In addition, the exercise of self-monitoring is reinforced by a structure where information about personal achievements is transparent and accessible to all consultants (Berrebi-Hoffmann, 2006). We can therefore postulate that consultants who are aware of how their performance is viewed by others are forced to self-monitor, hence our sixth hypothesis is:
H6: Along with delegation of management decision rights to teams of consultants, transparency of information, self-disciplining the consultant, as an informal control mechanism positively influences the performance of an IT consulting firm.

The third block of the organizational design theory is the performance incentive system. These mechanisms motivate consultants to exceed their goals by using their specific knowledge and making it accessible to others. Agents will be rewarded according to their marginal contributions to the firm's result (Osterloh and Frey, 2000), (Brickley et al., 2001). Collective reward makes it possible to overcome the difficulty of measuring individual performance and therefore its reward (Brickley et al., 2001). It is consistent with collective evaluation and peer review. Therefore, our seventh hypothesis is:
H7: Granting financial incentives based on collective bonuses, in line with a collective performance evaluation, positively influences the performance of an IT consulting firm.

The reward and sanction system can also have a non-monetary dimension such as honor, consideration, reputation... (Jensen and Meckling, 2009) because the reward itself is not important: what matters is the value that the recipient attributes to it (Foss et al., 2015). This can be in the form of recognition from colleagues, other teams, and management and reputation (Husted and Michailova, 2002). A balance between financial and non-financial incentives is likely to have positive effects on knowledge sharing and thus on firm performance, therefore our eight hypothesis is:

H8: Granting Informal incentives based on subjective performance evaluation positively influences the performance of an IT consulting firm.

2.2 Resource-based view of the firm

The positive effects of knowledge on firm performance have long been analyzed by proponents of the resource-based approach (Penrose, 1959; Wernerfelt, 1984; Barney, 1991, 1996; Grant, 1991). Penrose conception of the firm describes it as a collection of productive resources of administrative organization. This is what, according to the author, contributes to the profitability of the firm. In the theory of resources, an IT consulting firm is efficient if it ensures better exploitation of the services provided by its internal resources. In terms of knowledge management, (Dierickx and Cool, 1989) distinguish between two notions: the stock, reservoir or pool of knowledge and the flow of knowledge. The knowledge pool refers to the current knowledge held by the firm while the knowledge flow refers to the acquisition of new knowledge. Combining a strong employer brand with selective recruitment is one strategy to help achieve this goal (Gamage, 2014; Fulmer et al., 2003; Sutherland et al., 2002), hence our ninth hypothesis is:

H9: The constitution of a quality knowledge pool positively influences the performance of an IT consulting firm.

To maintain this quality pool of knowledge, we propose several mechanisms based on the density of social relationships in this type of organization. They are known for stimulating knowledge flows. They are knowledge-friendly culture (Mas Machuca and Martínez Costa, 2012; Heisig, 2009), communities of practice (Lesser and Storck, 2001; Lave and Wenger, 1991) and training (Chen and Huang, 2009; Bauernschuster et al., 2008), therefore our tenth hypothesis is:

H10: The maintenance of a quality knowledge pool positively influences the performance of an IT consulting firm.

In previous exploratory research among French consulting firms Partners and consultants, we have identified the agile methodology as one of the key elements emphasizing the success of IT consulting projects. In the context of IT companies, the notion of agility, as explained by Khalil (2011), refers to their ability to adapt to changes in customer demands during the project, and to master the functional scope of the project as well as the cost and quality criteria. It is a methodology conducive to self-organization and promoting adaptability. Therefore, we have integrated it to our research model as a moderating variable:

H11: The use of agile methodology in consulting projects intensify the positive influence of the disciplinary and cognitive model on the performance of an IT consulting firm.

Our research model is as follows:

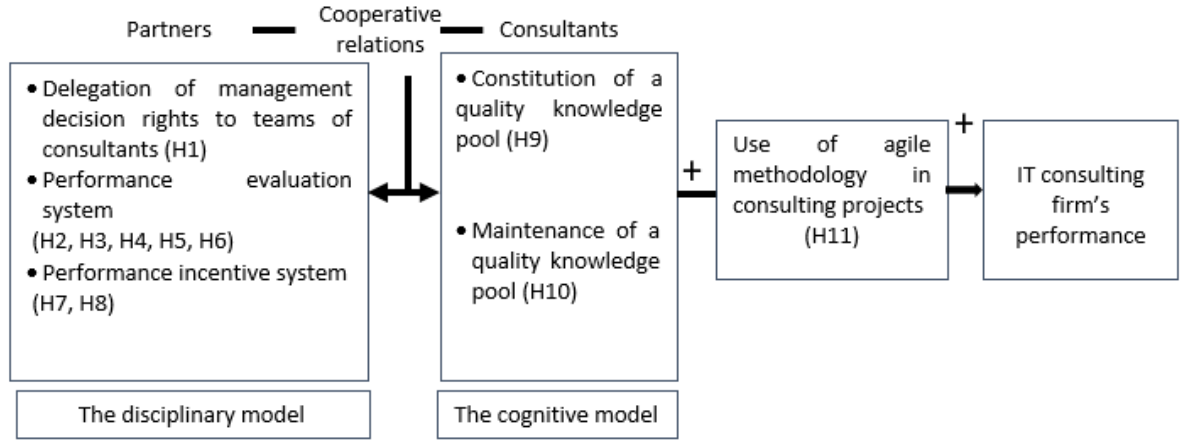


Figure 1: Our research model

Having presented our research model, we detail in the following section the results of our case study.

3. Results

3.1 Research methodology

To test our hypotheses, we chose to follow the qualitative method of the case study. We therefore chose an IT consulting firm recommended by several respondents in our exploratory phase as being in the top 10 IT consulting firms' performers in France. Our research took over a period of 14 weeks in 2020. We used data triangulation to test our theoretical model. Secondary data from the internal documentation of the IT consulting firm (intranet, mailing lists), shared by our respondents, and available on the company's websites (corporate and publications on social networks) of the IT consulting firm, along with participant observation were crossed with primary data from 35 interviews with different profiles representing a volume of 32 hours. The interviews collected were analyzed using two techniques: analysis by analytical questioning as well as analysis in writing mode.

3.2 The case study

3.2.1 LCR, a premium IT consulting firm

«Our main objective is a business company objective [...] we can consider that our development axis and our added value is to provide premium expertise in software development and therefore, we measure this quality in relation to indicators that allow us to demonstrate that we know how to deliver software quickly, but all this is just a positioning argument. The proof and relevance of our positioning is in relation to the premium level of our prices, and therefore our margin. » M. M.K, Partner. Founded in France in the 1990s, LCR is an IT consulting firm that has nearly 600 employees. Since 2014, the company has defined its internal organization mode in tribes. With a management committee of 19 Partners and a head office in Paris, LCR has regional branches in the south and north of France and an international branch in North Africa. To measure its performance, we opted for a financial indicator for its ability to display a synthetic measure of the company's overall performance over a given period. It also has the advantage of allowing comparisons (between firms or over time) due to its homogeneous calculation standards (Giraud, 2011). For this purpose, we used the indicator of commercial profitability, and therefore the operating margin. This indicator is very relevant for consultancy firms since it reflects their business model and therefore provides information on the profitability of sales. With a double-digit operating margin since 2015, the IT consulting firm is one of the most profitable companies while showing very strong internal growth. Its sales have doubled in just four years, from 38 million in 2015 to over 80 million in 2019. We will now confront the hypotheses of our theoretical model with data collected.

3.2.2 Decentralized but highly monitored and controlled consulting projects

The first block of our theoretical modelling concerns the disciplinary mechanisms of the agent holding the specific knowledge. First, we postulated that due to the cognitive limitations of the principal (the partners), better decision making depends on the delegation of management decision rights to consultants who are best able to deal with the client's problem. What about the actual process of managing a consulting assignment at LCR? By cross-referencing the internal documentation with what the consultants said, we can see that the actual process of managing a consultancy assignment at LCR follows the four stages of the theoretical model recommended by Fama and Jensen (1983) except for the initiation phase. In the context of LCR, this is not fully delegated to consultants. In fact, the search for a consulting project (by mutual agreement) or in response to calls for tender is carried out by the partners (the principal) or by the consultant (the agent). The latter, in partnership with a business consultant, then selects the offers in line with the firm's orientations. The ratification stage corresponds to contract signing by a Partner (the principal). The implementation stage is delegated to consultants (agents) who are responsible for carrying out the project. In the final stage, these agents are monitored using a combination of frequent control by the project manager and various monitoring committees.

They are supported by experts external to the project in case of detection of delays in the achievements, dissatisfaction of the stakeholders or any other difficulty. Considering these results, we can deduce that project management rights are partially delegated to consultants (agents) while decision control rights are held by the principal (the partners) and the project manager. We, then, can corroborate partially our first hypothesis.

Secondly, we emphasized that delegating management decision rights to consultants can only contribute to the performance of an organization if it is consistent with a performance evaluation system that disciplines potentially opportunistic agents with limited rationality (Jensen and Meckling, 2009). The criteria of performance evaluation of the consultants within this IT consulting firm are directly linked to collective

achievements. The annual evaluation of the consultant depends on the performance of his tribe as well as that of LCR. In other words, it is a question of evaluating on the one hand the achievement of the operating margin target by tribe up to 50%, and on the other hand, the participation of the tribe in the achievement of the operating margin of LCR up to the remaining 50%. We can therefore conclude that this evaluation mechanism is in line with our theoretical hypothesis and has the advantage of favoring both intra- and inter-team collaboration to the detriment of competition between consultants. As regards the periodicity of the evaluation of the performances of the consultants, LCR proceeds during the project to frequent evaluations relating to the technical, financial, and behavioral indicators and at the end of the year to a collective evaluation of the tribe to which the consultant belongs. We can therefore conclude that our second and third hypotheses, according to which the use of frequent evaluations and a collective evaluation of the performance of the consultants determine the performance of an IT consulting firm, are corroborated. Along with a delegation of management decision rights to the consultants, we postulated that the existence of an informal control on both the cultural and social levels would have the advantage of disciplining the consultant, thus contributing to a better performance of the IT consulting firm. On its institutional page, LCR communicates on its culture as a differentiator from the competition. Internally, we observed the same. The onboarding process is mainly around LCR's history and culture. We particularly noted the communication by "mottos" to anchor the culture of the firm. For reasons of confidentiality, we will only reveal the meaning of the two "mottos" most often relayed by the consultants: trust by default and encouragement of individual initiatives. In the event of a breach of trust, deviant behavior or declining performance, the collective takes over from management to warn or informally/ formally punish. In the light of this analysis, we can deduce that LCR trusts the intelligence and accountability of its consultants to work according to its interests, to be in a continuous quest for improvement and to display high performance behaviors. On the other hand, in case of deviation, the consultant community acts as a social controller. Indeed, the consultants are demanding towards each other, look at each other, push each other to improve in their projects and to conform to the values of the IT consulting firm thus leading to corroborating our fourth and fifth hypothesis. With regards to our sixth hypothesis, we postulated that the exercise of self-control, reinforced by a context where the information on the personal achievements is transparent and public, has the advantage of disciplining the consultant. Several respondents told us that almost all the information was available there (the operating margin of each tribe, the activity report of each consultant, his daily rate...etc.).

From our observations and use of Beta (the transparent management system used by all employees), we can confirm its openness and accessibility by all (including trainees). This leads us to conclude that it is consistent with social control by peers. Indeed, it allows to inhibit the counter-productive behaviors of the consultants, conscious of the look of their community, to self-discipline. It therefore participates, as a means of informal control, in exerting a positive action on the performance of LCR, thus corroborating our sixth hypothesis.

3.2.3 Financial incentives partly collective, and not only informal incentives

At LCR, annual bonuses are awarded based on the company's collective performance, in other words its overall operating margin. As mentioned earlier, the bonus calculation scheme can be done in two ways depending on the choice of the tribes. The first model is based on 50% of the tribe's operating margin and the remaining 50% of LCR's overall operating margin. The second model is based on 50% of the operating margin achieved by the tribe and 50% of the operating margin achieved by the league. Furthermore, we noticed that although the financial incentive at LCR is based on a collective performance objective, the amount of the annual bonus differs from one consultant to another depending on his level or advancement within the IT consulting firm. We also noted a second particularity of the calculation of financial incentives at LCR. These are dependent on a system of points according to the seniority of the consultant. This leads us to question the existence of an entirely collective bonus at the firm. We can therefore only partially corroborate our seventh hypothesis. As explained above, LCR does not individually assess the consultant's direct contribution to the tribe's operating margin. However, the consultant is evaluated individually on his overall achievements, i.e., by looking at his activity rate and his achievements outside the consulting projects. For that purpose, in addition to the report of activity of the Beta interface, the consultant proceeds to his self-evaluation, submits to the evaluation of his manager and that of his peers. The latter can give feedback face to face, via e-mail or during public presentations, which can enhance or tarnish the consultant's image. Based on the analysis of the various comments of our interviewees, the hypothesis of the reputation phenomenon as an informal incentive mechanism seems to be a powerful mechanism within LCR. Indeed, these consultants feel a need to gain visibility and legitimacy within the community through publishing books or articles in peer-reviewed journals for example. However, individual incentives are not only informal. In fact, the mechanisms of reputation and recognition by peers are a prerequisite for individual financial incentives such as a salary increase or promotion to a higher grade. We can,

therefore, only partially corroborate the superiority of informal incentive mechanisms within our IT consulting firm because they are a prerequisite of formal and monetary incentives over the long term.

3.2.4 LCR, a pool of up-to-date experts

In the cognitive part of our theoretical model, we postulated that the constitution of a quality knowledge pool positively impacts the performance of an IT consulting firm, through the association of an employer brand with selective recruitment. The analysis of our respondents' comments and the study of internal and external documentation show that it's not "Great Place To Work" certificates that influenced their choice of LCR. Several participants told us that it was meeting and interacting with LCR consultants that motivated them to join the firm. Whether it is a question of tracking or co-opting new consultants, LCR consultants remain the best ambassadors of the company. Through their projects or professional events, they are often in contact with future employees and can detect in them skills and behaviors in line with LCR's positioning and values. We observe that the participation of consultants in the selection of their future colleagues has two major objectives. Firstly, the consultants are in the best position to judge whether the candidate's skills and expertise meet the company standards. Secondly, they can detect if future LCR consultants will be in line with the corporate culture proving to be a powerful informal control mechanism. Given this evidence, we can partly corroborate our ninth hypothesis. A pool of quality knowledge through expert and culturally aligned consultants can then explain LCR's performance. With regards to the maintenance of a quality pool of knowledge, all elements listed on the theoretical level have been observed within LCR (training, communities of practice and a knowledge friendly culture). Moreover, the firm is the only company of its kind to have created an entity called the scientific department. More concretely, LCR's scientific policy is reflected in its willingness to take on doctoral students, fund Phd research and to involve research laboratories, with the aim of publishing the results of this research.

The major conclusion that can be drawn from our observations is the coherence of these formal and informal mechanisms for capitalizing on knowledge, which is a criterion for evaluating consultants' individual performances. In fact, apart from their performance on the project side, consultants are evaluated by their peers in terms of their contribution to the development of their community internally and their company externally. In view of LCR's organizational configuration and the initiatives created to promote a knowledge friendly environment, inside and outside the organization, our tenth hypothesis seems to be corroborated.

3.2.5 Agility, more than a methodology at LCR

Since 2005, LCR has been one of the forerunners in France of the agile methodology for IT projects. It contributes to reinforcing delegation and control functions of the disciplinary model and maintaining a quality pool of knowledge as part of the cognitive model. In fact, LCR consultants are autonomous in carrying out their tasks on sprint basis. Delivering functional versions of the product on short terms enable the frequency of project evaluation and feedback from clients and users. In addition, peer programming, peer reviews and collective reviews are some examples of agility practices used in evaluating consultants' performance. They allow tracking the progress of computer coding tasks and improving them as the same time. The latter is also possible through different rituals such as retrospectives, daily and weekly meetings. They support training programs and scientific department actions in maintaining the quality of LCR cognitive pool. We were surprised though to find other departments working with the agile methodology. Employees from both human resources and communication department reported being agile. This means delivering projects on sprints and embracing daily and weekly meetings and retrospectives practices to check on teams' temperatures, share news and/or knowledge. If we rely on the above results, we could conclude, at first glance, that our hypothesis is corroborated. Indeed, the consulting missions are well conducted according to the agile methodology and its principles act as amplifiers of the positive effects of the disciplinary model and the cognitive model. However, having observed its adoption by other departments and having experienced it as a trainee, we must qualify the formulation of our last hypothesis. It is not only performing IT projects using the agile methodology that moderate disciplinary and cognitive models impact on LCR performance but embracing it as a way of working at a larger scale that is more interesting. Agility can help producing better results when it is in a firm's DNA becoming part of its culture. Therefore, we can only partially corroborate our last hypothesis (H11).

4. Discussions and conclusion

The objective of our research is to propose an explanation of KIF performance (through the case of an IT consulting firm) based on organizational design theory and resource-based view contributions. From the analysis of our results, we can conclude that a complementarity between the disciplinary and cognitive models seems to

participate in the explanation of LCR's performance. Both models are reinforced by the role of agile methodology and the firm culture in positively impacting the IT consulting firm performance.

With regards to the limitations of our research and future recommendations, we can discuss the following. First, the qualitative method of the case study is often criticized, and especially when it comes to a single case study, for its ability to produce generalizable results. However, we consider that the generalization of the results is not the only way to understand the world. A single black swan disproves the theory of the white color of swans (Popper, 1968). It was never necessary to see several to decide. Although, the case method allows us to collect rich and informative data, we encourage future researchers to test our model on a larger sample of KIF. Second, we must underline a concern addressed several times by different profiles of respondents (consultants, partners, and CEO). It is cognitive overload defined as the load on working memory experienced while performing a specific task (Kalyuga, 2011). If the cognitive load exceeds the available working memory capacity, learning and performance may be inhibited. Some consultants felt it was a consequence of peer pressure. We explained that the phenomena of reputation and peer recognition represented a very important informal incentive mechanism within LCR. According to our respondents, it results in a continuous search for meaning, legitimacy and a long phase of self- doubt. Consultants spend the first two years establishing their legitimacy within their community and gaining recognition in a third phase. A second level of cognitive overload seems to be felt by the boards of directors. Some partners told us that it became more and more energy consuming to maintain their organizational culture as the firm scaled up. Despite its positive effect on the performance, such culture of trust, social control, and knowledge sharing seems to adapt painfully to the change of the firm's size. It results in consultants under constant pressure, and exhausted managers. The organizational equilibrium described above is achieved at the cost of a cognitive overload felt at all levels of LCR. This finding may lead to future longitudinal research on one or more KIF having scaled up. The concept of culture within a firm's organizational design may be studied considering similar size changes.

References

Alvesson, M., & Kärreman, D. (2004). Interfaces of Control. Technocratic and Socio-Ideological Control in a Global Management Consultancy Firm. Accounting, Organizations and Society, 29, 423-444.

Barney J., (1996), « The resource-based theory of the firm », Organizational Science, 7 (5), pp. 469-502.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. Journal of Management, 17(1), 99-120.

Bauernschuster, S., Falck, O., & Heblich, S. (2008). The impact of continuous training on a firm's innovations. CESifo Working Paper, 2258.

Berraies, S., & Bchini, B. (2019). Effect of leadership styles on financial performance: mediating roles of exploitative and exploratory innovations case of knowledge-intensive firms. International Journal of Innovation Management, 23(03), 1950020.

Berrebi-Hoffmann, I. (2006). Les consultants et informaticiens. Revue française de gestion, 9, 157-176.

Brickley, J. A., Linck, J. S., & Smith, C. (2003). Boundaries of the firm : Evidence from the banking industry. Journal of Financial Economics, 70(3), 351-383.

Brickley, J. A., Smith, C. W., & Zimmerman, J. L. (1997). Management Fads and Organizational Architecture. Journal of Applied Corporate Finance, 10(2), 24-39.

Brickley, J. A., Smith, C., & Zimmerman, J. L. (2001). Managerial Economics and Organization Architecture. Irwin/McGraw-Hil.

Charreaux, G. (1998). Le point sur la mesure de performance des entreprises. Banque et Marchés, 34, 46-51

Charreaux, G., & Desbrières, P. (1998). Gouvernance des entreprises : valeur partenariale contre valeur actionnariale. Finance contrôle stratégie, 1(2), 57-88.

Chen, C.-J., & Huang, J.-W. (2009). Strategic Human Resource Practices and Innovation Performance – The Mediating Role of Knowledge Management Capacity. Journal of Business Research, 62, 104-114.

Dierickx, I., & Cool, K. (1989). Asset Stock Accumulation and Sustainability of Competitive Advantage. Management Science, 35(12), 1504-1511.

Dreesen, T., Diegmann, P., & Rosenkranz, C. (2020). The Impact of Modes, Styles, and Congruence of Control on Agile Teams : Insights from a Multiple Case Study. Hawaii International Conference on System Sciences 2020

Foss, N. J., Pedersen, T., Reinholt Fosgaard, M., & Stea, D. (2015). Why Complementary HRM Practices Impact Performance : The Case of Rewards, Job Design, and Work Climate in a Knowledge-Sharing Context. Human Resource Management, 54(6), 955-976.

Fulmer, I. S., Gerhart, B., & Scott, K. S. (2003). Are the 100 best better? An empirical investigation of the relationship between being a "great place to work" and firm performance. Personnel Psychology, 56(4), 965-993

Gamage, A. S. (2014). Recruitment and Selection Practices in Manufacturing SMEs in Japan : An analysis of the link with business performance. 1(1), 16.

Grant R., (1991), « A resource-based theory of competitive advantage: Implications for strategy formulation », California Management Review, 33 (3), pp. 114-135.

Greenwood, R., Li, S. X., Prakash, R., & Deephouse, D. L. (2005). Reputation, diversification, and organizational explanations of performance in professional service firms. Organization Science, 16(6), 661-673.
Hayek, F. A. (1986). L'utilisation de l'information dans la société. Revue française d'économie, 1(2), 117-140. https://doi.org/10.3406/rfeco.1986.1120
Heisig, P. (2009). Harmonisation of knowledge management – comparing 160 KM frameworks around the globe. Journal of Knowledge Management, 13(4), 4-31.
Henderson, J. C., & Lee, S. (1992). Managing I/S Design Teams : A Control Theories Perspective. Management Science, 38(6), 757-777.
Henderson, J. C., & Lee, S. (1992). Managing I/S Design Teams : A Control Theories Perspective. Management Science, 38(6), 757-777.
Husted, K., & Michailova, S. (2002). Diagnosing and Fighting Knowledge-Sharing Hostility. Organizational Dynamics - ORGAN DYN, 31, 60-73.
Jensen M. et Meckling W., (1976) « Theory of the firm : managerial behavior, agency costs and ownership structure », Journal of Financial Economics, 3 (4), pp. 305-360.
Jensen, M. C., & Meckling, W. H. (1992). Specific and general knowledge and organizational structure. In Contract economics (Blackwell, p. 251-274).
Jensen, M. C., & Meckling, W. H. (2009). Specific Knowledge and Divisional Performance Measurement. Journal of Applied Corporate Finance, 21(2), 49-57.
Kalyuga, S. (2011). Cognitive load theory: How many types of load does it really need?. Educational Psychology Review, 23(1), 1-19.
Khalil, C. (2011). Les méthodes" agiles" de management de projets informatiques : une analyse" par la pratique".
Khalil, C., & Khalil, S. (2020). Exploring knowledge management in agile software development organizations. International Entrepreneurship and Management Journal, 16(2), 555-569.
Kirsch, L. S. (1997). Portfolios of Control Modes and IS Project Management. Information Systems Research, 8(3), 215-239.
Lave, J., & Wenger, E. (1991). Situated Learning: Legitimate Peripheral Participation. Cambridge University Press.
Lesser, E. L., & Storck, J. (2001). Communities of practice and organizational performance. IBM SYSTEMS JOURNAL, 40(4), 11.
Løwendahl, B. R., Revang, Ø., & Fosstenløkken, S. M. (2001). Knowledge and value creation in professional service firms: A framework for analysis. Human relations, 54(7), 911-931.
Maruping, L. M., Venkatesh, V., & Agarwal, R. (2009). A control theory perspective on agile methodology use and changing user requirements. Information Systems Research, 20(3), 377-399.
Mas Machuca, M., & Martínez Costa, C. (2012). A study of knowledge culture in the consulting industry. Industrial Management & Data Systems, 112(1), 24-41.
Muller, E., & Doloreux, D. (2009). What we should know about knowledge-intensive business services. Technology in Society, 31, 64-72.
Nidumolu, R., & Subramani, M. (2004). The Matrix of Control : Combining Process and Structure Approaches to Managing Software Development. J. of Management Information Systems, 20, 159-196.
Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. Organization Science, 5(1), 14-37.
Osterloh, M., & Frey, B. (2000). Motivation, Knowledge Transfer, and Organizational Forms. Organization Science, 11, 538-550.
Penrose (1959). Les Grand Auteurs en Economie des Organisations, 49.
Popper K., (1968), The logic of scientific discovery, Ed. Harper and Row.
Sutherland, M., Torricelli, D., & Karg, R. (2002). Employer-of-choice branding for knowledge workers. South African Journal of Business Management, 33, 13-20.

Organisational Factors Affecting Knowledge Retention in a Public Organisation

Joshua Ishaku Azaki and Ulrike Rivett
iCOMMS Research Team, Department of Information Systems, University of Cape Town, South Africa
azakij@gmail.com
ulrike.rivett@uct.ac.za

Abstract: Knowledge is a strategic resource for any organisation to maintain optimal operational efficiency and competitiveness. Knowledge could be in the knower's mind (tacit) or codified and stored in knowledge repositories for retrieval when needed (explicit). Knowledge retention in organisations is becoming a global concern as the shortage of professionals or knowledge workers persists. Organisations over the years have focused on investing in activities leading to knowledge creation, improving technological capabilities, and increasing performance with less attention given to knowledge retention. The Covid-19 pandemic has exacerbated this concern leading to the exit of more knowledge workers from organisations voluntarily or involuntarily. The current study seeks to investigate the role of organisational factors on knowledge retention in public organisations using the water sector in a South African metropolitan city. This study seeks to deepen the knowledge management scholarship by viewing knowledge retention as a system rather than a process or strategy only, as explored by most studies. The water sector is a knowledge-driven sector that utilises heterogeneous knowledge (engineers, hydrologists, technicians, IT specialists) to achieve its mandate, making it information and knowledge-rich. This study intends to use the knowledge-based view as a sensitising lens to explore how a public organisation systemically integrates and coordinates its heterogeneous knowledge resources to ensure that knowledge is retained as well as maintain optimal operational efficiency. The basic assumptions of the knowledge base view are that knowledge is the most strategic resource in an organisation, and its coordination facilitates optimised efficiency. The study will adopt a pragmatist paradigm to uncover the role of organisational factors on knowledge retention. A purposive sample of supervisors and managers in the water sector will be interviewed. Qualitative data will be collected, and qualitative methods will be used to analyse the data.

Keywords: knowledge retention, knowledge management, organisational factors, knowledge-based view, public organisation

1. Introduction

Knowledge retention in organisations is fast becoming a global concern as shortage of professionals or knowledge workers persist (Sumbal *et al.*, 2018; Levallet and Chan, 2019). Knowledge is a strategic resource for organisations to achieve their mandate in the current knowledge driven economy. As a matter of priority, organisations make investments (time and finances) in their knowledge workers for a high-level operational efficiency (Robert M. Grant, 1996; Levy, 2011). Consequently, the departure of knowledge workers voluntarily or involuntarily can lead to knowledge loss, decreased revenue and poor operational efficiency of such organisation (Martins and Meyer, 2012; Lin, Chang and Tsai, 2016). To mitigate these potential adverse effects, knowledge retention is critical. Organisations over the years have focused on investing in activities leading to knowledge creation, improving technological capabilities, and increasing performance with less attention given to knowledge retention (Sumbal *et al.*, 2018). Recently studies on knowledge retention have received traction and have examined knowledge retention phases, the effect of knowledge retention, mitigating knowledge loss due to employee exit (Lin, Chang and Tsai, 2016; Levallet and Chan, 2019). Fewer studies exist showing the role of organisational factors on knowledge retention. This study is designed to fill this gap and provide an in-depth understanding about the role of organisational factors on knowledge retention in a public organisation using a South African metropolitan department of water and sanitation (water sector hereafter) as a case.

The main research question this study seek to answer is How do organisational factors affect knowledge retention in a South African water sector? The main objective is to understand the dynamic roles of organisational factors on knowledge retention in a South African water sector. Other objectives are (i) to identify the strategies used by the water sector to retain knowledge as an organisation, (ii) to identify the predominant organisational factors that facilitate knowledge retention process in the water sector, and (iii) to explain the role of information communication technologies in knowledge retention in the water sector.

The rest of the paper is organised in the following order: the next section presents the literature review, section three highlights the theoretical consideration for this study. Section four and five outline the proposed research methodology and the potential contribution of this study.

2. Literature review

2.1 Overview of Knowledge Management

Knowledge management (KM) is a process that systematically facilitate generating, organising, sharing, and applying knowledge to achieve a set of goals in an organisation (Alavi and Leidner, 2001; Jasimuddin, 2006). It is an aspect of strategic Information Systems (Jasimuddin, 2006). One of the core purpose of KM is to retain knowledge within an organisation which mitigates the undesirable effects of the exit of a knowledge worker and subsequent knowledge loss (Levy, 2011; Lin, Chang and Tsai, 2016). A knowledge worker is a custodian of organisational knowledge which is considered to be an asset comprising of individuals' skills, experiences, values, and norms (von Krogh, Nonaka and Rechsteiner, 2011). Knowledge can either be tacit (in the mind) or explicit (codified and stored in repositories) (Alavi and Leidner, 2001). Knowledge management was developed as a strategy to benefit private organisations to maintain competitiveness but it has also become pertinent for public organisations to enhance their operational efficiency (Moollan, 2004; Massaro, Dumay and Garlatti, 2015; Pee and Kankanhalli, 2016). This study primarily focuses on management of tacit knowledge, however, not limited to it.

2.2 Knowledge Management in Public Organisations

It has been shown in the literature that a systematic application of KM is scarce in public sector organisations and where traces are found, they are either in isolation, not coordinated, informal, undocumented or rarely communicated (Moollan, 2004; Ndiege and Wamuyu, 2019; Ncoyini and Cilliers, 2020). This situation is further aggravated by the general lack of institutional policy and frameworks to support knowledge management in the public sector (Ndiege and Wamuyu, 2019). The prevalence of the described complexity makes the public organisation lose much of its knowledge competencies, especially that it is the largest employer of labour and majority of its functional knowledge is tacit (MacGillivray, 2018; Sandelin, Hukka and Katko, 2019; Suresh, Renukappa and Kamunda, 2019).

In public organisations knowledge is managed contextually (Mc Evoy, Ragab and Arisha, 2019). For example, the water sector manages knowledge differently from an educational sector (Lin, Chang and Tsai, 2016; Sandelin, Hukka and Katko, 2019). Some factors that differentiate organisations are the presence or absence of information systems, the difference in organisational culture and structure among others (Lin, Chang and Tsai, 2016; MacGillivray, 2018; Sandelin, Hukka and Katko, 2019). Agarwal & Marouf (2014) opined that people, technology, culture, and process are four basic resources necessary for effective KM. The impact of these factors on KM also differ geographically (Ashok *et al.*, 2021). The importance of investigating more public organisations to enrich current understanding about the dynamics of KM such as knowledge retention to provide a robust scholarly discussion is argued for in the literature (Pee and Kankanhalli, 2016; Mbhalati, 2017; Ashok *et al.*, 2021).

2.3 Knowledge Retention in Organisations

Knowledge retention entails identifying, capturing and storing specific knowledge from the mind of a knowledge worker for use even when such worker is unavailable (Levy, 2011; Martins and Meyer, 2012; Levallet and Chan, 2019). Employee exit is mostly characterised by gaps in operation because employees leave with more than they know (Farooq, 2021). Studies are beginning to emerge exploring the dimensions of knowledge retention in relation to factors affecting it. For example, Raudeliūnienė, Davidavičienė, and Petrusevičius (2018) revealed five main factors affecting knowledge retention in the military to include organisational, knowledge content, human, technological and financial. Farooq (2021) showed that knowledge retention is less in organisations with a complex organisational structure. Bairi, Manohar, and Kundu (2011) examined why IT based organisations implement knowledge retention. Other scholars highlight the complexity of retaining knowledge within an organisation to be associated to lack awareness about the consequences of losing knowledge by management intentionally or unintentionally, thereby leading to difficulty in persuading them to see the benefit of embarking on knowledge retention initiatives (Levy, 2011; Levallet and Chan, 2019).

Understanding an organisation's structure is one of the factors considered important in managing and retaining knowledge. Organisational structure defines the role and duties of individuals as well as the direction of information flow across different tiers of management within an organisation (Farooq, 2021). The organisational

structure in public organisations has been characterised by a complex intersection of human and cultural elements, negative attitude toward change, lack of appreciation of personal contributions, rigid bureaucratic relationship where most times employees only receive directives and are rarely given chances to make input to daily organisational operations (Nonaka, 1994; Moollan, 2004; Mbhalati, 2017; MacGillivray, 2018; Farooq, 2021). MacGillivray (2018) noted that managers in public organisations increasingly face the challenge of managing employees with diverse sociocultural experience and understanding. It is, therefore, important that managers understand the nature of their organizations to manage and retain the knowledge effectively (Farooq, 2021). Since organisational structure sets the boundaries of employee duties, it suggests that it influences the cultural setting of an organisation.

Culture refers to the basic assumptions guiding an organisation and is expressed explicitly through organisational handbooks and implicitly in the daily activities or routines of employees (Nonaka, 1994). Ineffective organisational routines and standard operating procedure leads to knowledge loss (Daghfous, Belkhodja and Angell, 2013). In many instances, a standard operating procedure serves as a backup for organisations to move on when an employee exit, however, they are missing or not properly implemented (Daghfous, Belkhodja and Angell, 2013; Farooq, 2021) in public organisations. Culture contributes to the way information and knowledge are processed within organisations (Ashok *et al.*, 2021), thereby affecting knowledge retention in an organisation. Furthermore, an organisation whose culture does not support the use of information and communication technologies (ICTs) to facilitate KM potentially increases the risks of knowledge loss (Zhang and Venkatesh, 2017; Levallet and Chan, 2019).

Organisations invest some much resources in acquiring ICTs and the requisite skills for maintaining them (Sumbal *et al.*, 2018). ICTs have been used to enhance KM activities such knowledge storage, transfer, and sharing (Bairi, Manohar and Kundu, 2011; Levallet and Chan, 2016; Zhang and Venkatesh, 2017; Zimmermann *et al.*, 2018). Zhang and Venkatesh (2017) found that ICTs used in knowledge sharing improved job satisfaction and performance. Zimmermann et al. (2018) showed that communication was the core use of ICTs in knowledge sharing. ICTs in themselves are necessary but not sufficient in themselves to driving operational efficiency, therefore, ICTs serve as complimentary tools for achieving efficiency (Pee and Kankanhalli, 2016). Interestingly, the use of ICTs in knowledge retention was found to lead to unintentional loss of knowledge (Levallet and Chan, 2016). They Levallet and Chan (2016) explained that while trying to retain knowledge in accessed controlled repositories in a public organisation, knowledge can be lost. This loss occurs because knowledge sits in repositories and is inaccessible by workers who potentially stand to benefit from accessing it. The inability to access such knowledge makes such knowledge unusable as long as those who need it are unable to access it and thus lead to knowledge loss. They further explained that the lack of unified formatting procedure to store knowledge, lack of transparency in knowledge storage which leads to siloed storage contribute to knowledge loss. They refer to this phenomenon as the "paradoxical role of IT". It remains unclear how organisations engage ICTs such that knowledge is continually accessed by other knowledge workers when a knowledge worker exits an organisation especially in the public organisations.

2.4 The Current Study

The water sector in South Africa is mainly run by the government of South Africa (National Government) under the Department of Water and Sanitation (DWS) (Department of Water and Sanitation, 2020). The Department of Water and Sanitation has the constitutional responsibility of managing the water and sanitation needs of South Africa (Department of Water and Sanitation, 2020). Municipalities in the country are responsible for providing water related services to the citizens (Amoako, 2019). Like other countries 70-95% of its functional knowledge is tacit (Sandelin, Hukka and Katko, 2019; Department of Water and Sanitation, 2020). Phaladi (2011) investigated knowledge transfer and retention in a South African public water utility focusing on retirees, suggested that an accurate diagnosis of organisational culture, structure and leadership will go a long way towards cultivating a knowledge sharing culture. Moollan (2004) recommended further studies to investigate the KM system of a municipal's water sector. To the researcher's knowledge, this gap still exists and the knowledge-based view (Robert M. Grant, 1996) will be used as a fundamental theoretical lens to guide this study.

3. Theoretical Consideration

3.1 Knowledge-Based View (KBV)

Knowledge-based view is an organisational theory with an underlying assumption that knowledge is the most strategic resource an organisation can leverage for achieving efficiency and competitiveness (Robert M Grant, 1996; Robert M. Grant, 1996). It emphasises that without knowledge other resources in an organisation cannot be developed such that efficiency and competitiveness are optimised. Efficiency and competitiveness are only achieved when knowledge is integrated and coordinated appropriately within an organisation (Robert M Grant, 1996; Robert M. Grant, 1996). At the core of KBV is the efficient integration of knowledge within an organisation (Robert M. Grant, 1996). Since public organisations are not profit driven, but efficient driven (Ashok *et al.*, 2021), the KBV suits this study. The aspects of the KBV applicable to this study includes coordination within an organisation, organisational structure, and the role of management.

3.2 Concepts of the KBV and its relation to the Current Study

3.2.1 Coordination within the Firm

One of the assumptions of KBV is the existence of heterogeneity of specialised knowledge such as is found in professionals needed for the achievement of organisational goals, what Robert M. Grant (1996) refers to as "production" (Robert M Grant, 1996; Robert M. Grant, 1996). The author argues that the gain from specialised knowledge is at the core of having a blend of specialised knowledge in an organisation (Robert M Grant, 1996). Robert M. Grant (1996) further argues that organisational theories lack rigour in examining the coordination of specialised knowledge hence the peculiarity of this aspect of organisational operations. Coordination within an organisation is hinged on the mechanisms that enable knowledge integration for production. This follows organisational routines, standard procedures and so on in executing individual and specialised knowledge activities that lead to delivering the desired product or service (Robert M Grant, 1996; Daghfous, Belkhodja and Linda, 2013); service in this study because the water sector provides services. The routines, for example, are embedded in the organisational culture. If there are hierarchical ways (best practices) of performing a task in the water sector, this could facilitate knowledge retention. The hierarchy in this context is not authority-based but process-based (Robert M Grant, 1996). For example, if there is a leakage in an area that needed to be fixed, who will be the first point of call to address the leakage – hydrologist, engineer, or technician? Such routines as well could be affected were an employee exits and no one or some documents show how things get done (Daghfous, Belkhodja and Linda, 2013). Knowledge integration is facilitated by "*(i) The efficiency of integration – the extent to which the capability accesses and utilises the specialist knowledge held by individual organizational members; (ii) by the scope of integration – the breadth of specialized knowledge the organizational capability draws upon; (iii) the flexibility of integration – the extent to which a capability can access additional knowledge and reconfigure existing knowledge*" (Grant, 1996a p.380). The coordination within an organisation is not limited to the knowledge integration found in routines but to the type of cultural setting operational in an organisation. There are several dimensions to culture and its implications to coordination such that knowledge is retained.

3.2.2 Organizational Structure

Another assumption of the KBV is that organisations exit to integrate heterogenous knowledge, implying that the hierarchy and decision-making rights reside in the organisational structure. Hierarchy in organisational structure is authority-based (Robert M. Grant, 1996). Organisational structures that are more bureaucratic achieve knowledge integration through rules and directives. In a typical bureaucratically structured organisation, rules and directives flow downwards from the top (Robert M. Grant, 1996; MacGillivray, 2018) but this notion should not be what drives a knowledge base organisation (Robert M. Grant, 1996). For knowledge-based organisations, "*rules and directives exist to facilitate knowledge integration*" (Grant, 1996b p.118). Grant (1996b p.118) further states that: "*knowledge-based view suggests that, to the extent that 'higher-level decisions' are dependent upon immobile 'lower-level' knowledge, hierarchy impoverishes the quality of higher-level decisions*". This implies that the higher-level decision makers are incapacitated in their ability to deliver if they do not have a requisite specialised knowledge required to perform a task. For example, the leak example, if a manager or a team lead requires several specialists to fix the leak and there is shortage of specialists, the quality of decision made by the manager or team lead may be impoverished especially if such shortage is persistent. The implications of organisational structure could be examined vertically (top-down) and horizontal (intra and inter team relationship) (Robert M. Grant, 1996).

3.2.3 Distribution of decision-making rights

In terms of the distribution of decision making rights in managing knowledge within an organisation, there are two implications "decision rights and ownership" and "co-location of decision making and knowledge" (Robert M. Grant, 1996). The former is concerned with the autonomy of knowledge by the owner and its terms of usage within an organisation (Robert M. Grant, 1996; Zhang and Venkatesh, 2017). As an employee, organisations contract such knowledge to use and do not own the knowledge as they would other physical or financial assets (Robert M. Grant, 1996). In this study, the government is the custodian/owns the organisation and operate it according to government guidelines and policy guiding public organisations. When employees are accorded autonomy to their knowledge and incentivised, there is likelihood of encouraging activities that will retain knowledge (Zhang and Venkatesh, 2017; Amoako, 2019). The water sector may be slacking in the practise of balancing between ownership and decision rights as found by Amoako (2019). The co-location of decision making, and knowledge is concerned with the types of decisions and knowledge that are centralised and decentralised within an organisation. For example, quantifiable knowledge (explicit) can be accessed centrally while tacit knowledge like investment appraisal, should be decentralised (Robert M. Grant, 1996).

In summary, the KBV focuses on the internal operations of an organisation rather than external placement of the organisation. It assumes that the efficient integration of the knowledge resources in an organisation can affect the external outlook of an organisation. This integration is achieved through the coordination of an organisation, organisational structure, and distribution of decision-making rights. This theoretical consideration shall guide this study.

4. Research Methodology

The choice of philosophical assumptions, research methods adopted for this research and their justifications are presented in this section.

4.1 Research Philosophy

The concept of research philosophy is fundamental for Information Systems (IS) research because it impacts how a researcher (i) understand the research questions, (ii) chooses the methods to implement in the research, (iii) interpret findings and (iv) presents the knowledge developed from the research to the scientific community (Gregor, 2006; Blaikie and Priest, 2017). The two philosophical standpoints broadly known for scientific research are ontology and epistemology (Blaikie and Priest, 2017).

Ontology is the study of the nature of reality, while epistemology refers to the way knowledge is created, in other words, how new knowledge is legitimised. The ontology and epistemology adopted for this research is pragmatist (Goldkuhl, 2004; Blaikie and Priest, 2017). Pragmatism has been considered suitable to provide explanation to improve both research and practice in the IS domain (Goldkuhl, 2004). Applying pragmatism to this research allows me to use the most suitable way of collecting and analysing data – quantitatively, qualitatively or both as well as approach – inductive, deductive, abductive or retroductive (Blaikie and Priest, 2017). In making sense of data, pragmatism seeks to make interpretations of findings beyond theoretical value to include more importantly practical value; implying that actions lie at the core of pragmatism (Goldkuhl, 2004). In this study, the concept of knowledge retention will be approached as such. The findings from this study does not aim to only satisfy the theoretical discourse but practical implications of the identified organisational factors on knowledge retention. Applying pragmatism in my opinion suits this study more so because the water sector is a practical than theoretical organisation. Notwithstanding, rapt attention will be given to the theoretical values this research can leverage on.

4.2 Research Methods

This section highlights the research methods I intend to use in generating empirical data to answer the research questions; these steps include the research purpose, the choice of research strategy, data collection and data analysis as well as sampling technique.

The purpose of the research is exploratory and explanatory. It is exploratory because knowledge retention is gaining traction in the KM literature. The involvement of different hierarchy/categories of participants (see participants sampling in the next section) is further expected to enrich the exploratory aspect of this (Voss, Tsikriktsis and Frohlich, 2002). The study is explanatory because it seeks to explain the role of organisational factors in knowledge retention in a public organisation. The research strategy considered for this study is a single case study using a South African's municipal water sector. A single case study with different units of analysis is

appropriate for this study as it seeks to generate an in-depth understanding of how knowledge retention is understood and approached in a public organisation (Voss, Tsikriktsis and Frohlich, 2002; Yin, 2015). Furthermore, since the study seeks quality than quantity, the case study strategy suits this goal.

The primary data collection method adopted for this study will be the qualitative method. Qualitative data will be collected using semi-structured interviews. The interview questions will thoroughly be developed using the Information Systems, organisational management and qualitative research literature as guide (Voss, Tsikriktsis and Frohlich, 2002; Goldkuhl, 2004; Yin, 2015). The interview will be held either virtually using MS Teams or physically, depending on the preference of the interviewees and the corresponding COVID-19 protocols in place at the time of the interview. The interview responses will be recorded, transcribed and analysed thematically consistent with the qualitative data analysis procedure such as compiling, disassembling, reassembling, interpreting and drawing conclusions (Yin, 2015). The data analysis will guide in identifying the predominant organisational factors that affect knowledge retention. Other data sources include literature and documents from the South African metropolitan water sector. I will be using a purposive sample of managers and team supervisors in the water sector. Purposive sampling is a non-probabilistic technique that allows a researcher to have criteria for selecting research participants (Voss, Tsikriktsis and Frohlich, 2002). For this research, criteria such as length of service, area of specialisation and specialised department will be considered in determining the research participants as suggested by the literature (Voss, Tsikriktsis and Frohlich, 2002; Yin, 2015). The listed criteria has been identified in the literature to increase the richness and integrity of data collected in research (Voss, Tsikriktsis and Frohlich, 2002). The findings from this study does not seek generalizability because the context within which this study will be conducted completely differs from other public organisations.

4.3 Ethical Considerations

The primary consideration for this research is gaining ethical clearance to collect date in the selected South African metropolitan municipality. Due process will be followed to gain ethical clearance from the University and the water sector. An important ethical consideration is conflict of interest where the research findings may turn out to be unfavourable to the organisation and the organisation becomes unwilling for such findings to be made public to the scientific community (Walsham, 2006). To mitigate this potential problem, the researcher intends to have a signed undertaking with the organisation before the commencement of data collection noting that the research findings would be reported and published. Other ethical considerations such as obtaining informed consent and ensuring the confidentiality, anonymity, and dignity of research participants will be secured (Cilliers and Viljoen, 2021).

5. Potential Contribution

5.1 Theoretical

Theoretically, this research will

1. Contribute to scholarly discussion about i) KM in general, and ii) knowledge retention specifically, in Information Systems.
2. Provide a multilevel theorising (team and organisational level) about KM in a public organisation.
3. Contribute to the understanding and application of the KBV in information systems discipline.

5.2 Practical

This research will identify the predominant organisational factors that affect knowledge retention in the water sector in a South African metropolitan municipality. The evidence from this study can assist in strategising the water sector's knowledge needs such that its operational efficiency remains optimal even when an employee leaves. The research will further provide insights to the concerns raised in the DWS report in 2020 and guide policy formulation and implementation on knowledge retention.

References

Agarwal, N.K. and Marouf, L.N. (2014) 'Initiating Knowledge Management in Colleges and Universities: A template', *International Journal of Knowledge Content Development & Technology*, 4(2), p. 95. doi:10.5865/IJKCT.2014.4.2.067.

Alavi, M. and Leidner, D.E. (2001) 'Review: Knowledge Management and Conceptual Foundations and Knowledge Management Systems: Research Issues', *MIS Quarterly*, 25(1), pp. 107–136.

Amoako, G.N.. (2019) *Development of A Success Model for Water Management Information Systems*. University of Cape Town.

Ashok, M. *et al.* (2021) 'How to Counter Organisational Inertia to Enable Knowledge Management Practices Adoption in Public Sector Organisations', *Journal of Knowledge Management* [Preprint]. doi:10.1108/JKM-09-2020-0700.

Bairi, J., Manohar, M.B. and Kundu, K.G. (2011) 'Knowledge Retention in the IT Service Industry', *Journal of Systems and Information Technology*, 13(1), pp. 43–65. doi:10.1108/13287261111118340.
Blaikie, N. and Priest, J. (2017) *Social Research: Paradigms in Action*. 1st edn. Cambridge: Polity Press.
Cilliers, L. and Viljoen, K. (2021) 'A framework of ethical issues to consider when conducting internet-based research', *South African Journal of Information Management*, 23(1), p. a1215. doi:10.4102/sajim.
Daghfous, A., Belkhodja, O. and Angell, L.C. (2013) 'Understanding and managing knowledge loss', *Journal of Knowledge Management*, 17(5), pp. 639–660. doi:10.1108/JKM-12-2012-0394.
Daghfous, A., Belkhodja, O. and Linda, C.A. (2013) 'Understanding and managing knowledge loss', *Journal of Knowledge Management*, 17(5), pp. 639–660. doi:10.1108/JKM-12-2012-0394.
Department of Water and Sanitation (2020) *Annual Report 2019/20*. RP81/2021. Pretoria.
Farooq, R. (2021) 'Employee exit and its relationship with multidimensional knowledge retention: the moderating role of organizational structure', *VINE Journal of Information and Knowledge Management Systems* [Preprint]. doi:10.1108/VJIKMS-06-2021-0093.
Goldkuhl, G. (2004) 'Meanings of Pragmatism : Ways to conduct information systems research', *International Business*, pp. 13–26.
Grant, Robert M (1996) 'Prospering in Dynamically-Competitive Environments: Organizational Capability as Knowledge Integration', *Organization Science*, 7(4), pp. 375–387.
Grant, Robert M. (1996) 'Toward a Knowledge-based Theory of the Firm', *Strategic Management Journal*, 17, pp. 109–122. doi:10.1002/smj.4250171110.
Gregor, S. (2006) 'The Nature of Theory in Information Systems', *MIS Quarterly*, 30(3), pp. 611–642.
Jasimuddin, S.M. (2006) 'Disciplinary Roots of Knowledge Management: A Theoretical Review', *International Journal of Organizational Analysis*, 14(2), pp. 171–180. doi:10.1108/10553180610742782.
von Krogh, G., Nonaka, I. and Rechsteiner, L. (2011) 'Leadership in Organizational Knowledge Creation: A Review and Framework', *Journal of Management Studies*, 49(1), pp. 240–277. doi:10.1111/j.1467-6486.2010.00978.x.
Levallet, N. and Chan, Y.E. (2016) 'Knowledge Loss and Retention: The Paradoxical Role of IT', in Liebowitz, J. (ed.) *Successes and Failures of Knowledge Management*, pp. 97–111.
Levallet, N. and Chan, Y.E. (2019) 'Organizational Knowledge Retention and Knowledge Loss', *Journal of Knowledge Management*, 23(1), pp. 176–199. doi:10.1108/JKM-08-2017-0358.
Levy, M. (2011) 'Knowledge retention: Minimizing organizational business loss', *Journal of Knowledge Management*, 15(4), pp. 582–600. doi:10.1108/13673271111151974.
Lin, T.-C., Chang, C.L. and Tsai, W.-C. (2016) 'The Influences of Knowledge Loss and Knowledge Retention Mechanisms on the Absorptive Capacity and Performance of a MIS Department', *Management Decision*, 54(7), pp. 1757–1787. doi:10.1108/MD-02-2016-0117.
MacGillivray, A.E. (2018) 'Leadership as Practice meets Knowledge as Flow: Emerging Perspectives for Leaders in Knowledge-Intensive Organizations', *Journal of Public Affairs*, 18, p. e1699. doi:10.1002/pa.1699.
Martins, E.C. and Meyer, H.W.J. (2012) 'Organizational and Behavioral Factors that Influence Knowledge Retention', *Journal of Knowledge Management*, 16(1), pp. 77–96. doi:10.1108/13673271211198954.
Massaro, M., Dumay, J. and Garlatti, A. (2015) 'Public sector knowledge management: A structured literature review', *Journal of Knowledge Management*, 19(3), pp. 530–558. doi:10.1108/JKM-11-2014-0466.
Mbhalati, O.J. (2017) 'Reinventing the public sector in Africa through knowledge management', *Knowledge Management Research & Practice*, 12(1), pp. 114–121. doi:10.1057/KMRP.2013.5.
Mc Evoy, P.J., Ragab, M.A.F. and Arisha, A. (2019) 'The effectiveness of knowledge management in the public sector', *Knowledge Management Research and Practice*, 17(1), pp. 39–51. doi:10.1080/14778238.2018.1538670.
Moollan, R.W. (2004) 'A Framework for the Assessment of Knowledge Management That Can Be Applied in the Water Services Industry', in *Water Institute of Southern Africa (WISA) Biennial Conference*, pp. 770–779.
Ncoyini, S.S. and Cilliers, L. (2020) 'Factors that Influence Knowledge Management Systems to Improve Knowledge Transfer in Local Government: A Case Study of Buffalo City Metropolitan Municipality, Eastern Cape, South Africa', *SA Journal of Human Resource Management*, 18, pp. 1–11. doi:10.4102/sajhrm.v18i0.1147.
Ndiege, J.R.A. and Wamuyu, P.K. (2019) 'Knowledge Management Practices and Systems in County Governments in Developing Countries: Perspectives from selected Counties in Kenya', *VINE Journal of Information and Knowledge Management Systems*, 49(3), pp. 420–439. doi:10.1108/VJIKMS-01-2019-0014.
Nonaka, I. (1994) 'Dynamic Theory of Organizational Knowledge Creation', *Organization Science*, 5(1), pp. 14–37.
Pee, L.G. and Kankanhalli, A. (2016) 'Interactions among Factors Influencing Knowledge Management in Public-Sector Organizations: A Resource-Based View', *Government Information Quarterly*, 33, pp. 188–199. doi:10.1016/j.giq.2015.06.002.
Phaladi, M.P. (2011) *Knowledge Transfer and Retention: The Case of a Public Water Utility in South Africa*. Stellenbosch University.
Raudeliūnienė, J., Davidavičienė, V. and Petrusevičius, R. (2018) 'Factors influencing knowledge retention process: case of Lithuanian armed forces', *Technological and Economic Development of Economy*, 24(3), pp. 1104–1124. doi:10.3846/20294913.2017.1309598.
Sandelin, S.K., Hukka, J.J. and Katko, T.S. (2019) 'Importance of Knowledge Management at Water Utilities', *Public Works Management and Policy*, pp. 1–17. doi:10.1177/1087724X19870813.

Sumbal, M.S. *et al.* (2018) 'Critical areas of knowledge loss when employees leave in the oil and gas industry', *Journal of Knowledge Management*, 22(7), pp. 1573–1590. doi:10.1108/JKM-08-2017-0373.

Suresh, S., Renukappa, S. and Kamunda, A. (2019) 'Building Information Modelling in the Framework of Knowledge Management: A Water Industry Case Study', in *ACM International Conference Proceeding Series*. Houston,: ACM Press, pp. 234–240. doi:10.1145/3325917.3325958.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002) 'Case research in operations management', *International Journal of Operations & Production Management*, 22(2), pp. 144–3577. doi:10.1108/01443570210414329.

Walsham, G. (2006) 'Doing Interpretive Research', *European Journal of Information Systems*, 15(3), pp. 320–330. doi:10.1057/palgrave.ejis.3000589.

Yin, R.K. (2015) *Qualitative research from start to finish*. 2nd edn. New York, London: The Guilford Press.

Zhang, X. and Venkatesh, V. (2017) 'A Nomological Network of Knowledge Management System Use: Antecedents and Consequences', *MIS Quarterly*, 41(4), pp. 1275–1306.

Zimmermann, A. *et al.* (2018) 'Sourcing In or Out: Implications for Social Capital and Knowledge Sharing', *Journal of Strategic Information Systems*, 27(1), pp. 82–100. doi:10.1016/j.jsis.2017.05.001.

Role of Knowledge Management in Small and Medium Enterprise Performance

Krishna Dixit and Satya Ranjan Acharya
Entrepreneurship Development Institute of India, Gujarat, India
Krishna06@ediindia.org
satya@ediindia.org

Abstract: Aim-The aim of this study is to bring a unified framework that integrates Knowledge Management Process (KMP), Innovation Capability(IC), Internal Social Capital(ISC), and Organizational Performance(OP) and empirically explore the framework in the context of SMEs. These small and medium enterprises are highly relevant because of their economic and social importance globally, as they constitute nearly 90% of all firms in OECD countries, 70% of jobs, and 50-60 % of value creation. Design/ methodology/ approach- The study addressed the CEO and managers of Small and medium enterprises with the help of a designed questionnaire. The study being exploratory in nature, and employs Partial Least Square-Structural equation modeling (PLS-SEM) using Smart PLS. Practical Implications- SMEs, compared to large firms' esp. in developing economies, require different strategies to sustain and perform in the long term. Therefore, it is imperative that these enterprises begin processing knowledge management for the sake of overall organizational performance. Originality/ Value- The existing research has explored the phenomenon in the context of large enterprises, and this study explored the comprehensive framework in SMEs. The study extends the previous literature by understanding the role of Internal Social Capital in enhancing organizational performance through the knowledge Management Process.

Keywords: Knowledge Management Processes, Innovation Capability, Internal Social Capital, Organizational performance

1. Introduction

Knowledge Management (KM) has received significant attention from both researchers and practitioners. They recognized the importance of managing knowledge in a knowledge-based economy. Researchers have confirmed the vital role of knowledge in the modern economy and creative industry, emphasizing the importance of knowledge as one of the primary resource of the modern economy(Manfredi Latilla *et al.*, 2018). Despite the significant time and financial commitment in state-of-art technology, it has been estimated that at least $31.5 billion are lost per year by Fortune 500 companies which is primarily because of the failure to manage and share Knowledge (Wang and Noe, 2010). Thus, knowledge is a vital resource for an organization that provides a sustainable competitive advantage in a competitive and dynamic economy(Grant, 1996; Spender and Grant, 1996; Wang and Noe, 2010).

Knowledge Management, in general, refers to the processes and practices conducted in a firm to unleash its intellectual potential by enhancing the effectiveness and efficiency of the management(Andreeva and Kianto, 2012). The collective knowledge within the organization helps to compete. However, in this highly competitive environment and diverse customer demand, KM no longer stands out as a sufficient factor to provide a competing edge against its rivals. The role of knowledge is still ambiguous(Liao, Fei, and Chen, 2007; Shahzad *et al.*, 2016). Some studies suggest innovation is a crucial driving factor in organizational performance(Huang and Li, 2009; Migdadi, 2020).

Innovation is an extensive term that includes different types of innovation and stages of the innovation process(Gopalakrishnan and Damanpour, 1997). Innovation can also be regarded as organizational capability as it deploys resources with a new ability to create value(Yang and Wan, 2004; Saunila, 2016). Therefore, innovation capability is vital for firms, especially small organizations, for survival and sustained growth in the long term(Liao, Fei, Chen, 2007; Le and Lei, 2017). Innovation capability has been regarded as a multi-dimensional construct that includes innovative output in the form of products, services, managerial practices, and marketing strategies(Weerawardena, 2003; Popadiuk and Choo, 2006; Andreeva and Kianto, 2012; Ritala *et al.*, 2015).

Several studies asserts that KMP do not directly influence Organizational Performance(López-Nicolás and Meroño-Cerdán, 2011; Migdadi, 2020). There are other mediating and moderating variables that impact the KMP and OP. However, according to Z. Wang et al.(2016 a, b), the existing body of literature is almost silent about the role of mediators and moderators in KMP and OP. Though, firms' intellectual aspect needs to focus on three main areas: intangible assets(Knowledge), the firm's competencies and capabilities(innovation

capability), and the social environment in which knowledge processes occur(Martínez-Cañas, Sáez-Martínez, and Ruiz-Palomino, 2012).

The social environment plays a key role as innovation is not a discrete event but a result of interactions among the knowledge possessed by diverse actors within the organization's boundaries (Hansson et al., 2005). Nahapiet & Ghoshal (1998) defines Internal Social capital as ''the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit''. Thus, social capital is a resource and factor that provide access to resources. Hence, researchers emphasize the significance of social capital dimensions for innovation (Zheng, 2008).

Many studies in the past have explored the several dimensions of social capital in the domain of knowledge sharing and creation(Mcfadyen and Cannella, 2004; Hansen, Mors, and Løvås, 2005; Reinholt, Pedersen, Foss, 2011; Tsai and Cheng, 2012; Xiang, Lu and Gupta, 2013; Migdadi, 2020; Gubbins and Dooley, 2021). However, very few have talked about its role in the context of SMEs, especially in developing economies. This study will explore the quest of the past researchers by incorporating all three dimensions of the internal social capital in the context of Indian SMEs.

This phenomenon is well explored in large organizations, and scholars argue that small and medium enterprises could not manage knowledge because of various organizational constraints(CN Wee and Y.K. Chua, 2013; Sartori *et al.*, 2020). Most SMEs include no explicit policy aimed at strategic KM and keep KM at an operational level (e.g., level of systems and instruments). Social interactions in SMEs are more frequently observed in inter-firm as compared to intra-firms. Knowledge Creation within these small firms is unconventional, and sharing of tacit knowledge is found to be less formal and systematic as compared to large firms. (McAdam and Reid, 2001; Tunc Bozbura, 2007; Hutchinson and Quintas, 2008; Andreeva and Kianto, 2012; CN Wee and Y.K. Chua, 2013; Sartori *et al.*, 2020).

These small and medium enterprises are highly relevant because of their economic and social importance globally, as they constitute nearly 90% of all firms in OECD countries, 70% of jobs, and 50-60 % of value creation. If an informal business is considered, it can account for up to 50% of GDP(OECD, 2019). Hence, this study will attempt to understand the role of KMP, IC, and SC on SMEs' performance, especially in the Indian context. SMEs in India have a significant contribution to local production and export. These enterprises are generating nearly 80 million employment opportunities with 36 million units. They add nearly 8% to GDP and 40% to Indian exports. The share of manufacturing MSMEs is around 31%, and service MSME includes nearly 33% (MSME Annual Report, 2020-21).

Based on the gap identified in previous research, this study wants to explore the relationship between the Knowledge management Process, Innovation Capability, and Internal Social Capital in SMEs Performance. Few studies have discussed this phenomenon in the SME context, especially in developing economies. Thus this research is an addition to the existing literature on Knowledge management and SMEs Performance.

1.1 Research Questions

What is the impact of Knowledge Management on Innovation capability?
What is the impact of Knowledge Management on SMEs' Performance?
Do Innovation capability in SMEs enhances the positive effect of knowledge Management and SMEs Performance?
Does Social Capital moderates the relationship between Knowledge Management and SMEs Performance?

1.2 Research Objective

1. To understand the impact of Knowledge Management on Innovation Capability.
2. To understand the impact of Knowledge management on SMEs performance.
3. To understand the role of Innovation Capability between KMP and SMEs performance.
4. To understand the role of Social Capital as a moderator between the Knowledge Management Process (Knowledge Creation & Sharing) and SMEs' Performance.

2. Literature Review & Hypothesis

2.1 Knowledge Management and Innovation Capability

Based on the Knowledge-based View, Several academicians have connected knowledge as a resource for innovation and claimed that these resources determine an organization's capability for innovation.(Gopalakrishnan and Damanpour, 1997; Darroch and McNaughton, 2001; Darroch, 2003; Ben Zaied, Louati and Affes, 2015; Migdadi, 2020). Several studies have revealed that, in general, Knowledge Management processes (Al-Sa'di, Abdallah and Dahiyat, 2017; Migdadi, 2020)- such as Knowledge creation and sharing (Le and Lei, 2017; Bereznoy, Meissner and Scuotto, 2021; Gubbins and Dooley, 2021), Knowledge sharing, application and storage (Lee *et al.*, 2013), and Knowledge creation, documentation and storage, sharing, and acquisition (Andreeva and Kianto, 2012; Migdadi, 2020)- have positive impacts on firm's Innovation performance. Hence, based on past research, the following is the first hypothesis:
H1: Knowledge Management Processes have a significant positive influence on Innovation capability.

In the following each section we will explore each KMP sub-dimension and how it impact the innovation capabilities leading to the hypothesis.

2.1.1 Knowledge Creation and Innovation capability.

Knowledge Creation is defined as a process that involves tacit and explicit knowledge. Tacit is closely related to "knowledge exploration- the pursuit of new knowledge, of things that might come to be known. While explicit involve with knowledge exploitation- the use and development of things already known(Levinthal and March 1993)". Several studies predict with empirical validation that Knowledge creation positively impacts innovation and improves performance (Laeeque and Babar, 2017; Santos *et al.*, 2021). Empirical research emphasizes the positive relation between Knowledge creation and product and process innovation(Smith, Collins and Clark, 2005), product and market performance (Lai *et al.*, 2014), and organization innovation performance(Andreeva & Kianto, 2012; Ben Zaied et al., 2015; Ngah et al., 2016). Hence, we present the sub-hypothesis:
H1.1 There is positive impact of Knowledge creation on IC.

2.1.2 Knowledge Sharing and Innovation Capability

"Knowledge sharing process can be defined as the process through which employees mutually exchange knowledge and jointly create new knowledge" (Van den Hooff and de Leeuw van Weenen, 2004; Van Den Hooff and De Ridder, 2004). A recent study conducted by Vătămănescu et al. (2020) on 102 European SMEs has found a significant positive impact of knowledge sharing, which enhances their innovative performance in emerging economies. While, Podrug et al. (2017) attempted to empirically distinguish the influence of individual, organizational, and technology factors on Knowledge sharing processes. Past studies suggest that employee willingness to donate and collect knowledge enables the firm to improve its innovation capability. (Van den Hooff and de Leeuw van Weenen, 2004; Lin, 2007; Saenz, Podrug, Filipović and Kovač, 2017; Ali *et al.*, 2019; Vătămănescu *et al.*, 2020; Bereznoy, Meissner and Scuotto, 2021; Gubbins and Dooley, 2021). Hence we introduce the following sub-hypothesis:
H1.2. There is positive impact of knowledge sharing on IC.

2.1.3 Knowledge Storage & Documentation and Innovation Capability

Organization performance is path-dependent. Past experience of individuals and success co-evolved. Walsh & Ungson (1991) offer a deeper insight into how former experiences of a company can affect its present decision-making. Gunsel et al. (2011) have found several studies assuming that organizational knowledge influences the innovation process. Hence, retrieving and manipulating the firm's experience is vital to avoid contingencies and exploit valuable old Knowledge (Rabeh, Jimenéz-Jimenéz, and Martínez-Costa, 2013). An organization's intellectual capital relies on the intelligence and creativity of its employees(Mumford, 2000). Therefore, I formulate the following sub-hypothesis:
H1.3. There is positive impact of knowledge storage and documentation on IC.

2.1.4 Knowledge acquisition and innovation capability.

Acquisition of Knowledge from external resources enables individuals to develop new and recreate the existing Knowledge (Chen and Huang, 2009). Several studies have investigated the KA and innovation relationship and conclude with the empirical investigation that KA enhances administrative and technical innovation (Chen and Huang, 2009), product/ service innovation (Dahiyat and Al–Zu'bi, 2012), product innovation(Al-Sa'di, Abdallah and Dahiyat, 2017), new product performance (Molina-Morales, García-Villaverde, and Parra-Requena, 2014).

Y. Liao & Barnes (2015) found the significant role of knowledge acquisition in SMEs. These firms are generally characterized as having a higher ability to respond faster to changing needs, which significantly impacts innovation. Therefore, I introduce the following sub-hypothesis:
H1.4. There is a positive impact of knowledge acquisition on IC

2.2 Knowledge management processes and organizational performance

Despite getting an edge in terms of physical and financial capital, the performance of SMEs is now dependent on managing the knowledge of owners and the employees of these small firms(Man, Lau, and Chan, 2002). Hence, to enhance organizational performance, knowledge management strategies must be incorporated. The literature review of KMP predicts a positive linkage between KMP and performance. A study by Li et al.(2018) attempted to study the knowledge creation models and innovation performance during complex product system development and found that knowledge internalization by practice (KIP) is the crucial mode of knowledge creation as well as for organization high-quality performance. As we know, performance is the product of the interaction of individuals with each other and an element affecting this interaction Doğan & Doğan (2020). In their study, Z. Wang et al. (2016) also empirically tested the relation between knowledge sharing and firm performance in 89 high-tech firms in China. The research found that explicit knowledge sharing significantly impacts innovation and firm performance while tacit KS has more impact on product quality and operational performance.

According to Obeso et al.(2020), past researchers attending the relationship between knowledge acquisition and firm performance have reported a positive association (Ali et al., 2019; Ahmed et al., 2015; Tubigi and Alshawi, 2015). The result of these studies has included many performance variables such as return on sales (ROS), return on assets(ROA), and return on equity (ROE)(Choi and Jong, 2010; Migdadi, 2020). Non-financial indicators include product quality, firm productivity, efficiency, and firm process effectiveness(De Pablos, 2002; Tsai and Cheng, 2012; Migdadi, 2020). Hence empirical research has indicated that KM significantly impacts organizational performance(Andreeva and Kianto, 2012; Sartori *et al.*, 2020). Hence, I introduce the hypothesis:
H2. There is positive impact of KMP on OP.
H2.1. There is positive impact of knowledge creation on OP.
H2.2. There is positive impact of knowledge sharing on OP.
H2.3. There is positive impact of knowledge storage and documentation on OP.
H2.4: There is positive impact of knowledge acquisition on OP.

2.3 The mediating role of innovation capability

Shujahat et al. (2018, 2019) highlight that the critical component of KBV is the effective management of knowledge resources which increases innovation, which in turn augments OP. This theoretical linkage suggests the mediating role of innovation between the relationship of KM and OP, as depicted in past studies. Nawaz et al. (2014) also found in their study that KM practices contribute to increased sales through new product development, adaptations, and improvement in innovation. Ruiz-Jiménez & del Mar Fuentes-Fuentes (2013) have found that product and process innovation mediated the relationship between knowledge capability and OP. However, Maldonado-Guzmán et al. (2019), in their research, state that a limited body of knowledge currently talks about the role of innovation in the context of SMEs as compared to the large firms and found mixed results in regards to the effect of innovation capabilities have on the business performance of SMEs.

Similarly, Saunila (2016) develops a framework for improving innovation capability through performance measurement in SMEs. Therefore, based on this discussion- in order to clarify how the relationship between KMP and Performance outcome works in SMEs - this study adopts IC as a mediator between KMP and OP. Hence, I introduce the following hypothesis:
H3. Innovation capability mediates the relationship between KMP and OP

2.4 Internal Social Capital as a moderator

Socialization is the process where individuals exchange and synthesize tacit knowledge, which is eventually externalized and contributes to the group's semantic memory. As defined by Adler and Kwon (2002), internal social capital is the structure and content of relationships among the actors within a system. Nahapiet & Ghoshal (1998) defines the three dimensions of Internal Social Capital: structural, cognitive, and relational. Structural dimension refers to the connections among actors-with whom and with what frequency they share information. Individuals learn how knowledge in use may differ from formal documented practice through storytelling, reflective dialogue, and collaborative discussions.

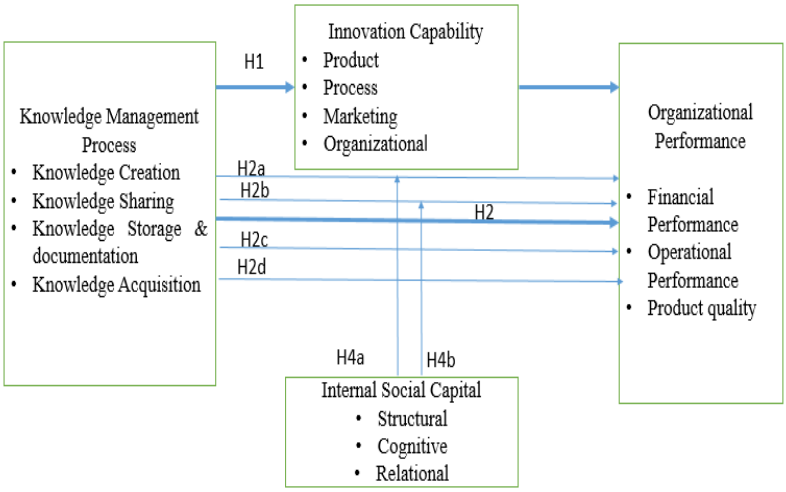
Second, the aspect of relational social capital defines the kinds of bonds that have established among people over the time through interactions. (Nahapiet and Ghoshal, 1998). Among its key attributes is the level of trust among actors(Nahapiet and Ghoshal, 1998; Leana and Pil, 2006; Claridge, 2018). Third dimension of social capital refers to the fact that as individuals interact with one another as part of a collective, they are better able to develop a standard set of goals and a shared vision for the organization—what Nahapiet and Ghoshal (1998) call the cognitive dimension of social capital.

Several authors in the past have recognized the role of coordination for the implementation of a new idea instead of a single individual. Hence, the conversion of tacit and explicit knowledge is a social process between individuals and is not confined to a single person (Popadiuk & Choo, 2006). Such coordination becomes significantly easier when individuals are connected through strong rather than weak ties (Hansen, 1999; Burt, 2001). Mura et al. (2013) also found in their empirical investigation that higher levels of perceived social capital increase the individual's propensity to translate knowledge sharing into active exploitation of knowledge. A recent study by I. Ali et al. (2018) also found a positive moderating role of social process between knowledge sharing and absorptive capacity as well as absorptive capacity and project performance. Hence based on these past discussions, I build the hypothesis:

H4a: Internal Social capital positively moderates the relationship between Knowledge Creation and organizational performance.

H4b: Internal Social Capital positively moderates the relationship between Knowledge sharing and Organizational Performance.

3. Conceptual Framework



4. Research methodology

4.1 Data collection and Sampling

Data collection will be done by the survey instrument in order to test the hypothesis of the study. The questionnaire will be distributed among the small and medium-sized firms (which include manufacturing and service sectors) in India. The study aims to cover the direct, telephonic interviews with the chief executive officer and managers of the Knowledge Intensive firms as defined by OECD with a minimum sample size of 218.

4.2 Questionnaire development and measurement

After developing the theoretical framework and, based on the review of related literature, I created an initial data collection instrument. Four professors of KM and management have reviewed the first version of the questionnaire for face validity. Their comments and suggestions regarding the questionnaire's items have been considered. Accordingly, revisions were made to eliminate ambiguities, inadequate wording, and hidden biases. KMP was measured based on the scales developed by Andreeva and Kianto (2011). All KMP (knowledge creation, sharing, storage and documentation, and acquisition) were measured through four items for each process. IC and OP were measured based on scales developed by Kafetzopoulos and Psomas (2015). Each of the IC dimensions (product, process, marketing, and organization innovation) is measured through four items. Also,

each of the OP dimensions (operational performance, financial performance, and product quality) is measured through four items. All scales used the five-point Likert scale with 5 to represent "strongly agree" and 1 to represent "strongly disagree ."The social capital scale of all three dimensions was adopted from Carr. et.al (2011).

4.3 Analytical methods

This study's research model is analyzed using a multivariate analysis technique, i.e., a partial least squares – Structural Equation Modeling (PLS-SEM). There are several reasons for choosing the suitability of this technique: the study is exploratory, the study is relatively small in the sample, the constructs in this study are both formative and reflective; the construct in this model involves considerable complexity concerning the type of relationships in the hypothesis, this study focus on the prediction of dependent variables(Richter *et al.*, 2016; Hair Jr *et al.*, 2021).

4.4 Control Variables

For this study, we have incorporated three control variables, firm size(Damanpour, 1992), Firm age(Eberhard and Craig, 2013), and industry classification(Damanpour,1992)can impact organizational performance.

4.5 Significance of the Study

This study represents one of few research projects in the innovation management field that operationalizes IC (four dimensions) and empirically explores its relationship with the three dimensions of OP in the SME context. The following way in which the present study contributes to the literature is that it examines relationships between KMP, organizations' IC, and their performance dimensions together in a single model. To the best of my limited knowldege based on the extensive review of the past research, this is also one of few empirical attempts at defining and confirming the causal path between "KMP," "IC," firms' "financial performance," "operational performance," and "product quality. This study finally extends the existing theoretical and practical knowledge of literature by including the role of internal social capital to understand the extent of Knowledge creation and sharing impact on the SME's Performance.

References

Alegre, J., Sengupta, K., and Lapiedra, R. (2013) 'Knowledge management and innovation performance in a high-tech SMEs industry', *International small business journal*, 31(4), pp. 454–470.

Ali, A. *et al.* (2019) 'Key factors influencing knowledge sharing practices and its relationship with organizational performance within the oil and gas industry, *Journal of Knowledge Management*, 23. doi:10.1108/JKM-06-2018-0394.

Ali, I., Musawir, A. and Ali, M. (2018) 'Impact of knowledge sharing and absorptive capacity on project performance: the moderating role of social processes, *Journal of Knowledge Management*, 22. doi:10.1108/JKM-10-2016-0449.

Al-Sa'di, A., Abdallah, A. and Dahiyat, S. (2017) 'The Mediating Roles of Product and Process Innovations on the Relationship between Knowledge Management and Operational Performance in Jordanian Companies', *Business Process Management Journal*, 23, pp. 349–376. doi:10.1108/BPMJ-03-2016-0047.

Andreeva, T. and Kianto, A. (2012) 'Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance, *Journal of Knowledge Management*. Edited by G. Schiuma, 16(4), pp. 617–636. doi:10.1108/13673271211246185.

Ben Zaied, R.M., Louati, H. and Affes, H. (2015) 'The Relationship Between Organizational Innovations, Internal Sources of Knowledge and Organizational Performance, *International Journal of Managing Value and Supply Chains*, 6(1), pp. 53–67. doi:10.5121/ijmvsc.2015.6105.

Bereznoy, A., Meissner, D. and Scuotto, V. (2021) 'The intertwining of knowledge sharing and creation in the digital platform-based ecosystem. A conceptual study on the lens of the open innovation approach, *Journal of Knowledge Management*, 25(8), pp. 2022–2042. doi:10.1108/JKM-10-2020-0769.

Choi, B. and Jong, A.M. (2010) 'Assessing the impact of knowledge management strategies announcements on the market value of firms', *Information & Management*, 47(1), pp. 42–52.

Claridge, T. (2018) 'Dimensions of Social Capital - structural, cognitive, and relational, p. 4.

CN Wee, J. and YK. Chua, A. (2013) 'The peculiarities of knowledge management processes in SMEs: the case of Singapore', *Journal of Knowledge Management*, 17(6), pp. 958–972. doi:10.1108/JKM-04-2013-0163.

Dahiyat, S.E. and Al–Zu'bi, Z.M. (2012) 'The role of knowledge acquisition in facilitating customer involvement in product development: examining the mediation effect of absorptive capacity, *International Journal of Learning and Change*, 6(3–4), pp. 171–206.

Damanpour, F. (1992) 'Organizational size and innovation', *Organization Studies*, 13(3), pp. 375–402.

Darroch, J. (2003) 'Developing a measure of knowledge management behaviors and practices, *J. Knowledge Management*, 7, pp. 41–54. doi:10.1108/13673270310505377.

Darroch, J. and McNaughton, R. (2001) 'Developing a measure of knowledge management, in *World congress on intellectual capital readings*, pp. 226–242.

De Pablos, PO (2002) 'Knowledge management and organizational learning: typologies of knowledge strategies in the Spanish manufacturing industry from 1995 to 1999', *Journal of knowledge management* [Preprint].

Doğan, M. and Doğan, H. (2020) 'Knowledge sharing, innovation and firm performance: Evidence from Turkey, *Financial Studies*, 24(1 (87)), pp. 36–52.

Eberhard, M. and Craig, J. (2013) 'The evolving role of organisational and personal networks in international market venturing', *Journal of world business*, 48(3), pp. 385–397.

Gopalakrishnan, S. and Damanpour, F. (1997) 'A review of innovation research in economics, sociology and technology management, *Omega*, 25(1), pp. 15–28. doi:10.1016/S0305-0483(96)00043-6.

Grant, R.M. (1996) 'Toward a knowledge-based theory of the firm: Knowledge-based Theory of the Firm', *Strategic Management Journal*, 17(S2), pp. 109–122. doi:10.1002/smj.4250171110.

Gubbins, C. and Dooley, L. (2021) 'Delineating the tacit knowledge-seeking phase of knowledge sharing: The influence of relational social capital components', *Human Resource Development Quarterly*, 32(3), pp. 319–348. doi:10.1002/hrdq.21423.

Hair Jr, JF *et al.* (2021) 'Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook'. Springer Nature.

Hansen, M.T., Mors, ML and Løvås, B. (2005) 'Knowledge Sharing in Organizations: Multiple Networks, Multiple Phases', *Academy of Management Journal*, 48(5), pp. 776–793. doi:10.5465/amj.2005.18803922.

Huang, J. and Li, Y. (2009) 'The mediating effect of knowledge management on social interaction and innovation performance', *International Journal of Manpower*, 30(3), pp. 285–301. doi:10.1108/01437720910956772.

Le, P.B. and Lei, H. (2017) 'How transformational leadership supports knowledge sharing: Evidence from Chinese manufacturing and service firms, *Chinese Management Studies*, 11(3), pp. 479–497. doi:10.1108/CMS-02-2017-0039.

Leana, C.R. and Pil, FK (2006) 'Social Capital and Organizational Performance: Evidence from Urban Public Schools, *Organization Science*, 17(3), pp. 353–366. doi:10.1287/orsc.1060.0191.

Lee, V.-H. *et al.* (2013) 'Knowledge management: a key determinant in advancing technological innovation?', *Journal of Knowledge Management*, 17(6), pp. 848–872. doi:10.1108/JKM-08-2013-0315.

Levinthal, DA and March, JG (1993) 'The myopia of learning, *Strategic management journal*, 14(S2), pp. 95–112.

Li, M., Liu, H. and Zhou, J. (2018) 'G-SECI model-based knowledge creation for CoPS innovation: the role of grey knowledge', *Journal of Knowledge Management* [Preprint].

Liao, S.-H., Fei, W.-C. and Chen, C.-C. (2007) 'Knowledge sharing, absorptive capacity, and innovation capability: An empirical study of Taiwan's knowledge-intensive industries', *J. Information Science*, 33, pp. 340–359. doi:10.1177/0165551506070739.

Liao, Y. and Barnes, J. (2015) 'Knowledge acquisition and product innovation flexibility in SMEs', *Business Process Management Journal* [Preprint].

López-Nicolás, C. and Meroño-Cerdán, Á.L. (2011) 'Strategic knowledge management, innovation and performance, *International Journal of Information Management*, 31(6), pp. 502–509. doi:10.1016/j.ijinfomgt.2011.02.003.

Maldonado-Guzmán, G. *et al.* (2019) 'Innovation capabilities and performance: are they truly linked in SMEs?', *International Journal of Innovation Science* [Preprint].

Manfredi Latilla, V. *et al.* (2018) 'Knowledge management, knowledge transfer and organizational performance in the arts and crafts industry: a literature review', *Journal of Knowledge Management*, 22(6), pp. 1310–1331. doi:10.1108/JKM-08-2017-0367.

Martínez-Cañas, R., Sáez-Martínez, F.J. and Ruiz-Palomino, P. (2012) 'Knowledge acquisition's mediation of social capital-firm innovation', *Journal of Knowledge Management*, 16(1), pp. 61–76. doi:10.1108/13673271211198945.

Mcfadyen, MA and Cannella, A.A. (2004) 'SOCIAL CAPITAL AND KNOWLEDGE CREATION: DIMINISHING RETURNS OF THE NUMBER AND STRENGTH OF EXCHANGE RELATIONSHIPS', *Academy of Management Journal*, p. 13.

Migdadi, M.M. (2020) 'Knowledge management processes, innovation capability and organizational performance, *International Journal of Productivity and Performance Management*, ahead-of-print(ahead-of-print). doi:10.1108/IJPPM-04-2020-0154.

Molina-Morales, F.X., García-Villaverde, P.M. and Parra-Requena, G. (2014) 'Geographical and cognitive proximity effects on innovation performance in SMEs: A way through knowledge acquisition, *International Entrepreneurship and Management Journal*, 10(2), pp. 231–251. doi:10.1007/s11365-011-0214-z.

Mumford, M.D. (2000) 'Managing creative people: Strategies and tactics for innovation, *Human resource management review*, 10(3), pp. 313–351.

Mura, M. *et al.* (2013) 'Promoting professionals' innovative behaviour through knowledge sharing: the moderating role of social capital, *Journal of Knowledge Management*. Edited by K. Moustaghfir, 17(4), pp. 527–544. doi:10.1108/JKM-03-2013-0105.

Nahapiet, J. and Ghoshal, S. (1998) 'Social Capital, Intellectual Capital, and the Organizational Advantage, *The Academy of Management Review*, 23(2), p. 242. doi:10.2307/259373.

Nawaz, M.S., Hassan, M. and Shaukat, S. (2014) 'Impact of Knowledge Management Practices on Firm Performance: Testing the Mediation Role of Innovation in the Manufacturing Sector of Pakistan', p. 14.

Ngah, R., Tai, T. and Bontis, N. (2016) 'Knowledge Management Capabilities and Organizational Performance in Roads and Transport Authority of Dubai: The mediating role of Learning Organization: KM Capabilities and Learning Organization', *Knowledge and Process Management*, 23(3), pp. 184–193. doi:10.1002/kpm.1504.

Nonaka, I. and von Krogh, G. (2009) 'Perspective—Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory', *Organization Science*, 20(3), pp. 635–652. doi:10.1287/orsc.1080.0412.

Obeso, M. *et al.* (2020) 'Knowledge management processes and organizational performance: the mediating role of organizational learning, *Journal of Knowledge Management* [Preprint].

Podrug, N., Filipović, D. and Kovač, M. (2017) 'Knowledge sharing and firm innovation capability in Croatian ICT companies', *International Journal of Manpower* [Preprint].

Popadiuk, S. and Choo, C.W. (2006) 'Innovation and knowledge creation: How are these concepts related?', *International Journal of Information Management*, 26(4), pp. 302–312. doi:10.1016/j.ijinfomgt.2006.03.011.

Rabeh, H.A.D., Jimenéz-Jimenéz, D. and Martínez-Costa, M. (2013) 'Managing knowledge for a successful competence exploration', *Journal of Knowledge Management* [Preprint].

Ramadani, V. *et al.* (2017) 'The impact of knowledge spillovers and innovation on firm-performance: findings from the Balkans countries', *International entrepreneurship and management journal*, 13(1), pp. 299–325.

Reinholt, M., Pedersen, T. and Foss, N. (2011) 'Why a Central Network Position Isn't Enough: The Role of Motivation and Ability for Knowledge Sharing in Employee Networks', *Academy of Management Journal*, 54, pp. 1277–1297. doi:10.5465/amj.2009.0007.

Richter, N.F. *et al.* (2016) 'European management research using partial least squares structural equation modeling (PLS-SEM)', *European Management Journal, 34 (6), 589-597.* [Preprint].

Ritala, P. *et al.* (2015) 'Knowledge sharing, knowledge leaking and relative innovation performance: An empirical study, *Technovation*, 35, pp. 22–31. doi:10.1016/j.technovation.2014.07.011.

Ruiz-Jiménez, J.M. and del Mar Fuentes-Fuentes, M. (2013) 'Knowledge combination, innovation, organizational performance in technology firms', *Industrial Management & Data Systems* [Preprint].

Saenz, J., Aramburu, N. and Blanco, C.E. (2012) 'Knowledge sharing and innovation in Spanish and Colombian high-tech firms', *Journal of Knowledge Management* [Preprint].

Santos, G.M.C. *et al.* (2021) 'The impact of knowledge creation and acquisition on innovation, competition and international opportunity development, *European Journal of International Management*, 16(3), pp. 450–472. doi:10.1504/EJIM.2021.117511.

Saqib, M., Mohammed Din, Z. and Baluch, N.H. (2017) 'The impact of knowledge management on organizational performance in today's economy, *South East Asia Journal of Contemporary Business, Economics and Law*, 12(3), pp. 25–33.

Sartori, J.T.D. *et al.* (2020) 'Specificities of SMEs relevant to knowledge management: a systematic literature review', *International Journal of Business Excellence*, 22(1), p. 83. doi:10.1504/IJBEX.2020.109212.

Saunila, M. (2016) 'Performance measurement approach for innovation capability in SMEs', *International Journal of Productivity and Performance Management*, 65(2), pp. 162–176. doi:10.1108/IJPPM-08-2014-0123.

Shahzad, K. *et al.* (2016) 'Integrating knowledge management (KM) strategies and processes to enhance organizational creativity and performance', *Journal of Modelling in Management*, 11, pp. 154–179. doi:10.1108/JM2-07-2014-0061.

Shujahat, M. *et al.* (2018) 'Translating the impact of knowledge management into knowledge-based innovation: The neglected and mediating role of knowledge-worker satisfaction', *Human Factors and Ergonomics in Manufacturing & Service Industries*, 28(4), pp. 200–212. doi:10.1002/hfm.20735.

Shujahat, M. *et al.* (2019) 'Translating the impact of knowledge management processes into knowledge-based innovation: The neglected and mediating role of knowledge-worker productivity, *Journal of Business Research*, 94, pp. 442–450.

Spender, J.-C. and Grant, R. (1996) 'Knowledge and the Firm: An Overview', *Strategic Management Journal*, 17, pp. 3–9. doi:10.1002/smj.4250171103.

Tsai, M.-T. and Cheng, N.-C. (2012) 'Understanding knowledge sharing between IT professionals – an integration of social cognitive and social exchange theory, *Behaviour & Information Technology*, 31(11), pp. 1069–1080. doi:10.1080/0144929X.2010.550320.

Tunc Bozbura, F. (2007) 'Knowledge management practices in Turkish SMEs', *Journal of Enterprise Information Management*. Edited by C. Kahraman, 20(2), pp. 209–221. doi:10.1108/17410390710725788.

Van Den Hooff, B. and De Ridder, J.A. (2004) 'Knowledge sharing in context: the influence of organizational commitment, communication climate and CMC use on knowledge sharing, *Journal of knowledge management* [Preprint].

Van den Hooff, B. and de Leeuw van Weenen, F. (2004) 'Committed to share: commitment and CMC use as antecedents of knowledge sharing, *Knowledge and process management*, 11(1), pp. 13–24.

Vătămănescu, E.-M. *et al.* (2020) 'SMEs strategic networks and innovative performance: a relational design and methodology for knowledge sharing, *Journal of Knowledge Management*, 24(6), pp. 1369–1392. doi:10.1108/JKM-01-2020-0010.

Walsh, J.P. and Ungson, G.R. (1991) 'Organizational memory', *Academy of management review*, 16(1), pp. 57–91.

Wang, S. and Noe, R.A. (2010) 'Knowledge sharing: A review and directions for future research, *Human Resource Management Review*, 20(2), pp. 115–131. doi:10.1016/j.hrmr.2009.10.001.

Wang, Z. *et al.* (2016) 'The impact of intellectual capital – knowledge management strategy fit on firm performance, *Management Decision*, 54, pp. 1861–1885. doi:10.1108/MD-06-2015-0231.

Wang, Z. and Wang, N. (2012) 'Knowledge sharing, innovation and firm performance, *Expert systems with applications*, 39(10), pp. 8899–8908.

Weerawardena, J. (2003) 'Exploring the role of market learning capability in competitive strategy', *European Journal of Marketing*, 37(3/4), pp. 407–429. doi:10.1108/03090560310459023.

Wexler, M.N. (2002) 'Organizational memory and intellectual capital', *Journal of Intellectual Capital* [Preprint].

Xiang, C., Lu, Y. and Gupta, S. (2013) 'Knowledge sharing in information system development teams: examining the impact of shared mental model from a social capital theory perspective, *Behaviour & Information Technology*, 32(10), pp. 1024–1040. doi:10.1080/0144929X.2012.745901.

Yang, J.-T. and Wan, C.-S. (2004) 'Advancing organizational effectiveness and knowledge management implementation', *Tourism Management*, 25(5), pp. 593–601. doi:10.1016/j.tourman.2003.08.002.

Zheng, W. (2008) 'A Social Capital Perspective of Innovation from Individuals to Nations: Where is Empirical Literature Directing Us?: A Social Capital Perspective of Innovation', *International Journal of Management Reviews*, 12(2), pp. 151–183. doi:10.1111/j.1468-2370.2008.00247.x.

The Mediating Role of Knowledge Management Processes in the Development .... https://scialert.net/fulltext/?doi=jas.2014.112.120

Knowledge Management for Integrated Health and Social Care: The Case of Keusote in Finland

Tuomas Hujala and Harri Laihonen
University of Eastern Finland, Kuopio, Finland
tuomhu@uef.fi
harri.laihonen@uef.fi

Abstract: Knowledge management is expected to contribute to the management of health and social services as the challenges of the present and future are addressed. It is expected that organizations working in the field can be developed, thereby deriving efficiency benefits as well as promoting the effectiveness of services through knowledge management. However, despite the increasing interest in knowledge management as an organizational practice, there is a lack of evidence and practices showing how an effective knowledge management system should be designed, implemented, and promoted in health and social care organization. The integration of highly specialized and professionalized organizational cultures and traditions constitutes a complex context for managing knowledge. The purpose of this article is to identify development needs related to knowledge management systems in integrated health and social care and based on a case study suggest KM initiatives for responding these needs. The found key factors for knowledge management relate to strategic orientation, careful analysis of the organization's knowledge and expertise, and an ability to harness these in a cross-administrative, multi-professional and strategy-oriented way. The qualitative analysis is based on the strategic documentation, the results of an external evaluation of the case organization's knowledge management practices, and notes and other documentation of internal development workshops carried out in the case organization.

Keywords: knowledge management, healthcare, social care, integrated care

1. Introduction

The growing need for health and social care services, limited resources, and the increasing complexity of governance pose challenges to the management of health and social care (Nordin *et al*, 2021; Valli-Lintu, 2017). Integration of care is considered as one possible solution to overcome these challenges (Kaehne, 2019). The main aim of the integration agenda is to influence customer service chains and increase continuity of care (Cheng & Catallo, 2018). In addition to functional integration, new service models require new structures and new forms of cooperation, both internally and with other service providers, that promote multidisciplinary work and common practices (Williams, 2012a). The potential for integration is complemented by diversification capabilities and knowledge resources provided by the various parties concerned (Williams 2012b).

Knowledge management (KM) has achieved an established position in the management of health and social care (e.g., Ikonen, 2020; Lunden *et al*, 2017; Nicolini *et al*, 2008). Underlying this is the idea that organizations working in the field can be developed through KM, thereby achieving efficiency benefits and promoting the effectiveness of services. With the support of KM, health and social care organizations aim to enhance their understanding of customer needs, improve organizational performance, achieve better targeted decision-making, improve quality of services, drive cultural change, and improve risk management (Hujala & Laihonen, 2021). Indeed, KM and integrated care pursue similar aims at different levels of the service system, from the management level to clinical operations and customer encounters (e.g., Martin & Knowles 2019; Williams 2012b).

This article analyzes KM development in an integrated care organization and aims to provide a new understanding of the role of KM in service integration and to identify priorities for future development. The case organization is Keusote (Keski-Uusimaa health and social services), which is a regional public health and social care organization in southern Finland. Keusote and Finland provide an interesting context for the study because Finland is reorganizing its health and social services and moving from a decentralized model to a more centralized model (see https://soteuudistus.fi/en/frontpage). The ongoing reorganization poses new challenges to the KM of the newly launched wellbeing services counties. This study thus examines how the transformation from a decentralized system to regional wellbeing services counties affects KM, and how the new strategy of an integrated health and social care organization is operationalized through KM. The study contributes by providing new information about KM in integrated health and social care by answering the research question: How to design and promote the implementation of a new KM system (KMS) in integrated health and social care organization? The design and implementation of KM as a purposefully constructed design is a little-studied area influenced by the organization's business model, culture, and history (Robu & Lazar, 2021; Strans & Odom, 2006;

Sarvary, 1999), and the few practical examples have not considered the context of integrated care in much detail (cf. Gall *et al*, 2021; Choy *et a.*, 2018; Massingham *et a.*, 2018).

2. Managing knowledge in an integrated health and social care

KM has been studied in health and social care since the early 2000s (Van Beveren, 2003). The theme has subsequently been explored from several perspectives including the effectiveness of KM (e.g., Kosklin *et al*, 2022; Hujala & Laihonen, 2021), the processes and tools (Kothari *et al*, 2011; Nicolini *et al*, 2008) and organizational performance (Najmi *et al*, 2018; Alajmi *et al*, 2016). Value-based health care (VBHC) has recently set new requirements for KM. VBHC aims to optimize health system performance in terms of population health, patient experience, and cost of care (Nuno-Solinis, 2019; Kokko, 2022). Integration of care is one central principle of VBHC (Kokko & Laihonen, 2021), having a direct impact on KM. Hence, the measurement of organizational performance needs to consider not only internal performance but also social well-being (cf. Dumay, 2020; Kokko & Laihonen, 2021).

KMS is an integral part of an organization's strategy and structure alongside technological entities, organization culture, processes, and practices (Starns & Odom, 2006; Lee & Choi; 2003). KMS includes the systems, policies, and processes by which information is utilized in an organization (Lee & Choi, 2003; Alavi & Leidner, 2001). Technology contributes to enabling KM but following Ghosh and Scott (2006), the organization's KM culture plays an even bigger role. KM initiatives should be derived from the strategy of the organization (Zack, 1999; Laihonen & Mäntylä, 2017). Effective KMS presupposes high-quality information, strong promotion of KMS by initiators and clarification of what is being measured (Ali *et al*, 2017). Robu and Lazar (2021) underline that the successful design and implementation of KMS requires a strong foundation in people, technology, and processes, where everything starts with strategy and its integration into different business areas. Laihonen and Mäntylä (2018) argue that KM requires four basic pillars to succeed - 1) strategic focus, 2) integration of KM into the general management system, 3) clearcut processes and responsibilities for refining the data, and 4) quality of the underlying data.

When considering the implementation of KMS, Choo's (2002) information management cycle provides guidance on designing the critical elements of KMS. The key variables in the process are the perception of information needs, data acquisition, data organization and storage, data products and the promotion of data utilization, and behavioral change based on knowledge-based decisions. Choo's (2002) model can be applied to public health and social services, where the target of KMS is to build a conduit toward data utilization and behavior change through the recognition of information needs. However, especially in the context of integrated health and social services, a paradigm shift from silo-like organization and information structures to vertical and horizontal structures entails a reinterpretation of the organization and managerial information needs and behavior (cf. Laihonen & Kokko, 2020; Laihonen & Huhtamäki, 2020). Next, we will describe a development process where a new KMS was designed and implemented in the case organization.

3. Research design

3.1 Context of the empirical study

Finland is undergoing a major reform of health and social care. In 2023, 22 new welfare services counties will start operations and assume responsibility for organizing and providing health, social and rescue services. Alongside the reform, the importance of KM has been proclaimed. This study examines one wellbeing services county from the perspective of KM, aiming to provide a knowledge base for both operational and strategic management while creating a basis for national- and regional-level information steering. The case organization studied was Keusote in Finland (Keski-Uusimaa health and social services), which is a public organization providing health and social care services in the area of six municipalities in southern Finland. Keusote will be one of the wellbeing services counties as of 2023. The population base for which services are provided is over 200,000 inhabitants and the consortium of municipalities has 3,500 employees. Keusote was chosen as the case organization for two reasons. First, this case organization is one of the most active and advanced wellbeing services counties as regards KM and regional KM development is ongoing. Second, we were granted good access to the organization because the first author of this study is working in Keusote and responsible for the development of KM in the organization.

3.2 Empirical methods and data

This article applies a qualitative case approach to obtain detailed information on the conditions, critical events and processes of a single entity (Eisenhardt, 1989; Gummesson, 2000; Yin, 2009). The empirical part describes the development of KMS in integrated health and social services. The empirical data consisted of materials from three steps of KM development. First, the strategic documents were reviewed to identify the state of mind and goal setting. Second, the results of an external evaluation of KM practices were used to determine the starting point for KM development. Third, data from a total of 36 workshops were used to identify key elements to be considered in KMS design. The first author of this article was chairman in each of these workshops. The workshops comprised three large entities with 12 workshops per entity. The organization's top management, health and social care professionals and IT management were divided into three groups: management, experts, and IT. The three groups met once a week for four weeks. The final output of each workshop was a hypothesis canvas (see Figure 3). The method of collecting the data was a round table discussion including top management and experts from different service areas. In addition, the groups were divided so that top management and experts were in different sessions thereby giving all present an equal voice. Notes on the workshops were always reviewed in the group before the next session. The aim was to ensure the correctness of the findings and also the reliability and validity of the data for this study.

4. Knowledge management system development in Keusote

4.1 Starting points for knowledge management

The basic documents of Keusote were created in 2017 and the responsibility for organizing health and social care was transferred from the municipalities to the consortium of municipalities in 2019. The strategy of the consortium sets high expectations for KM and Keusote aims to be a national pioneer in KM during the 2020-2025 strategy period. No separate strategy was made for KM, but the consortium strategy includes a program for knowledge governance through which various development projects are promoted (see Figure 1).

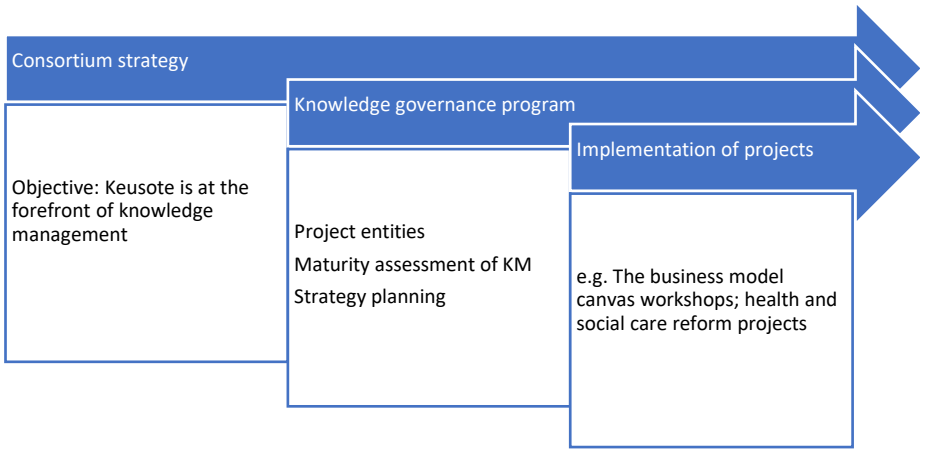


Figure 1: From consortium strategy to operationalization of KM in Keusote

The overall objective was to enhance the case organizations' KM capabilities so that tools and technology, skills and competences, and processes and governance support knowledge-based management throughout the organization. More specifically, the objective was firstly to invest in knowledge-based management expected to drive change towards a new kind of management culture based on data. Secondly, to accelerate decision-making to be more effective in organizations' different operation levels. The aim was to make the use of information and knowledge in decision-making integral parts of all management situations and to achieve transparency in operations and cost management.

In accordance with the strategic goals, Keusote decided to create a KM unit, which was assigned the responsibility for the technological and operational implementation of KM. The work started by examining the current state of KM. This was done using a KM evaluation model developed in Finland for the purposes of frequent monitoring, trend analysis, and in-depth analysis of contemporary information and knowledge management practices in the public sector (Jääskeläinen *et al*, 2020).

The results of the external evaluation in Keusote can be condensed into three factors (see Figure 2). First, the organization's commitment to developing KM was relatively high and had strong support from top management.

Second, the benefits of KM were well understood in the organization. Third, the technical capability of KM in an organization was weak in terms of both data availability and KM products. In general, according to the survey, the current state of KM was challenging and development work needed prioritizing. The integrity of knowledge, the fragmentation of information systems and the silaged nature of an integrated health and social care organization were considered to pose major challenges for the development of KM.

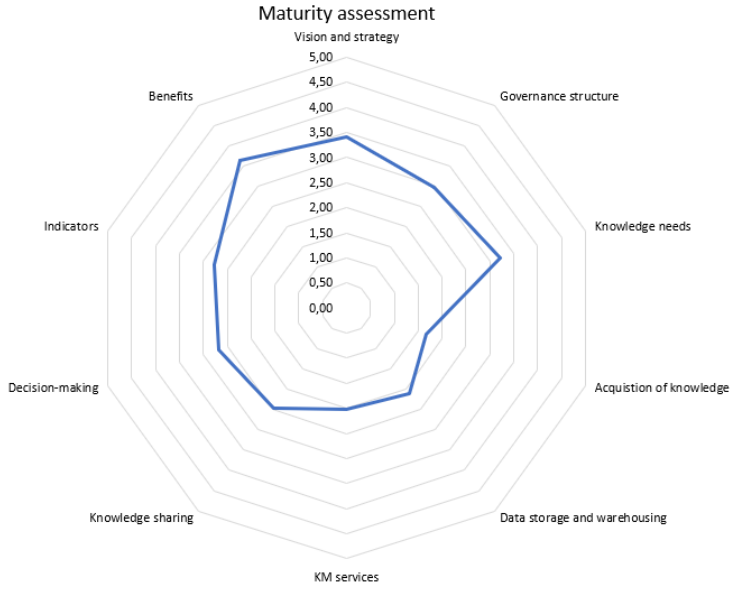


Figure 2: Main results of the KM maturity assessment in Keusote

4.2 Transforming strategic objectives into managerial information needs

Following the maturity assessment, Keusote created a development plan for KM. The technical path emphasized data management in distributed information systems where a data lake was introduced to manage data from different sources. The development of analytical layers with data warehousing followed. Another development area related to customer segmentation and the recognition of managerial information needs. The aim of this work was to direct the KM focus to those factors having the greatest impact in the environment of health and social care. The development targets were defined under the guidance of top management and organization's strategy. Keusote used the business canvas model (here hypothesis canvas, see Figure 3) to map the strategic phenomena relevant to the different service chains (themes) that were chosen based on their national importance. The first theme dealt with aging, the second was focused on families with children, and the third primary health care as distinct from specialized care.

The KM development targets related to strategic objectives were also recognized, assessed and tested in the workshops. Hypothesis canvases were used for identifying and linking managerial information needs to strategic objectives. Canvases contained twelve different perspectives as shown in Figure 3. These perspectives linked strategy, information needs, information production, decision making, and adaptive behavior. In the workshops, the top management identified key objectives and hypotheses across the organization. Several dozen hypotheses were evinced in three workshops, but the biggest and cross-sectional openings were:

> *"Shifting the focus to preventive and well-being-enhancing services prevents the accumulation of individual problems and the complexity of finding solutions, simplifies the service structure, and changes the allocation of resources in the service chain."*

> *"Interface projects with specialized care speed up consultation in solving the client's problems, increase the efficiency of the customers situation information flow between organizations and enable better preparedness."*

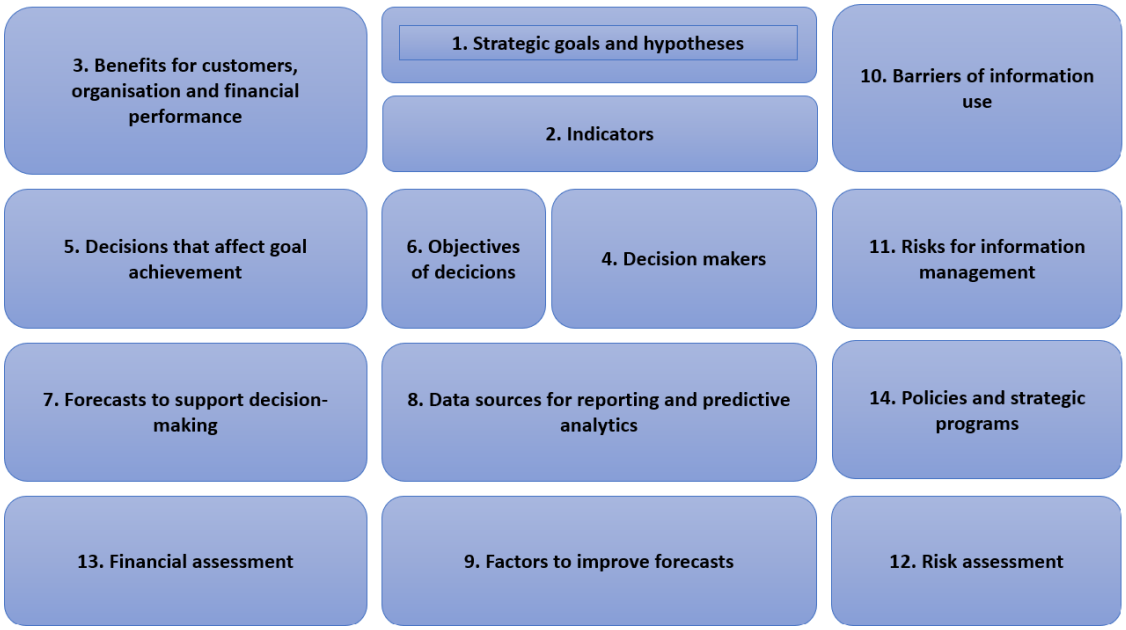


Figure 3: Hypothesis canvas model used for information needs.

Based on the workshops results, the organization started planning the KMS so that it makes information available at the right time to the right person. The workshops helped to break organizational silos and fostered multi-professional dialog. At the beginning of the workshops, the various service areas of the organization posed service-oriented challenges and information needs, but as the workshops progressed, they also found common denominators for the themes to be addressed. The workshops strengthened not only the dialog related to individual information needs but also around KM more generally. Central to this method was to summarize the issues related to the development work and the achievement of the organizations' goals in one page of plain language, which contributes to facilitating communication between management, health and social care professionals, and IT to accelerate KMS design. Also, the hypothesis-canvas supported the discussion related to goal setting and performance.

5. KMS development needs and suggested KM initiatives in integrated health and social care

As the case study showed, the case organization clearly positioned KM as an entity in its own right to make the rationale for investments clearer and the monitoring of objectives transparent. However, positioning KM as a separate organizational unit did not mean that KM became detached from the rest of the organization. This is also a central message of the previous literature, KM should be closely involved with various areas of the organization in terms of technology, operations, and strategy (Starns & Odom 2006; Lee & Choi 2003). Only in this way can KM have an impact on organizational performance, service quality, customer understanding and more efficient decision-making (cf. Hujala & Laihonen, 2021).

After the objectives for KM were set and the organizing model was decided, the next step was to determine how the objectives are to be achieved. This was a matter of operative planning and implementation. Adequate resources are crucial to successful KM, and in the case organization a separate KM unit was found to be an appropriate approach to resourcing and competence development. Ali *et al* (2016) state that a successful KMS requires initiators and in the case organization KM unit acted as an initiator. Another important starting point for the development work was the mapping of the current state. In the case organization the external maturity assessment provided this starting point. With limited resources it is essential to prioritize. Indeed, an organization needs to choose its battles wisely. Managerial judgement is therefore needed to identify and invest in those projects and initiatives likely to yield the best return on investment.

Identifying managerial information needs in the case organization brought to the fore two different viewpoints. First, a concrete and practical framework for structuring information needs, like the hypothesis canvas in our case, provided all workshop participants with a clear picture of the organization's strategy and helped to communicate the strategy in terms of managerial information needs. It also linked these two to underlying

information structures and technology and provided a holistic understanding of the whole information management cycle (cf. Choo, 2002), that is, a knowledge-based view of integrated care. Second, the canvas workshops can be considered as examples of performance dialogs (Laihonen & Mäntylä, 2017; Rajala & Laihonen, 2019), where performance information is interpreted in a collaborative manner. This highlights the importance of focusing not only on the efficiency of information production but also on those interpretative processes where meanings are attached to the data. Indeed, focusing on relevant business cases is very close to prioritization. Massingham *et al* (2018) propose similar ideas in their KMS design research by arguing that KM should be positioned to resolve key issues for the organization. Likewise, Dumay (2020) has suggested that KM should be harnessed to solve complex societal issues and not merely tame organizational problems.

Considering the key factors affecting KM implementation, it can be claimed that there are often many challenges at the starting point. The main challenges arise from the ways in which the utilization of information is perceived across the organization. Sub-optimization is a well-known challenge calling for integration (Nuno-Solinis, 2019) and KM should provide a way to overcome this problem by providing a holistic and inter-organizational overview of health and social services. In terms of resources, time allocation poses a continuous challenge for leading the organization based on knowledge. From the point of view of data, several entities emerged, the most important of which were fragmented systems, data quality, and recording practices. In terms of tools, the lack of analysis tools was highlighted in the workshops. Based on the description of the case organization and considering Choo's (2002) information management cycle, many challenges in KMS design and implementation originate from technological issues, but even more importantly the organization's culture and how this succeeds in promoting knowledge-based management are often the defining factors in the implementation of KMS. This is supported by Ghosh and Scott (2006) who also found technology as an important enabling factor, but organizational culture with an even greater role in a knowledge-driven organization (Starns & Odom, 2006; Lee & Choi, 2003). Table 1 summarizes the development needs and related KM initiatives for an integrated health and social care organization.

Table 1: KMS development needs and suggested KM initiatives in integrated health and social care.

Activity of the information management cycle (Choo, 2002)	**KMS development needs in integrated health and social care**	**Suggested KM initiatives in integrated health and social care**
- Identification of information needs	- Unclear information needs	- Strategy-based hypothesis canvas workshops to further specify the managerial information needs
- Information acquisition	- Unclear information gathering processes - Time-consuming information processes	- Multi-professional dialog regarding reporting needs and roles of different actors in information acquisition - Technological development
- Information organization and storage	- Decentralized information systems - Different recording practices	- Technological development (such as data platforms and data lakes) - Development of the data architecture and interfaces - Integration of systems, practices and data
- Development of information products and services	- Static reports - Lagging indicators	- Integrated reporting and development clearly defined information products - Codesign of information products and services with end-users - Modern technology to enable dynamic reporting
- Information distribution	- Unclear information needs - Different expectations, unclear accountabilities, and varying understanding of KM	- Strategy-based hypothesis canvas workshops - Multi-professional dialog focusing on information use - Developing a shared understanding of the roles of KM unit
- Information use	- Misfit between managerial information needs and information products - Incompatible information systems induce extra work - Lack of KM capabilities	- Development of the data architecture and interfaces - Developing knowledge-based management culture

Activity of the information management cycle (Choo, 2002)	KMS development needs in integrated health and social care	Suggested KM initiatives in integrated health and social care
- Adaptive behavior	- Focus on data and reporting not on information use and learning - Information changes behavior only in rare cases	- KM as part of the organization's culture

6. Concluding remarks

This study aimed to provide empirical evidence of the design and implementation of KMS in integrated health and social care. The study contributes to the KM literature by recognizing, which KM initiatives are critical for the integration of highly specialized and professionalized organizational cultures. More practically, the research provides new information to support the development of an effective KMS by recognizing the KMS development needs in different stages of the information management cycle and in the different phases of KM development.

The study also suggests ways to overcome the recognized development needs, or pitfalls of KM, by suggesting KM initiatives that may help in responding to the recognized development needs. The descriptive study also contributes to the literature on the management of health and social care because there is still little empirical research elaborating the application of KM to promote service integration. The case study illustrates that in the integration of health and social care, when it comes to multidisciplinary work across organizational boundaries, the KM activities described by Choo (2002) are more challenging and complex like discussed by Laihonen and Kokko (2020) in connection to institutional complexity and by Laihonen and Huhtamäki (2020) in the specific contexts of hybridity and organizational fluidity. The following managerial guidelines for the design and implementation of KMS in integrated health and social care can be identified:

1. Consider the mutual link between organization's strategy and KM.
2. Start by mapping KM maturity and choosing the right battles, that is, focus on the most relevant and impactful processes.
3. Define such objectives that force breaking organizational silos. This creates new managerial information needs and necessitates multi-professional dialog.

The study leaves ample options for future research. The new welfare services counties begin operations in early 2023 and a follow-up analysis is needed to assess the effectiveness of the chosen initiatives. We also focused on only one of the 22 counties in Finland. However, the organization studied has systematically developed its KM in recent years and is among the most advanced counties in terms of KM maturity. Nevertheless, a comparative analysis of different strategic approaches would provide important data on best practices.

References

Alajmi, B., Marouf, L. & Chaudhry, A. (2016) "Knowledge management for healthcare: Investigating practices that drive performance. *Journal of Information & Knowledge Management*, Vol. 15, No.2, pp 1–17.

Alavi, M. & Leidner, D. (2001) "Review: knowledge management and knowledge management systems. Conceptual foundations and research issues", *MIS Quarterly*, Vol. 25, No. 1, pp 107-136.

Ali, N., Tretiakov, A., Whiddett, D. & Hunter, I. (2016) "Knowledge management systems success in healthcare: Leadership matters", *International Journal of Medical Informatics*, Vol. 97, pp 331-340.

Cheng, S.M. & Catallo, C (2018) "Case definition for health and social care services integrated initiatives", *Journal of Integrated Care*, Vol. 27, No.4, pp 264-275.

Choo, C.W. (2002) *Information Management for the Intelligent Organization: The Art of Scanning the Environment* (3rd ed.). Medford, NJ: Information Today, Inc.

Choy, K.L.T., Siu, K.Y.P., Ho, T.S.G., Wu, C.H., Lam, H.Y., Tang, V. & Tsang, Y.P. (2018) "An intelligent case-based knowledge management system for quality improvement in nursing homes*", VINE Journal of Information and Knowledge Management Systems*, Vol. 48, No.1, pp 103-121.

Dumay, J. (2020) "Using critical KM to address wicked problems", *Knowledge Management Research & Practice*, Vol. ahead-of-print No. ahead-of-print, pp 1-9, doi: 10.1080/14778238.2020.1790310.

Eisenhardt, K.M. (1989) "Building theories from case study research", *Academy of Management Review*, Vol. 14, No. 4, pp 532-550.

Gall, D., Presler, J., Hurtienne, J. & Latoschik, M.E. (2020) "Self-organizing knowledge management might improve the quality of person-centered dementia care: A qualitative study", *International Journal of Medical Informatics*, Vol. 139.

Ghosh, B. & Scott, J. (2006) "Effective knowledge management system for a clinical nursing setting", *Information System Management*, Vol. 24, No. 1, pp 73-84.

Gummesson, E. (2000) Qualitative Methods in Management Research. Thousand Oaks, California, Sage Publications Inc.

Hujala, T. & Laihonen, H. (2021) “Effects of knowledge management on the management of health and social care: a systematic literature review”, *Journal of Knowledge Management*, Vol. 25, No.11 pp 203-221.

Ikonen, A-K. (2020) “Knowledge as a critical success factor in the Finnish social and health-care reform”, *Knowledge Management Research and Practice*, Vol. 18 No. 1, pp 69–80.

Jääskeläinen, A., Sillanpää, V., Helander, N., Leskelä, R.-L., Haavisto, I., Laasonen, V., Torkki, P. (2020) “Designing a maturity model for analyzing information and knowledge management in the public sector”, *VINE Journal of Information and Knowledge Management System*, Vol. 52, No. 1, pp 120-140.

Kaehne, A. (2019) “Big Data and what it means for evaluating integrated care programmes”, *Journal of Integrated Care*, Vol. 27, No. 3, pp 249–258.

Kokko, P. & Laihonen, H. (2021) Performance Management and Hybridization of Healthcare—The?? Case of the Accountable Care Organization, *Journal of Public Budgeting, Accounting & Financial Management*. DOI: 10.1108/JPBAFM-04-2021-0066.

Kokko, P. (2022) Improving the value of healthcare systems using the Triple Aim framework: A systematic literature review, *Health Policy*. DOI: 10.1016/j.healthpol.2022.02.005.

Laihonen, H. & Huhtamäki, J. (2020) “Organizational Hybridity and Fluidity: Deriving New Strategies for Dynamic Knowledge Management”, *Knowledge Management Research & Practice.* DOI: 10.1080/14778238.2020.1794993.

Laihonen, H. & Kokko, P. (2020) “Knowledge Management and Hybridity of Institutional Logics in Public Sector”, *Knowledge Management Research & Practice*. DOI: 10.1080/14778238.2020.1788429

Laihonen, H. & Mäntylä, S. (2017) “Strategic knowledge management and evolving local government”, *Journal of Knowledge Management*, Vol. 22 No. 1, pp 219-234.

Lee, H. & Choi, B. (2003) “Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination”, *Journal of Management Information Systems*, Vol. 20, No. 1, pp 179-228.

Lunden, A., Teräs, M., Kvist, T. & Häggman-Laitila, A. (2017) “A systematic review of factors influencing knowledge management and the nurse leaders’ role”, *Journal of Nursing Management*, 25, pp 407-420.

Martin, L. & Knowles, E.E. (2020) “Model for an integrated health system”, *Journal of Integrated Care*, Vol. 28, No. 2, pp 161-170.

Massingham, P. Massingham, R. & Pomering, A. (2018) “Designing a knowledge management system for social services not-for-profit organizations”, *International Journal of Knowledge Management*, Vol. 14, No 3, pp 69-81.

Najmi, K., Kadir, A.R. & Kadir, I.A. (2017) “Mediation effect of dynamic capability in the relationship between knowledge management and strategic leadership on organizational performance accountability”, *International Journal of Law and Management*, Vol. 60, No. 2, pp 517-529.

Nicolini, D., Powell, J., Conville, P. & Martinez-Solano, L. (2008) “Managing knowledge in the healthcare sector: a review”, *International Journal of Management Reviews*, Vol 10, No. 3, pp 245-263.

Nordin, P., Aronen, K & Johanson, J-E. (2021) “Tehtäväkohtainen yhteistyö kunnissa – integraatiotutkimus sosiaali- ja terveydenhuollon vuorovaikutuksesta ja yhteyksistä kunnan muihin tehtäviin”, Available at: https://www.kuntaliitto.fi/julkaisut/2021/2102-tehtavakohtainen-yhteistyo-kunnissa-acta-nro-278 (Accessed 29 March 2021).

Nuno-Solinis, R. (2019) “Advancing towards value-based integrated care for individuals and populations”, *International Journal of Integrated Care*, Vol. 19, No. 4, pp 1-3.

Rajala, T. and Laihonen, H. (2019) “Managerial choices in orchestrating dialogic performance management”, *Baltic Journal of Management*, Vol. 14, No. 1, pp 141-157.

Robu, A. & Lazar, J.B. (2021) “Digital transformation designed to succeed – Fit change into the business strategy and people”, *Electronic Journal of Knowledge Management*, Vol. 19, No. 2, pp 133-149.

Sarvary, M. (1999) “Knowledge management and competition in the consulting industry”, *California Management Review,* Vol. 41 No. 2, pp 95-107

Starns, J. & Odom, C. (2006) “Using knowledge management principles to solve organizational performance problems”, *VINE: The Journal of Information and Knowledge Management Systems*, Vol. 36, No. 2, pp 186–198.

Valli-Lintu, A. (2017) “SOTE- ja kuntarakenteen pitkä kujanjuoksu”, available at https://kaks.fi/wp-content/uploads/2017/09/sote-jakuntarakenteen-pitka-kujanjuoksu_2.pdf (accessed 6 March 2021).

Van Beveren, J. (2003) “Does health care for knowledge management”, *Journal of Knowledge Management*, Vol. 7, No. 1, pp 90-95.

Williams, P. (2012a) “Integration of health and social care: a case of learning and knowledge management”, *Health and Social Care in the Community*, Vol. 20, No. 5, pp 550–560.

Williams, P. (2012b) “The role of leadership in learning and knowledge for integration”, Journal of Integrated Care, Vol. 20, No. 3, pp 161–174.

Yin, R.K. (2009) *Case Study Research – Design and Methods*, Sage, Thousand Oaks, California.

Zack, M. (1999) “Developing a knowledge strategy”, *California Management Review*, Vol. 41, pp 125-45.

Collaborative Knowledge Building and Social Capital in Gender-Based Violence, Northern Iraq

Goran Yousif Ismael
NOBEL Institute, Department of business Administration, Northern Iraq (Erbil)
goran.yusif@yahoo.com

Abstract: As the number of COVID-19 continue to increase exponentially in an alarming rate, so as the number increase in Gender-based Violence (GBV). Different authorities and human right groups have making effort to tackle the increase in GBV but still more need to be done. The purpose of this study is to explore the role of collaborative knowledge building and social capital in the fight against gender-based violence. To analyse this issue, the study developed a model with 3 constructs; social capital, Crisis preparedness and collaborative knowledge building. The data generated from the survey was analysed using statistical tools in SPSS and model fitness was tested based on reliability and validity. The study's findings indicate that 69% of the respondents believe that women are at risk of increase in domestic gender-based violence due to the pandemic. Respondent's perceptions on collaborative knowledge building and social capital varies significantly. The hypothesis testing has shown that all the hypothesis is supported due to attainment of path coefficient greater than 0.1, t-value of greater than 1.96 and level of significance of above 0.05.

Keywords: Gender based Violence (GBV), Social Capital, Collaborative knowledge building, crisis, crisis preparedness

1. Introduction

The Covid 19 pandemic has led to lockdown of countries and loss of jobs worldwide. This has increased tensions in households and the reported cases of gender-based violence have also increased since the corona virus pandemic started. According to Ismael and Sagsan (2020), despite this organizations have employed creative solutions in order to operate amidst the pandemic. They also pointed out that knowledge management application can be seen in various ways in survival during the pandemic. Knowledge is key to decision making as well as improving competencies (Tehrani et al 2018). One of the approaches that is being used is that of increasing collaborative efforts as the crisis had prompted different parties to come together and find solutions. Amidst crisis, it is fundamental that knowledge be created, shared and applied and there needs to be processes in place to ensure this. Social capital is also being utilized with emphasis on social relationships to provide a wealth of knowledge and encourage collaborations. According to Boyd and Martin (2020) a sense of community goes a long way in reducing the impact of pandemics.

The Cordaid organization is one of the organizations that set up a Context Matters initiative in a bid to decrease the gender-based violence incidences in Northern Iraq. This initiative thrives on collaborative efforts between different parties like the organization employees, religious leaders, the police force and the community at large to facilitate knowledge sharing and transfer between these parties. In addition, solving problems of gender-based violence also require much social capital as it entails relationship building, a solid networking system, instilling feelings of trust and safety to ensure the flow of communication. According to Ismael,G.Y.(2021), This study aims to determine the role of collaborative knowledge building and social capital in the fight against gender-based violence. It will explore the effectiveness of the system of the current set up and how knowledge sharing and transfer is being facilitated and the tools employed and determine any existing challenges and how they can be solved. The COVID 19 pandemic has worsened an already bad situation and with the lockdowns and restrictions in place it would be most valuable to determine how knowledge building and social capital can be employed under a crisis. The study has the potential of improving policies, shedding light on any weaknesses and strengths of the systems; and can add new literature to the current knowledge repositories and enhance learning. This knowledge can be used to improve crisis preparedness as well as for evaluation of any more crisis that may occur.

1.1 Aim and Objectives

The main aim of this study is to determine the role of collaborative knowledge building and social capital in the fight against gender-based violence.

The study objectives are as follows;

- To evaluate the impact of collaborative knowledge building on gender-based violence in a crisis.
- To evaluate the effect of collaborative knowledge building on social capital

- To recommend governmental and non-governmental agencies on the impact of collaborative knowledge building and social capital in the fight against gender-based violence

1.2 Statement of Problem

There have been a few studies regarding gender-based violence. However, even fewer have dealt with the relationship between collaborative knowledge building and social capital in Northern Iraq. The corona virus pandemic is a recent development and a crisis of a global scale; no other study of this nature has yet been conducted in Northern Iraq exploring the subject under the COVID crisis hence this is a novel study capable of shedding light on collaborative knowledge building in times of crisis. This therefore is the knowledge gap that the researcher seeks to feel and it has prompted a few questions mentioned below. Are there any tools that are being employed to reduce gender violence during the pandemic and are they effective? What is the role of collaborative knowledge building in dealing with gender violence? What is the role of social capital in gender violence under a crisis? Is there correlation between collaborative knowledge building and social capital in the fight against gender violence under a pandemic crisis? The model below illustrates clearly these questions and forms the basis of the hypotheses that are represented thereafter.

1.3 Significance of the Study

As the number of COVID-19 cases continue to surge exponentially in shocking rate, so as the increase in GBV across the world. This is attributed to the curfews, lockdowns or confinement, restriction of movements and quarantines. However, different authorities and groups such as the government, police, justice department, women right activists, civil society groups etc have been making effort to counter GBV around the globe and states (Mittal and Singh, 2020). Despite their effort, more is needed to be done especially in underdeveloped countries such as Iraq with slow crime intervention, inadequate social amenities, lack of domestic violence helplines, policies and shelters. Even before COVID-19 pandemic, domestic GBV was already one of the biggest threats to humanity and human right violations. The increase in GBV must tackle with urgent response by creating measures which embedded social capital in the form of economic support (i.e., stimulus package) (Johnson et al., 2020). Other measures include collaborative knowledge sharing among agencies, communities and groups in creating awareness and how to deal with GBV effectively. Thus, this study is to determine the role of collaborative knowledge building and social capital in the fight against gender-based violence.

2. Theoretical background

This chapter discuss about the role of collaborative knowledge building and social capital in the fight against gender-based violence. It offers a theoretical background on each construct separately by conceptualizing collaborative knowledge building, social capital and gender-based violence.

2.1 Collaborative knowledge building

Sorensen et al (2019) pointed out that collaborative efforts improve crisis preparedness. This notion was also supported by Norhstedt et al (2018) who pointed out that where there is effective collaboration amongst organizations, a community can easily prepare and recover from crises. The scholars also explained that in dealing with crises there are several aspects of utmost importance which include the leadership, the costs, urgency of the matter, the magnitude of the crises and the level of uncertainty involved. Prytz et al (2015) pointed out that in a crisis the decision-making process is done at a much faster rate and usually there is lack of adequate information to go by. This is also worsened by bureaucratic tendencies and in cases like these collaborative efforts may prove to be a cause for conflict as they try to cut through the usual routine (Magnussen et al 2018). Hayton (2005) pointed out that there is a shift in the creation of knowledge and more organizations are harnessing external collaborations and communities of practice in building their knowledge.

Stahl (2000) developed a model for collaborative knowledge building which shows the interactions in a social context that provides learning for organizations. Examination of the model above reveals that collaborative knowledge building is a social process. They reflect that social interactions are a vital tool in the process of knowledge building as they are used for argumentation and rationale where new insights can be gained. Aspects like shared understanding reveal aspects that are also forged as a result of social capital. According to Stahl (2000) knowledge is a result of social interaction. They explained that a person has their own understandings and preconceived notions and it is through interactions with others that they gain new knowledge. They explained that knowledge stems from the individual experiences, sense of rationality, cultural traditions and discussion.

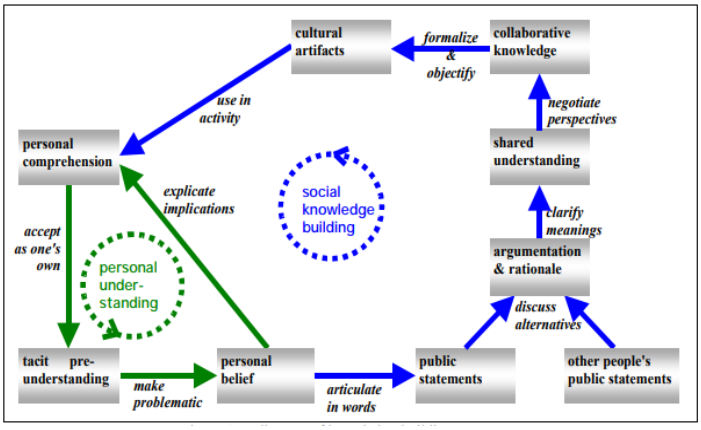


Figure 2.1: Model for collaborative social building (Stahl, 2000)

2.2 Social capital in a crisis

Liu et al (2016) defined social capital as the total value of an organization's relationships that stems from all its social networks and provides connection between the organization and the society. According to Nafei (2016) proactiveness allows the organization to utilize its physical and intellectual capabilities for application of knowledge to ensure survival inn a turbulent environment. Several authors point out that intellectual capital is one of the key resources that foster proactiveness in a crisis (Liu et al 2016, Wu (2021), Rennenkampf (2017), Tu (2020). They explained that organizations are social beings and through social capital they are able to forge relationships that allow them to obtain and share tacit and explicit knowledge as well as enhance their learning process.

According to Helliwell et al (2014), better social capital results in better ability and effectiveness in dealing with crises. Many scholars pointed out that social capital improves the ability of individuals and communities to prepare, respond and recover from crises (Klineberg 2003), Aldrich 2012, Helliwell et al 2014, Hikichi et al (2017), Wu (2021). Kawachi et al (2008) pointed out that social capital can be on individual and group level. They explained that the groups enhance crisis preparedness through collective socialization. At individual level they explained that this could be anyone from a vulnerable individual to a powerful leader but at some point, they all need to get to resources through socializing. A community with social cohesion is able to weather the effects of a crisis better and to prepare for it. Koh (2008) also supported this and added that social capital supported disaster preparedness through spread of information within social channels, mobilization of volunteers, strengthening the relationship and trust between the community and officials. Makridisid and Wu (2021) pointed out that the most essential aspect in social capital that helps in crises is the trust and social relationships. They explained that these two fuels the concern for one another and lead to unity towards a specific purpose.

2.3 Empirical Studies

Grimsdottir and Edvardson (2018) and Jafaridehkordi et al contended that social capital is a corporate asset that can yield value and strengthen the organization's performance. Khalid et al (2020) explained that the COVID 19 pandemic led to growth in social networking and collaborations which have led to a new knowledge repository being formed. Social media provided a platform where a wealth of information was created, shared and encouraged collaborative interactions in times of crisis (Kim 2020, La et al, 2020). Magnussen et al (2018) conducted a study based on collaboration and crisis management in the maritime industry in Norway. The study used a mixed method approach employing observations, interviews and surveys. The sample consisted of emergency personnel. The study revealed that collaboration was positively associated with learning and that it prompted work with regards to the crisis. Al-Omoush et al (2020) examined social capital and collaborative knowledge creation of e businesses in response to the COVID 19 pandemic in Spain. The study was based on essential services during the pandemic and obtained data from managers through a survey. The study revealed that collaborative knowledge creation and social capital provided management with the necessary tools to respond to crises as well as to manage the pressure that are associated with crises especially the corona virus pandemic; through enhancing organizational agility. On the other hand, Khaled et al (2020) conducted a study exploring the effect of sense of community in collaborative knowledge creation with regards to the COVID 19 pandemic. The study showed that sense of community triggers the need for collaborative knowledge creation. The scholars also pointed out that social media was a powerful tool in enhancing social capital and knowledge

amidst a pandemic. It provided the public as well as organizations with a platform where ideas, problems, experiences, solutions and opinions could be shared.

3. Methodology

The methodology section focuses on the research approach based on postpositivism research philosophy, deductive research approach based on qualitative and quantitative methods. The chapter also presents questionnaire or survey developments, sampling method, research participants and research model and tools.

3.1 Research Design

According to Saunders, research design addressed the step-by-step component on how the researcher plan to carryout the research work. It is also regarded as path taking to resolve the research questions (Marczyk, DeMatteo & Festinger, 2005). The step-by-step components includes theoretical background, literature review, hypothesis development, collection of data, sampling technique and mode of data analysis. Thus, the basic approach for collection of data includes quantitative (statistical) and qualitative (categorical). Thus, in this study both methods were explored. In the case of qualitative data, literature review is conducted to compiled data through journals, reports, books and other online sources. These sources were reviewed to obtain themes, expert and professional's perceptions, suggestions and opinions. While questionnaire is designed to collect primary source of data from respondents in Bagdad Iraq. As a result of the current pandemic, the questionnaires were distributed through emails and social media platforms.

3.2 Survey Development and Research Respondents

The gender-based domestic violence questionnaire items were adopted from the study conducted by Kirkuk et al., 2020 which contain 4 items. Collaborative knowledge building was adopted from study reported by Nonka & Takechi, (1995); Chen et al., 2016; Faccin & Balesterin, (2018) and Muukkomen et al., 2019 which contain 8 items. While social capital was adopted from study reported by both Hayton (2005) and Liu et al., 2016 which contain 5 items. The study targeted 200 people working in different sectors Bagdad which include Accounting and Finance, Government agencies, Human right agencies, Hospitality and Tourism sector, Healthcare, Food and agriculture etc.

3.3 Research Model

As shown in figure 3.1. The structural equation model (SEM) comprises of 3 constructs which include social capital, Crisis preparedness: GBV and collaborative knowledge building (which include knowledge transfer and sharing). According to the model, it proposed that there is direct effect between social capital and collaborative knowledge building in preparedness of GBV in responding to the current COVID-19 pandemic. Moreover, the model also postulates the direct effect of collaborative knowledge building on preparedness of GBV.

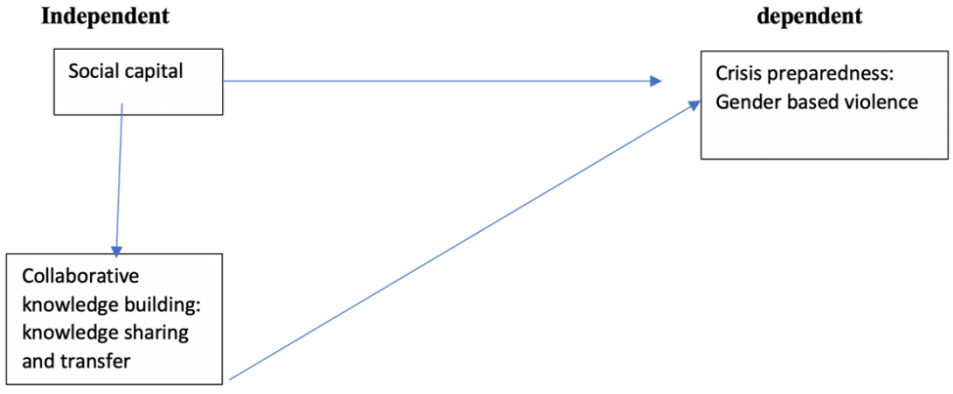


Figure 3.1: The Study's Model

3.4 Hypothesis

After conceptualization of the research constructs, the following hypothesis are outlined below:
H1 collaborative knowledge building has an impact on gender-based violence in a crisis
H2 collaborative knowledge building has an impact on social capital
H3 social capital has an impact on crisis preparedness in gender-based violence

3.5 Research Tools and Data Analysis

In every quantitative and qualitative research tool play a vital role in analysing data and interpretation of research findings (Ali & Bhaskar, 2016). As mentioned by Krauss (2007) the use of research tools is critical for achieving accurate, valid and reliable result. Thus, in this study, the data generated from survey is exported to IBM SPSS software and analysed using statistical techniques such as frequency, percentages, standard deviations, means etc. in terms of assessing the model fitness, discriminant and composite reliabilities were conducted while correlation analysis was also conducted to check the relationship between variables.

4. Result and Discussion

The main aim of this study is to determine the role of collaborative knowledge building and social capital in the fight against gender-based violence. Different statistical analysis and model fitness analysis were conducted. The outcomes generated from the listed analysis are presented in the form of frequency distribution tables (based on frequency and percentages) and figures (based on pie chart, bar chart and histogram). The first part of this section is characterized by demographic results of the respondents followed by outcomes generated from the survey according to frequency distribution tables. The final parts of this section contain model fitness measurements in terms of reliabilities and correlation analysis

4.1 Demographical Characteristics of Respondents

4.1.1 Age

As mentioned earlier, 200 questionnaires are distributed which resulted in 184 (92.3% response rate). In terms of age variation, 83 (45.0%) are less than 25 years of age, 67 (36.5%) are between 25 to 40 years and 34 (18.5%) are older than 40 years as shown in Table 4.1 and Figure 4.1

Table 4.1: Age Variation of Respondents

Classification	Frequency	Percentage (%)
<25	83	45.0
25-40	67	36.5
>40	34	18.5
Total	184	100

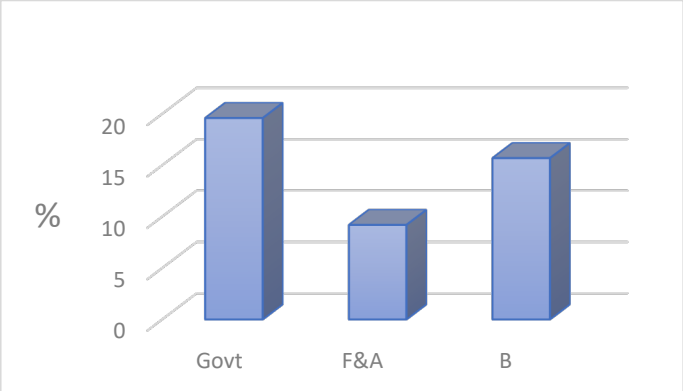


Figure 4.1: Age Distribution of Respondents

4.1.2 Gender

In terms of gender distribution, 115 (62.5%) are males and 69 (37.5% are females as shown in Table 4.2 and Figure 4.2

Table 4.2: Gender distribution of Respondents

Classification	Frequency	Percentage (%)
Male	115	62.5
Female	69	37.5
Total	184	100

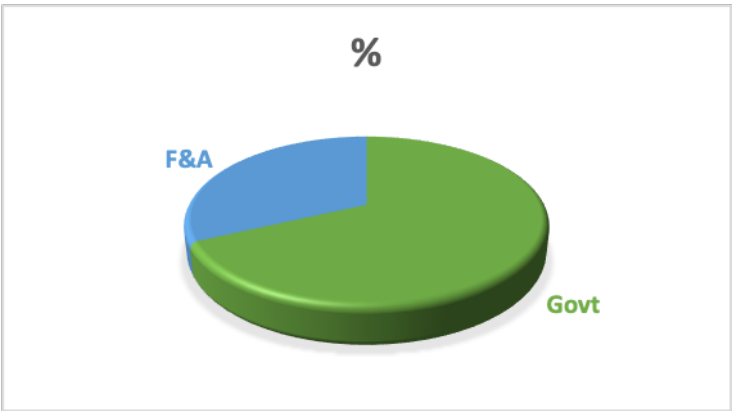


Figure 4.2: Gender Distribution of Respondents

4.1.3 ducational Level

In terms of educational level, 13 (7.1%) attended primary school, 25 (13.6%) graduated high school, 78 (42.4%) have diploma or advanced certificate, 51 (22.7%) have bachelor certificate, 17 (9.2%) have master's or doctorate certificate as shown in Table 4.3 and Figure 4.3.

Table 4.2: Educational Level of Respondents

Classification	Frequency	Percentage (%)
Primary school	13	7.1
High school	25	13.6
Diploma and certificate	78	42.4
Bachelor's degree	51	27.7
Masters/ Doctorate	17	9.2
Total	184	100

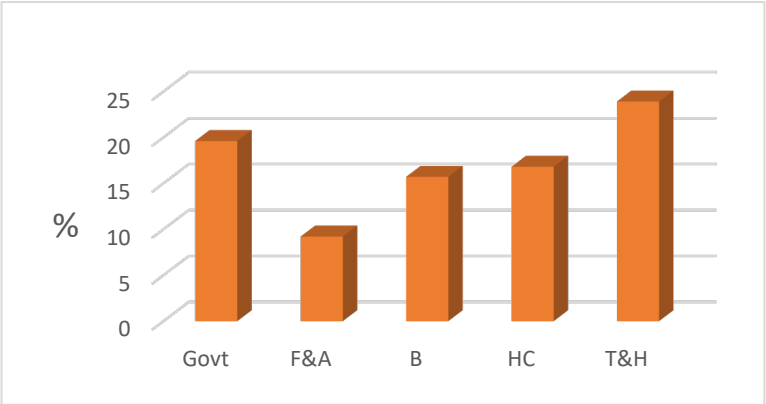


Figure 4.3: Educational Level of Respondents

4.1.4 Sector

In terms of Respondents working sector, 36 (19.6%) work in the Government Agencies, 17 (9.2%) work in Finance and Accounting sector, 29 (15.7%) are into business, 31 (16.8%) work in healthcare sector, 44 (23.9%) work in Tourism and Hospitality sector, 18 (9.8%) are into food and agriculture and 12 (6.5%) are neither as shown in Table 4.4 and Figure 4.4

Table 4.4: Specialization of Respondents

Classification	Frequency	Percentage (%)
Government Agencies (GA)	36	19.6
Finance and Accounting (F&A)	17	9.2
Business (B)	29	15.7
Healthcare (HC)	31	16.8
Tourism and Hospitality (T&H)	44	23.9
Food and Agriculture	18	9.8

Classification	Frequency	Percentage (%)
Others	12	6.5
Total	184	100

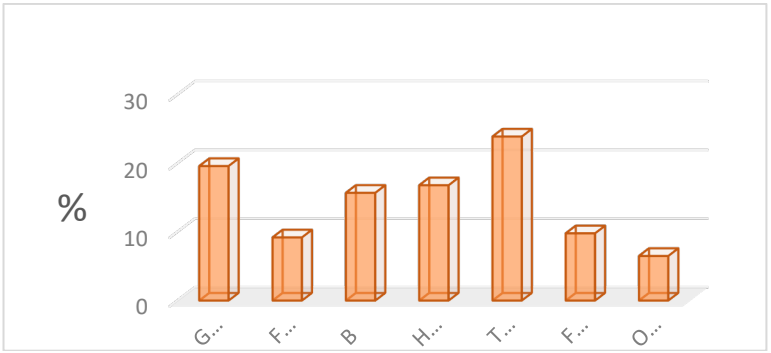


Figure 4.4: Specialization of Respondents

4.2 Survey

4.2.1 Gender-based Violence (GBV)

Based on the responses generated from the questionnaire as presented in table 4.5. It is quite clear that respondent (i.e., 69%) perceived that women are facing increase in the risk of Gender-based Violence due to coronavirus pandemic. However, 65% indicate that they don't have idea on how to report Gender-based Violence in Bagdad, indicating that there are no service mobile hotlines (i.e., 78%). Moreover 93% of the respondents indicates that assuming if there is confidential hotline, women will surely use it.

Table 4.5: Gender-based Violence (GBV)

Items	Yes	(2) A	No	(4) S D
	Freq	%	Freq	%
GBV1	127	69	57	31
GBV2	63	34.2	121	65.8
GBV3	339	21.2	145	78.8
GBV4	171	92.9	13	7.1

4.2.2 Social Capital

Based on the responses acquired from the survey questions as shown in table 4.6. Majority of respondents (A=53 and SA=54) believe that organization/company's social networks with other organizations promotes opportunities for acquiring cutting edge insight and ideas. In terms of close connection and collective actions with other organizations, majority of the respondents (A=47, SA= 60) believe that their organization collaborative and collective actions. However, the frequency slumped down in the case of collaborative decisions on matters that affect the organizations.

Table 4.6: Social Capital (SC)

Items	(1) SA	(2) A	(3) N	(4) S D	(5) D
SC1	21	40	16	53	54
SC2	33	24	20	47	60
SC3	28	22	40	58	36

4.2.3 Collaborative knowledge sharing and building

Based on the responses generated from the survey question as presented in table 4.8. Getting ideas and innovative techniques from other organizations, partners and social media is among the top priorities of majority of the organizations the respondents are working with. However, sharing knowledge and innovative ideas are not widespread among the organizations, companies or agencies in Bagdad.

Table 4.7: Collaborative knowledge sharing and building

Items	(1) SA (%)	(2) A (%)	(3) N (%)	(4) S D (%)	(5) D (%)
CKB1	33	28	24	51	48
CKB 2	19	35	40	31	51

Items	(1) SA (%)	(2) A (%)	(3) N (%)	(4) S D (%)	(5) D (%)
CKB 3	26	32	49	27	50
CKB 4	35	29	35	44	41
CKB 5	29	19	54	49	37
CKB6	22	34	47	39	42
CKB7	20	36	50	47	31
CKB8	25	19	30	46	64

4.3 Reliability and Validity of Constructs

In order to measure the convergent validity, the model analysis of average variance (AVE) and composite reliability were conducted. For composite reliability, Cronbach alpha is employed to asses internal consistency. As shown in table 4.8, the composite reliabilities, Cronbach alpha for all constructs were greater than 0,70 and AVE values are higher than 0.50 which indicate the model's internal consistency and convergent validity.

Table 4.8: Reliability and Validity of Constructs

Hypothesis	CR	AVE	CA
GBV	0.912	0.649	0.894
SC	0.816	0.573	0.871
CKB –>	0.804	0.519	0.833

4.4 Hypothesis Testing

As shown in table 4.9, there is casual relationship between gender-based violence, social capital and collaborative knowledge building. In order to test the research hypothesis, β, significance and t-value are used. According to Hair et al., 2010, hypothesis is statistically significance when the path coefficient is higher than 0.1, t-value greater than 1.96 and the level of significance of greater than 0.05.

Table 4.8: Reliability and Validity of Constructs

Hypothesis	β	t	Significance
CKB –> GBV	.671	4.788	0.00
CKB –> SC	.534	4.801	0.00
SC –>GBV	.472	5.411	0.00

Thus, the result supported the claim that collaborative knowledge building has an impact on gender-based violence with β score 0f 0.671, t-value of 4.788 and 0.00 level of significance. The result supported the claim that collaborative knowledge building has significance effect on social capital with β score 0f 0.534, t-value of 4.801 and 0.00 level of significance. The result also supported the claim that social capital has an impact on gender-based violence with β score 0f 0.472, t-value of 5.411 and 0.00 level of significance.

5. Conclusion

The study focuses on exploring the impact of collaborative knowledge building and social capital on gender-based violence especially in this era of COVID-19 pandemics. In order to limit the spread of the virus, government have imposed lockdowns, curfews, restrictions, closure of workplaces, cultural, religious, sportive and entertainment centres. As a result of these measures, people are confined at home which increase the risk of gender-based violence as cited by previous studies such as Mittal & Singh (2020), Johnson et al., 2020 and Ruiz-Perez et al., 2020. In order to minimize the cases of gender-based violence, many scholars reported the significant impact of collaborative knowledge building and social capital in form of stimulus packages, loans, palliatives, foodstuffs as some of the measures to resolve the threat of gender-based violence during the pandemic period. However, majority of these studies were conducted in developed countries such as China, Germany, USA, France, UK Australia etc.

As a result of the increase in number of cases and continuous imposition of measures which restricted people's movement and confine them at home in Iraq and the increase of gender-based violence due to the pandemic as reported by other studies, this makes this subject worthy of investigation using Bagdad as a case study. The research questions and hypothesis were developed through conceptualization of the literature review. In order to test the hypothesis, a structured based questionnaire is designed and distributed to 200 respondents in Bagdad through emails and social medial platforms. The data generated from the survey was analysed using statistical tools in SPSS and model fitness was tested based on reliability and validity. The study's findings indicate that 69% of the respondents believe that women are at risk of increase in domestic gender-based

violence due to the pandemic. Respondent's perceptions on collaborative knowledge building and social capital varies significantly. The hypothesis testing has shown that all the hypothesis are supported due to attainment of path coefficient greater than 0.1, t-value of greater than 1.96 and level of significance of above 0.05.

6. Recommendation

According to the result achieved from the data analysis, it is recommended that government should increase their efforts in tackling gender-based violence in Iraq. Compare to other developed countries, Iraq is left behind with limited agencies task with reporting gender-based violence as well as limited mobile hotlines available to support victims of gender-based violence. Moreover, the government need to create a massive campaign of awareness on how to prevent these atrocities and human right violations. In addition, both government and non-governmental organizations need to come up with aid in terms of economic package to poor people and promote collaborative knowledge sharing between organizations, companies, agencies on how to minimize the occurrence of gender-based violence in Iraq.

References

Al Omoush et al (2018). The degree of e-business entrepreneurship and long-term sustainability: An institutional perspective.Information Systems and E-Business Management, pp. 29-56

Aldrich, Daniel & Meyer, Michelle. (2015). Social Capital and Community Resilience. American Behavioral Scientist. 59. 254-269.

Ali, Z., & Bhaskar, S. B. (2016). Basic statistical tools in research and data analysis. Indian journal of anaesthesia, 60(9), 662.

Chen, W., Jiao, H., Zeng, Q., & Wu, J. (2016). Ios-enabled collaborative knowledge creation and supply chain flexibility: The moderate role of market uncertainty. In PACIS proceedings. Chiayi, Taiwan

Faccin, K., & Balestrin, A. (2018). The dynamics of collaborative practices for knowledge creation in joint R&D projects. Journal of Engineering and Technology Management, 48, 28–43

Grimsdottir and Edvardsson, (2018). Knowledge management, knowledge creation, and open innovation in Icelandic SMEs, SAGE Open, 8, pp. 1-13

Hair, J., Black, W., Babin, B., & Anderson, R. (2010). Multivariate data analysis. New Jersey: Prentice Hall

Hayton, (2005).Competing in the new economy: The effect of intellectual capital on corporate entrepreneurship in high-technology new ventures. R&D Management, 35, pp. 137-155

Helliwell, John & Huang, Haifang & Wang, Shun. (2014). Social Capital and Well-Being in Times of Crisis. Journal of Happiness Studies. 15. 10.1007/s10902-013-9441-z.

Hikichi, H., Tsuboya, T., Aida, J., Matsuyama, Y., Kondo, K., Subramanian, S. V., & Kawachi, I. (2017). Social capital and cognitive decline in the aftermath of a natural disaster: a natural experiment from the 2011 Great East Japan Earthquake and Tsunami. *The Lancet. Planetary health*, *1*(3), e105–e113.

Ismael, G. Y., & Sağsan, M. (2020, December). Designing Innovation Strategy in the Context of Competitive Advantage in Telecommunication Industry. In ECKM 2020 21st European Conference on Knowledge Management (p. 352). Academic Conferences International Limited.

Ismael, G. Y. (2021). The Mediation Effect of Organizational Culture between Knowledge Management Processes and Creative Thinking: A Case of COVID 19 Healthcare Workers in Northern Iraq. *Revista Argentina de Clínica Psicológica*, *30*(1), 658.

Jafaridehkordi et al (2015). Intellectual capital and investment opportunity set in advanced technology companies in Malaysia. International Journal of Innovation and Applied Studies, pp. 1022-1027

Johnson, K., Green, L., Volpellier, M., Kidenda, S., McHale, T., Naimer, K., & Mishori, R. (2020). The impact of COVID-19 on services for people affected by sexual and gender-based violence. International Journal of Gynecology & Obstetrics, 150(3), 285-287.

Kawachi I, Subramanian SV, Kim D (2008). Social capital and health: a decade of progress and beyond. In: Kawachi I, Subramanian SV, Kim D, editors. *Social Capital and Health.* Springer; New York: pp. 1–28

Khaled Saleh Al-Omoush, Maria Orero-Blat, Domingo Ribeiro-Soriano (2020). The role of sense of community in harnessing the wisdom of crowds and creating collaborative knowledge during the COVID-19 pandemic, Journal of Business Research

Kirkuk, Diyala and Sulaimaniyah Governorates (2020). Gender Analysis of the Covid-19 pandemic in Iraq.

Klinenberg, E. (2003). Heat wave: A social autopsy of disaster in Chicago. Chicago, IL:

Klinenberg, E. (2003). Heat wave: A social autopsy of disaster in Chicago. Chicago, IL:

Klinenberg, E. (2003). Heat wave: A social autopsy of disaster in Chicago. Chicago, IL:

Klinenberg, E. (2003). Heat wave: A social autopsy of disaster in Chicago. Chicago, IL:

Koh H.K., Cadigan R.O. (2008) Disaster Preparedness and Social Capital. In: Kawachi I., Subramanian S., Kim D. (eds) Social Capital and Health. Springer, New York, NY.

Krauss, S. E. (2005). Research paradigms and meaning making: A primer. The qualitative report, 10(4), 758-770.

Liu, H., Ke, W., Wei, K. K., & Lu, Y. (2016). The effects of social capital on firm substantive and symbolic performance: In the context of E-Business. Journal of Global Information Management, 24(1), 61–85

Makridisid, Christos & Wu, Cary. (2021). How social capital helps communities weather the COVID-19 pandemic. PLoS ONE. 16. 10.1371/journal.pone.0245135.
Marczyk, G., DeMatteo, D., & Festinger, D. (2005). Essentials of research design and methodology. John wiley & sons, Inc.
Mittal, S., & Singh, T. (2020). Gender-based violence during COVID-19 pandemic: a mini-review. Frontiers in Global Women's Health, 1, 4.
Muukkonen, H., Lakkala, M., Lahti-Nuuttila, P., Ilomäki, L., Karlgren, K., & Toom, A. (2019). Assessing the development of collaborative knowledge work competence: Scales for higher education course contexts. Scandinavian Journal of Educational Research
Nohrstedt, D., Bynander, F., Parker, C F., 't Hart, P. (2018) Managing Crises Collaboratively: Prospects and Problems - A Systematic Literature Review Perspectives on Public Management and Governance, 1(4): 257-271
Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford: Oxford university press
Ruiz-Perez, I., & Pastor-Moreno, G. (2020). Measures to contain gender-based violence during the COVID-19 pandemic. Gaceta sanitaria.
Sørensen, J. L., Carlström, E. D., Torgersen, G. E., Christiansen, A. M., Kim, T. E., Wahlstrøm, S., & Magnussen, L. I. (2019). The organizer dilemma: Outcomes from a collaboration exercise. International Journal of Disaster Risk Science, 10(2), 261-269.
University of Chicago Press
University of Chicago Press
University of Chicago Press
Wu Cary (2021) Social capital and COVID-19: a multidimensional and multilevel approach, Chinese Sociological Review, 53:1, 27-54.

Exploring Knowledge Exchange and Social Capital Within agri-food Business Support Programmes

Suzanne Kelly
Ulster University, Jordanstown, Co. Antrim; [2]Teagasc, Athenry, Co. Galway
kelly-S130@ulster.ac.uk

Abstract: Developing social capital and intellectual capital is critical to enhancing knowledge management (KM) and innovation. Social capital relates to KM as it provides access to new sources of knowledge, with each dimension of social capital having different effects on knowledge exchange. The amount of knowledge gathered over time and the use of communication technologies is essential to understand the role knowledge plays in social capital innovation, also referred to as intellectual capital.Social capital and intellectual capital are regarded as factors needed to enhance KM amongst agri-food business support programmes. Limited research to date has explored how intellectual capital is linked to each dimension of social capital. Current qualitative research being conducted in this PhD aims to contribute to this body of knowledge. This paper will include preliminary results from pilot study research. Initial interview and observation findings suggest that bonding social capital and intellectual capital lead to enhanced knowledge exchange and therefore increased innovation capabilities. The findings from this research will be beneficial to agri-food businesses, agriculture support programmes, training programmes, farmers, and governing bodies and will aid understanding into social capital and its benefits for knowledge exchange and innovation.

Keywords: Social Capital; Knowledge Exchange; Innovation; Agri-food business; Intellectual Capital

1. Introduction

The value of social capital for innovation has been widely acknowledged within the literature (King et al., 2019; Tura and Harmaakorpi, 2005; Fine, 2001). It has been identified that social capital leads to economic growth, innovation capabilities, knowledge exchange, regional development, and improved trust (Hasan et al., 2020; Lins et al., 2017; Lewis, 2010; Smith et al., 2017; Nahapiet and Ghoshal, 1998). Despite this, limited research has explored how social capital is developed in different contexts (Cofré- Bravo et al., 2019; Murphy et al., 2016). In particular, it could be suggested that farmers who are often located in rural contexts may have less opportunities to develop their social capital and innovation capabilities due to locational based disadvantages, lack of support or restrictions of freedoms (Tsai and Ghoshal, 1998; Portes, 1998). Within rural regions, business support programmes have been identified as a key mechanism to improve and create social capital relationships using peer-to-peer learning and advisory support (Faure et al., 2019; Garforth et al., 2003). However, much remains unknown on how business support programmes develop social capital, and how this consequently leads to increased innovation capacity and/or knowledge exchange (Fisher, 2016; Murphy, 2016). This calls for more research which explores how different types of social capital (i.e., bridging, bonding and linking) can have value for farmers and on-farm innovation (Cofré-Bravo et al., 2019). To contribute to the body of knowledge in this field, the aim of this paper is to investigate the role that business support programmes have in encouraging social capital and collaborative approaches within agri-food and farming specifically.

This research is part of a larger PhD study and aims to contribute new insights into how social capital is developed in the rural, farming contexts and the mediating role social capital might have in relation to farmer innovation capabilities. The paper will begin by discussing the role of social capital for innovation, then the role of business support programmes will be explored. A conceptual model will then be presented which forms the basis of the empirical analysis. The findings of a pilot study will then be presented, and the key contributions will be outlined.

2. Theoretical Development

2.1 Social capital and innovation capabilities

From the literature, there is no one clear, undisputed meaning of social capital, where most definitions are conceptual and complex in nature (Lang and Fink, 2019) and challenges exist in defining the elements of social capital (Bhandari and Yasunobu, 2009). Definitions vary depending on the discipline and conceptual nature of social capital in practice. The concept is used at the micro and macro levels, spanning across disciplines such as sociology, economics, management, political science, and health science (Bernardi, Huinink and Settersten, 2019).

Definitions focus on relations between actors (Teilmann, 2012), the structure of relations and types of linkages (Clark, 2010). Furthermore, authors identify different types and characteristics of social capital. Putnam's (1995, pp.67) definition is widely cited where social capital is defined as:

> *"Features of social organisation such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (Putnam, 1995, pp.67).*

This definition is deemed to be fitting towards this research, where business support programmes aim to work collaboratively with agri-food business owners to enhance their capabilities for creating mutual benefit (Levdokymov et al., 2020).

These actors then create social capital through various forms (macro, meso, micro) and on different scales (bonds, bridges, linkages) which work collectively with types of social capital (structural, cognitive, relational). Each type of social capital has key aspects, for example, structural social capital has aspects of network ties, structural holes, and tie strength. These factors can lead to varying levels of social capital achieved (Aral and Walker, 2014).

Research identifies numerous outcomes of social capital, which can be both positive and negative and occur at different levels. Social capital must have well established foundations in order to achieve positive outcomes (Lewis, 2010). Social capital can support rural areas in regional development through social capital stimulation. A major outcome of social capital is economic growth. This outcome is recognised by the World Bank and regarded as a benefit for stimulating social capital (Dasgupta, 2000; Woolcock and Nararyan, 2000; Durlauf and Fafchamps, 2004).

Knowledge exchange is also achieved through accumulation of social capital and intellectual capital. This is considered the most important resource for agri-food businesses to stay competitive and create new opportunities (Grant, 1996). However, transferring knowledge successfully can be difficult due to a variety of factors (Easterby-Smith, Lyles, & Tsang, 2008). Information is assumed to circulate through social ties where an actor gains access to resources through social interaction (Tsai and Ghoshal, 1998). Social interaction, also known as structural social capital, builds and forms social ties to increase contacts (Lee, 2009). Social interactions positively affect knowledge exchange, enhancing the learning network. Thus, the greater network social interaction, the greater knowledge exchange (Lefebvre et al. 2016). Knowledge exchange will be further discussed in section 2.2 below.

Innovation capability is deemed an outcome of social capital and is defined as an individual's potential to innovate (Saunila and Ukko, 2012). The ability to innovate is critical to the growth, success and competitive advantage of firms and individuals (Muller at al., 2005; Ukko et al., 2016). Strategy and innovation activities harvest a shared vision of innovation, essential in creating innovation capabilities (Skarzynski and Gibson, 2008). These capabilities include transforming ideas into products, processes or systems which will ultimately provide benefits (Lerro et al., 2009). Innovation capabilities have been defined as "the ability to mould and manage multiple capabilities'" (Lawson and Samson, 2001, pp. 380).

Other outcomes of social capital include sustainable development, regional development, and intellectual capital. However, social capital does not always produce desirable outcomes, the dark sides of social capital can also occur (Putzel, 1997; Zmerli, 2010). Negative outcomes of social capital include involvement in criminal groups or endangering an individual's opportunities (Lewis, 2010; Zmerli, 2010).

2.2 Knowledge transfer

Knowledge exchange is seen as an outcome of social capital but is also needed for programmes, advisors, and farmers to transfer knowledge throughout engagement activities. Once knowledge has been transferred amongst actors via social capital, innovation capability occurs, this can happen in various ways through product, service, process, market, and management practices (Rajapathirana and Hui, 2018).

Knowledge exchange is an important part of social capital. Intellectual property is a valuable economic resource providing the opportunity for support programmes and actors to improve their knowledge base, increasing competitive advantage (Tsai and Ghoshal, 1998; Subramaniam and Youndt, 2005). Enhanced knowledge exchange amongst actors and networks can ultimately lead to coordination of new activities, introduction of

products to the market or new innovative technologies (Boschma and Ter Wal, 2007). According to Scharmer (2001), there are three forms of knowledge, referred to as explicit, tacit, and potential. Explicit knowledge is thought of as knowledge that is easy to share or write down, implicit knowledge is considered as skills that are transferable from one network to another, while tacit knowledge is gained from personal experiences and is the most difficult to express (Alexander, 2018).

The literature on knowledge exchange and social capital has considered how knowledge flows through network actors and how new knowledge is introduced within each network (Nahapiet and Ghoshal, 1998; Adler and Kwon, 2002; Moran, 2005). In exploring knowledge exchange from a social capital perspective, a network approach is taken, arguing that social relationships and networks can influence the ability to access, transfer and apply knowledge, leading to absorptive capacity (Díez-Vial and Montoro-Sánchez 2014).

2.3 The role of rural advisory services

Rural advisory services vary depending on the management of each project, objectives and content provided (Lamm et al., 2017). Various studies have indicated a level of competition as opposed to collaboration and coordination between rural business support programmes (Faure et al., 2019). It is critical for business support programmes to help shape social capital to aid farmers to develop their networks, which can then in turn aid knowledge transfer and on-farm agriculture innovation (Cofré-Bravo et al., 2019). Trust is an important characteristic between actors, knowledge exchange and innovation to ensure the interaction is smooth (Cerf et al., 2017; Faure et al., 2019; Rijswijk and Brazendale, 2017).

Advisors' roles, characteristics and skills vary within each support programme. Advisor characteristics include being a good communicator, possessing technical knowledge and analytical and persuasion skills, relationship focused and having initiative. However, each advisor has different characteristics and skills, making it difficult for a farmer to adapt and build relationships with new advisors (Hejnowicz et al., 2016).

Farmers can be categorised as: Pro-activists, do-it-yourselfers, wait-and-see-ers and reclusive traditionalists (Klerkx et al., 2017). These categories are used to describe adoption levels, for example innovators and early adopters tend to be more proactive and likely to adapt well to change. However, these categories do not capture the advisor/client relationship and the various ways farmers can engage with advice and information by using social capital (Klerkx et al., 2017).

3. Conceptual Framework

Based on a review of relevant literature on social capital, intellectual capital, knowledge exchange and business support programmes, and the application of this to a rural context, an initial conceptual framework (Figure One) has been developed. This framework will form the basis of empirical research into the presence of social capital in advisor-client relationships.

As can be seen in Figure one, the knowledge transfer process centres around rural advisory programmes, and the interaction between advisor and farmer/client actors. The entire framework sits within the AKIS (Agricultural Knowledge and Innovation Systems) ecosystem. Programmes, advisors and farmers are at the heart of the innovation system and are needed to support modernisation, innovation, and knowledge flows (D'avino, 2019). The AKIS concept encourages a systematic view of complex structures which make up a functioning knowledge exchange network among various actors in society (Knierim et al., 2015). The actors within AKIS interact to generate various forms of social capital. Consideration must also be given to the antecedents and challenges in developing social capital and innovation capabilities and possible outcomes, listed outside the ecosystem. These outcomes have been discussed earlier in this paper (see section 2.1).

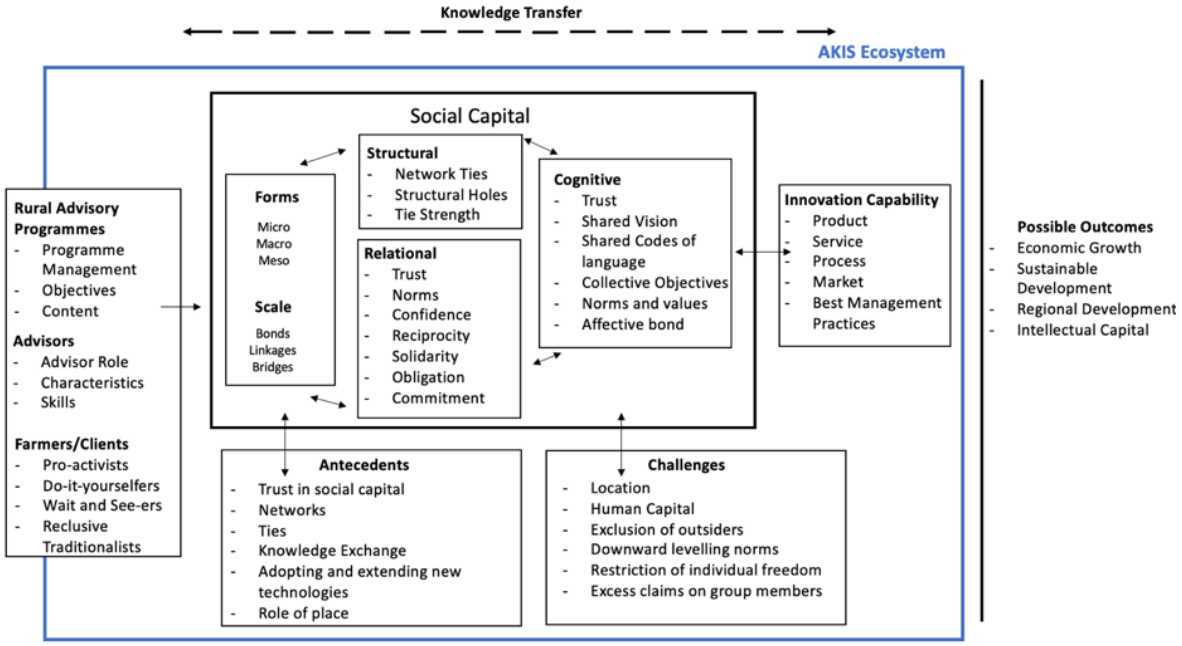


Figure 1: Conceptual Framework

4. Method

This research employs a qualitative, inductive methodology to achieve the research aim (to contribute to new insights into how social capital is developed in rural, farm contexts and to analyse the mediating role social capital might have on farmers innovation capabilities). A qualitative exploratory inductive approach is adopted due to a lack of prior research into the role of farmers and advisors in developing social capital and knowledge exchange (Kepes and McDaniel, 2013). Exploratory research is useful for problems which are not easily defined (Saunders et al., 2012). Jebb et al. (2016) identifies that inductive research is useful for theory building in underexplored contexts. The initial data collection to date has involved semi-structured interviews, observations, and document analysis. These tools are triangulated to increase quality and validity of data (Golafshani, 2015; Carter et al., 2014). This project is part of a larger PhD study which will use multiple case studies, but for the purpose of this paper, the results from a pilot study are presented.

The pilot study selected a European Partnership Programme (EIP) based on the profile of respondents and programme aims and objectives. Further selected cases will be heterogeneous, while sharing similar macro-environmental conditions within a clearly defined institutional and geographic context (Miller, 2011; Linton and Kask, 2017). This will facilitate comparison and theory development for findings to be "information rich" (Saunders et al., 2016).

A breakdown of interview types and numbers can be found in Table one. Interviews were held with participants, co-ordinators, funders, and other actors within the AKIS Ecosystem of the programme. This provided a holistic view of the case. Interview questions were influenced by the conceptual framework, structured around topics relevant to the study. This enabled the interviewer to obtain more in-depth knowledge and provide valuable data (Saunders et al., 2016). The semi-structured approach allows various themes to be discussed and allows flexibility to add further questions (Yin, 2014). Ideally, interviews will be carried out in a longitudinal approach, however, due to the scattered timeframes of programmes, repeat interviews and critical incident technique may be used.

Table 1: Interview Structure

Interviewee Type	Number of interviewees
Programme participants	5
Programme co-ordinators	2
Programme funders	1
Other actors/stakeholders (e.g., agricultural trade bodies).	1

4.1 Data analysis

Data analysis was conducted at the pilot individual case level, becoming familiar with the sets of data before a cross-case pattern approach will be applied within the main study. This method was chosen as it mobilises knowledge, compares cases and produces new knowledge (Khan and VanWynsberghe, 2008). Gioia et al's. (2014) coding process is followed, resulting in first order categories, second order themes and aggregate dimensions, providing clarity on data structure and ensuring information richness. NVivo is used to assist with management and analysis of data.

5. Discussion of findings

Interviews from the pilot study were recorded, transcribed, and coded both manually and through the use of NVivo 12. Open inductive coding was used which resulted in the researcher extracting empirically driven codes from the transcription. This has been outlined in a codebook and can be found in Table 2

Table 2: NVivo Codebook

Name	Description	Files	References
Advisor knowledge	Advisor knowledge of Programme	6	6
Level of trust	Perceived level of trust with advisor-farmer	4	4
Negative level of trust for advisor	Unlikely to accept advice from advisor	3	3
Positive level of trust for advisor	Likely to accept advice without question	3	3
Resistance	Accept advice with caution or resistance, subject to their own research	3	3
Covid-19 implications on network building	Covid impacted the Programme in a negative way	2	2
Levels of support	Participants felt levels of support decreased	3	3
Network building	Participants felt Covid-19 impacted network building and relationships	3	3
Outcomes of Programme relationships	Outcomes achieved from the Programme	2	2
Bonding social capital	Increased bonding social capital, friends, and acquaintances	4	4
Improved trust	Improved trust for the advisor over the period of the Programme	5	5
Innovation capabilities	Increased level of innovation shown within the Programme	3	4
Participant Innovation levels	How likely the participant is to innovate	6	6
Closed to innovation	Unlikely to innovate, laggard	2	2
Open to innovation	Likely to innovation, innovator	4	4
Struggle with innovation	Would like to innovate but struggle with adoption to technology	3	3
Peer-to-peer learning	Learning from other participants rather than the advisor	5	5
Importance of farm events and workshops	Preferred on farm physical events to see another participant's farm	5	5
Learning from participants	Enjoy listening and learning from others	4	4
Social value	Attend events and workshops for the social value the Programme provides	4	4

The findings resulted in the identification of five key themes, namely, advisor knowledge, Covid-19 implications on network building, outcomes of programme relationships, participant innovation levels and peer-to-peer learning. Each of the themes and corresponding subthemes were found to have varying impacts on knowledge exchange, the building of trust between programme advisor and participants, and innovation adoption levels. Themes, subthemes and supporting quotes have been outlined in Figure 2.

The key findings from the pilot study is consistent with themes identified from the literature review, and which informed the conceptual model (figure one). The findings address gaps in knowledge around the various types of social capital and their value for innovation. Murphy et al., (2016) and Fisher (2016) describe the uncertainty of business support programme's ability to develop strong social capital whereas these pilot study findings indicate that 3 participants have developed close bonding relationships within the programme, 4 have established a trustworthy relationship with their advisor and 3 have increased their innovation capabilities from the programme. The findings begin to address gaps in knowledge on how bonding, linking, and bridging social

capital can lead to innovation (Cofré-Bravo et al., 2019). They reveal the various types of relationships farmers have with their advisors, ultimately leading to intellectual capital. Further exploration is needed in the main study to fully understand what types of innovation are adopted from various categories of social capital.

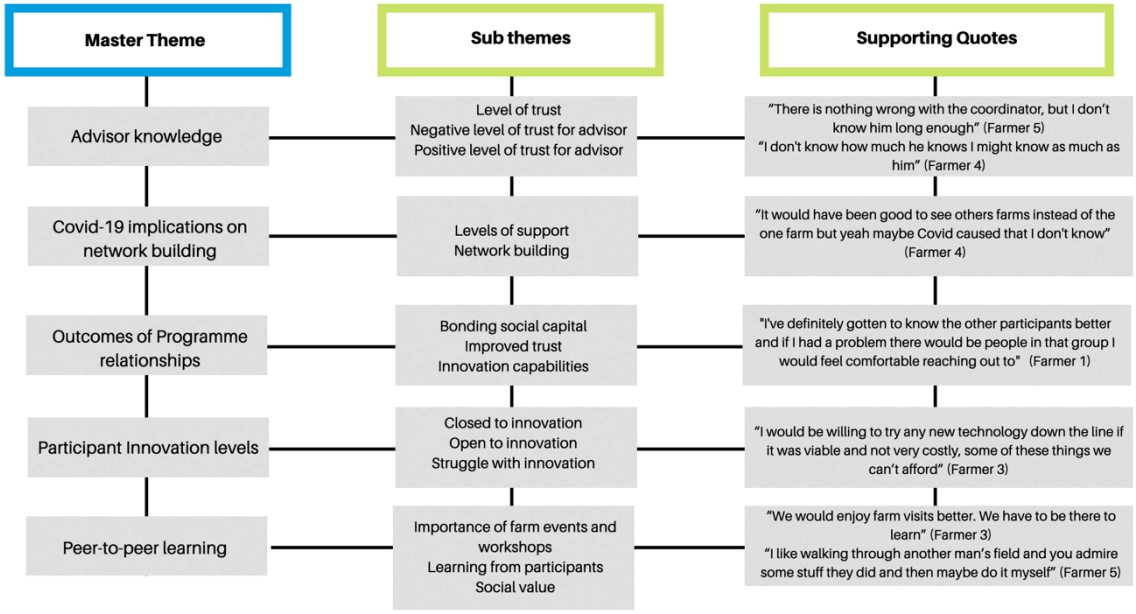


Figure 2: Outline of themes, subthemes and supporting quotes for pilot study.

6. Conclusion

This aim of this paper was to investigate the role that business support programmes in developing social capital and collaborative approaches among farmer clients. The paper considers the accumulation of social capital and intellectual capital and its effect on knowledge exchange. The paper has presented a conceptual framework and pilot study findings, which will inform further data collection and investigation. In the next stage of the research, six support programmes in the AKIS network (in Northern Ireland and the Republic of Ireland) will be studied. Data collection methods will again include interviews and observations with programme participants and brokers/advisers of support programmes along with documentary analysis.

References

Adler, P.S. and Kwon, S. (2002) Social Capital: Prospects for a New Concept. *The Academy of Management Review*, [online] 27(1), pp.17–40.

Alexander, R. (2018) *Tacit, Explicit, and Implicit Knowledge: Definitions and Examples*. [online] Bloomfire.

Aral, S. and Walker, D. (2014) Tie Strength, Embeddedness, and Social Influence: A Large-Scale Networked Experiment. *Management Science*, 60(6), pp.1352–1370.

Bernardi, L., Huinink, J. and Settersten, R.A. (2019) The life course cube: A tool for studying lives. *Advances in Life Course Research*, 41, p.100258.

Bhandari, H. and Yasunobu, K. (2009) What is Social Capital? A Comprehensive Review of the Concept. *Asian Journal of Social Science*, 37(3), pp.480–510.

Boschma, R.A. and ter Wal, A.L.J. (2007) Knowledge Networks and Innovative Performance in an Industrial District: The Case of a Footwear District in the South of Italy. *Industry & Innovation*, 14(2), pp.177–199.

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J. and Neville, A.J. (2014). The use of triangulation in qualitative research. *Oncology nursing forum*, 41(5), pp.545–7. doi:10.1188/14.ONF.545-547.

Cerf, M., Bail, L.E., Lusson, J.M., Omon, B. (2017) Contrasting intermediation practices in various advisory service networks in the case of the French Ecophyto plan. *J. Agric. Educ*, (23), 231–244.

Clark, L. (2010) Seeing the social capital in agricultural innovation systems: using SNA to visualise bonding and bridging ties in rural communities. *Knowledge Management for Development Journal*, 6(3), pp.206–218.

Cofré-Bravo, G., Klerkx, L. and Engler, A. (2019) Combinations of bonding, bridging, and linking social capital for farm innovation: How farmers configure different support networks. *Journal of Rural Studies*, 69, pp.53–64.

D'avino, A. (2019) *The Agricultural Knowledge and Innovation System (AKIS) under the new CAP AKIS, farm advice and networking for innovation networX event -12 April 2019 Alberto D'AVINO European Commission DG Agriculture and Rural Development Unit B2 -Research and Innovation*.

Dasgupta, P. and Ismail Serageldin (2000) *Social capital : a multifaceted perspective*. Washington, D.C.: World Bank.
Díez-Vial, I. and Montoro-Sánchez, Á. (2014) Social capital as a driver of local knowledge exchange: a social network analysis. *Knowledge Management Research & Practice*, 12(3), pp.276–288.
Durlauf, S.N. and Fafchamps, M. (2004) *Social capital*. Cambridge (Ma): Nber.
Easterby-Smith, M., Lyles, M.A. and Tsang, E.W.K. (2008) Inter-Organizational Knowledge Transfer: Current Themes and Future Prospects. *Journal of Management Studies*, [online] 45(4), pp.677–690.
Faure, G., Knierim, A., Koutsouris, A., Ndah, H.T., Audouin, S., Zarokosta, E., Wielinga, E., Triomphe, B., Mathé, S., Temple, L. and Heanue, K. (2019) How to Strengthen Innovation Support Services in Agriculture with Regard to Multi-Stakeholder Approaches. *Journal of Innovation Economics*, 28(1), p.145.
Fine, B. (2001) *Social Capital Vs Social Theory: Political Economy and Social Science at the Turn of the Millennium*. Routledge, London.
Fisher, R. (2016) 'A gentleman's handshake': The role of social capital and trust in transforming information into usable knowledge. *Journal of Rural Studies*, 31, pp.13–22.
Garforth, C., Angell, B., Archer, J. and Green, K. (2003) Fragmentation or creative diversity? Options in the provision of land management advisory services. *Land Use Policy*, 20(4), pp.323–333.
Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013). Seeking Qualitative Rigor in Inductive Research. *Organizational Research Methods*, 16(1), pp.15–31.
Golafshani, N. (2015). Understanding Reliability and Validity in Qualitative Research. *The Qualitative Report*, 8(4).
Grant, R.M. (1996) Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), pp.109–122.
Hasan, I., He, Q. and Lu, H. (2020) The impact of social capital on economic attitudes and outcomes. *Journal of International Money and Finance* [online], 108, p.102162.
Khan, S. and VanWynsberghe, R. (2008). Cultivating the Under-Mined: Cross-Case Analysis as Knowledge Mobilization. *The Analysis, Self-Reflection and Shaping of Professional Work*, 9(1).
King, B., Fielke, S., Bayne, K., Klerkx, L. and Nettle, R. (2019) Navigating shades of social capital and trust to leverage opportunities for rural innovation. *Journal of Rural Studies*, 68, pp.123–134.
Klerkx, L., Petter Stræte, E., Kvam, G.-T., Ystad, E. and Butli Hårstad, R.M. (2017) Achieving best-fit configurations through advisory subsystems in AKIS: case studies of advisory service provisioning for diverse types of farmers in Norway. *The Journal of Agricultural Education and Extension*, 23(3), pp.213–229.
Knierim, A., Boenning, K., Caggiano, M., Cristóvão, A., Dirimanova, V., Koehnen, T., Labarthe, P. and Prager, K. (2015) The AKIS Concept and its Relevance in Selected EU Member States. *Outlook on Agriculture*, 44(1), pp.29–36.
Lamm, K.W., Lamm, A.J., Davis, K. and Swaroop, B.J. (2017) Identifying Knowledge Management Capacity Needs of Rural Advisory Service Networks. *Journal of International Agricultural and Extension Education*, 24(2), pp.93–106.
Lang, R. and Fink, M. (2019) Rural social entrepreneurship: The role of social capital within and across institutional levels. *Journal of Rural Studies*, 70, pp.155–168.
Lawson, B. and Samson, D. (2001) Developing innovation capability in organisations: a dynamic capabilities approach. *International journal of innovation management*, 05(03), pp.377–400.
Lee, R. (2009) Social capital and business and management: Setting a research agenda. *International Journal of Management Reviews*, 11(3), pp.247–273.
Lefebvre, V.M., Sorenson, D., Henchion, M. and Gellynck, X. (2016) Social capital and knowledge sharing performance of learning networks. *International Journal of Information Management*, 36(4), pp.570–579.
Lerro, A., Linzalone, R. and Schiuma, G. (2009) Modelling organisational innovation capability: a knowledge-based approach, Proceedings of the 4th IFKAD.
Levdokymov, V., Lehenchuk, S., Zakharov, D., Andrusiv, U., Usatenko, O. and Kovalenko, L. (2020) Social capital measurement based on "The value explorer" method. *Management Science Letters*, pp.1161–1168.
Lins, K.V., Servaes, H. and Tamayo, A. (2017) Social Capital, Trust, and Firm Performance: The Value Of Corporate Social Responsibility During The Financial Crisis. *The Journal Of Finance*, 72(4), Pp.1785–1824.
Linton, G. and Kask, J. (2017). Configurations of entrepreneurial orientation and competitive strategy for high performance. *Journal of Business Research*, 70, pp.168–176. doi:10.1016/j.jbusres.2016.08.022.
Moran, P. (2005) Structural vs. relational embeddedness: social capital and managerial performance. *Strategic Management Journal*, 26(12), pp.1129–1151.
Muller, A., Välikangas, L. and Merlyn, P. (2005) Metrics for innovation: guidelines for developing a customized suite of innovation metrics. *Strategy & Leadership*, 33(1), pp.37–45.
Murphy, L., Huggins, R. and Thompson, P. (2016) Social capital and innovation: A comparative analysis of regional policies. *Environment and Planning C: Government and Policy*, [online] 34(6), pp.1025–1057.
Nahapiet, J. and Ghoshal, S. (1998) Social Capital, Intellectual Capital, and the Organizational Advantage. *The Academy of Management Review*, 23(2), pp.242–266.
Portes, A. (1998) Social capital: its origin and applications in modern sociology. *Annual Review of Sociology*, 24, pp. 1–24.
Portes, A. and Landolt, P. (1996) The downside of social capital. *vtechworks.lib.vt.edu*. [online] Available at: http://hdl.handle.net/10919/67453 [Accessed 17 Feb. 2021].
Putnam, R. (1995) Bowling alone: America's declining social capital. *Journal of Democracy*, 6(65-78).
Putzel, J. (1997) Policy arena accounting for the 'dark side' of social capital: reading Robert Putnam on democracy. Journal of International Development 9 (7), 939.

Rajapathirana, R.P.J. and Hui, Y. (2018) Relationship between innovation capability, innovation type, and firm performance. *Journal of Innovation & Knowledge*, 3(1), pp.44–55.

Rijswijk, K. and Brazendale, R. (2017) Innovation networks to stimulate public and private sector collaboration for advisory services innovation and coordination: the case of pasture performance issues in the New Zealand dairy industry. *J. Agric. Educ. Ex*, 23.

Saunders, M., Lewis, P. & Thronhill, A. (2012). Research Methods for Business Students (4th ed.). Harlow: Pearson Education Ltd.

Saunders, M., Lewis, P. and Thornhill, A. (2019). *Research Methods for Business Students.* 8th ed. Pearson.

Saunila, M. and Ukko, J. (2012) A conceptual framework for the measurement of innovation capability and its effects. *Baltic Journal of Management*, 7(4), pp.355–375.

Scharmer, C. (2001) Self-transcending knowledge: sensing and organizing around emerging opportunities. *Journal of Knowledge Management*, 5(2), pp.137–151.

Skarzynski, P. and Rowan Gibson (2008) *Innovation to the core : a blueprint for transforming the way your company innovates*. Boston, Mass.: Harvard Business School Press.

Smith, C., Smith, J.B. and Shaw, E. (2017). Embracing digital networks: Entrepreneurs' social capital online. *Journal of Business Venturing*, 32(1), pp.18–34. doi:10.1016/j.jbusvent.2016.10.003.

Subramaniam, M. and Youndt, M.A. (2005) The Influence of Intellectual Capital on the Types of Innovative Capabilities. *Academy of Management Journal*, 48(3), pp.450–463.

Teilmann, K. (2012) Measuring social capital accumulation in rural development. *Journal of Rural Studies*, 28(4), pp.458–465.

Tsai, W. and Ghoshal, S. (1998) Social capital and value creation: the role of intrafirm networks. *Academy of Management Journal*, 41(4), pp.464–476.

Tura, T. and Harmaakorpi, V. (2005) Social capital in building regional innovative capability. *Regional Studies*, 39(8), pp.1111–1125.

Ukko, J., Saunila, M., Parjanen, S., Rantala, T., Salminen, J., Pekkola, S. and Mäkimattila, M. (2016) Effectiveness of innovation capability development methods. *Innovation*, 18(4), pp.513–535.

Woolcock, M. and Narayan, D. (2000) Social Capital: Implications for Development Theory, Research, and Policy. *The World Bank Research Observer*, 15(2), pp.225–249.

Yin, R. (2014). Case Study Research Design and Methods (5th ed.). Thousand Oaks, CA: Sage. 282 pages. *The Canadian Journal of Program Evaluation*. doi:10.3138/cjpe.30.1.108.

Zmerli, S. (2010) Social capital and norms of citizenship: an ambiguous relationship? American Behavioural Scientist 53 (5), 657.

Major Drivers to Innovation in Higher Education Institutions of Developing Countries.

Alfred Hove Mazorodze and Peter Mkhize
University of South Africa, Department of Information Systems, School of Computing, Johannesburg, South Africa
mazorodzeah@yahoo.com
mkhizpl@unisa.ac.za

Abstract: In both developed and developing countries, innovation in higher education improves decision-making capabilities and contributes to institutional growth. Similarly, all higher education institutions naturally store and access knowledge in some manner and these institutions are expected to be at the cutting edge of such innovation. To this date, institutional recognition determines if a higher education institution meets or surpasses the minimum standards of quality education across the globe. Knowledge-sharing builds collective knowledge, retains knowledge and increases innovation capabilities. Higher education institutions in developing countries should be comparable to their counterparts in developed countries. The study therefore explores the key drivers to innovation in higher education institutions of developing countries using a survey strategy. The study collected different views from academics on the core drivers to innovation. An adequate sample of 240 participants was carefully chosen from 4 state universities in Zimbabwe, a developing country in Africa, with a 66.6% response rate. The research participants were actively involved in higher education functions of teaching, learning and research. After performing reliability tests on the data collection instruments, the researcher performed a descriptive analysis to measure the effect of the drivers towards the much needed innovation in higher education institutions. The empirical findings confirm that the most important driver for innovation in higher education institutions is Knowledge Management, followed by technological advances, competitive advantage and globalisation. It was established that technology is an enabler to higher education functions and is now embedded into teaching, learning and research. This educational transformation empowers academics with technical skills. The adoption of Knowledge Management practices supported by up-to-date technology will certainly improve the capabilities of these institutions. Because knowledge cannot be imitated by institutions to gain a competitive advantage, properly investing in Knowledge Management should certainly strengthen an institution into more competitiveness. The study therefore recommends the adoption of Knowledge Management practices for all higher education institutions in developing countries.

Keywords: Knowledge Management, Information Technology, innovation, competitive advantage, higher education institutions, Communities of Practice

1. Introduction

Innovation is a very important factor that makes higher education institutions (HEIs) compatible with the dynamic higher education landscape. In general, innovation in higher education means creating institutional value and recognition, improved decision-making capabilities as well as growth and sustainability. Dee (2016) posits that institutional recognition helps to determine if an institution meets or surpasses the minimum standards of quality higher education. In addition to that, innovation in higher education also means that an institution can make well informed decisions. All HEIs naturally store and access knowledge in some manner and these educational institutions are expected to be at the cutting edge of such innovation (Farinha, Nunes, Ferreira and Fernandez, 2018). Ranking of higher education institutions measure their performance using a range of indicators, which are combined into an overall score determining a higher education institution's rank at national or international level (Times Higher Education, 2020). HEIs are ranked according to their core missions of teaching, research and the international outlook.

In an effort to bring about innovation in HEIs of developing countries, this study investigates the drivers to such innovation so that the institutions become innovative and competitive like their counterparts in developed countries. The drivers to innovation considered for this study are Knowledge Management (KM), technological advances, globalisation and competitive advantage. It is vital to state here that the drivers to innovation in this study are not the end-all. KM, which is a fundamental organisational process to bring innovation within every higher education institution is reviewed to understand how it contributes to institutional value. Technological advances are reviewed to see how technology really enables educational functions of creating and sharing knowledge. Because of increased demand for better higher education throughout the world, globalisation creates worldwide networks of universities (Al-Husseini and Elbeltagi, 2018). Competitive advantage describes the ability of a HEI to perform better than its competitors (Farinha et al, 2018). When the effects of these drivers

towards innovation are acknowledged, then the HEIs in developing countries could be innovative like those in developed countries.

1.1 Background of the study

The most important engine for innovation in any HEI is knowledge (Lee and Trimi, 2018) and continuous innovation is very vital for almost all academic institutions. All HEIs look forward to exponential growth and sustainability and such growth is very important especially for developing countries. HEIs in developing countries including Zimbabwe, are not very innovative in comparison to their equivalents in developed countries and this could be attributed to a lack of understanding of what exactly drives innovation. In addition, there is also lack of adequate resources to implement effective systems geared towards innovation. Changes in technology and changes in how knowledge is shared in HEIs are different illustrations of innovation. There is therefore greater need to understand what exactly drives innovation from an academic perspective.

1.2 Problem statement

Higher education institutions (HEIs) in developing countries are not very innovative in comparison to their equivalents in developed countries because they lack a knowledge-sharing culture. The knowledge-sharing culture mentioned here could be promoted by implementing KM practices enabled by proper technologies. Cancino, Merigo and Coronado (2017) confirm that HEIs face increased pressure to perform better than their competitors. According to Times Higher Education (2020), certain HEIs perform better than others, even though these might have the same technological and human resources. Such a limitation is noticeable when an institution is always ranked below others. Ramjeawon and Rowley (2017) reported that HEIs recognise the importance of knowledge-sharing as this practice builds collective knowledge, retains knowledge and certainly increases innovation capabilities.

The importance of innovation has been well researched in higher education (Lee, 2018; Lee and Trimi, 2018; McClure, 2015), but there is still a gap in addressing what exactly drives such innovation, especially in developing countries. Empirical evidence by Saad, Guermat and Brodie (2015), established that globalisation, competitive advantage and technological advances are drivers for innovation in HEIs. If globalisation, competitive advantage and technological advances are the drivers for innovation, then, to what extent is this true in HEIs of developing countries, specifically Zimbabwe? This study therefore deliberates on the main factors that could help HEIs in developing countries improve their innovation capabilities. A comprehensive understanding of these factors could result in better ways of teaching, better ways of researching and effective use of technology to enable the smooth academic operations in HEIs of developing countries.

1.3 Research objectives

The study was guided by the following objectives which sought to:

- Evaluate the core drivers to innovation in higher education institutions of developing countries.
- Recommend the adoption of Knowledge Management practices in higher education institutions of developing countries.

This study was premised on a thoughtful understanding that innovation in HEIs is enabled by a combination of social and technical factors including the academic team which forms the institutional knowledge-base. The social and technical factors mentioned here are enabled and supported by information systems in the respective HEIs.

2. Literature review

This section reviews literature from accredited sources on the drivers to innovation in HEIs and it is imperative to state here that the drivers reviewed in this section are not the be-all and end-all. Only those drivers which could possibly contribute to innovation in HEIs of developing countries were reviewed.

2.1 Knowledge Management

Knowledge Management (KM) is about creating institutional value and contributing to strategic issues such as resilience, growth, sustainability, adaptive capacity and innovation. The KM processes offer a proper and convenient way to capture and store an institution's knowledge while individuals and teams are responsible for the generation of a new architecture of knowledge. The key resource in KM is people with relevant work experience (Girard and Girard, 2015; Yazhou and Jian, 2017). It is therefore important to question "What made

these people experts? What made them high performers? What make them so exceptional?" Some standard definitions of KM have been reflected upon in this review to facilitate conceptualisation of the research area and how it could drive innovation in HEIs of developing countries.

The pioneers and theorists to KM (Nonaka and Takeuchi, 1995), define KM as a process of capturing, sharing and effectively using organisational knowledge. According to O'Dell and Hubert (2011), KM is a systematic process that enables knowledge to grow, flow and create institutional value. Taking cue from the systematic flow of information above, Liu (2016) submits that KM is a multi-disciplinary approach to achieving institutional objectives by making the best use of knowledge possessed by individuals. Liu further stresses that KM concentrates on processes such as creating and sharing knowledge as well as the technical and cultural pillars that support them. Girard and Girard (2015) describe KM as the process of creating, sharing and managing organisational knowledge.

From the definitions above, the words used are: organising, creating, sharing and managing. Thus, systematicity and coordination run through the definitions submitted, implying that KM is critically important in higher education institutions for their survival and growth. These two are common features in the conceptualisation of KM. Such a mapping is extended in other authors such that Young (2013) concur with Liu (2016)'s view and suggest that KM involves carrying out activities involved in capturing, sharing and applying knowledge and people skills to solve real world problems. It is therefore important to highlight here that KM is one of the most important drivers for innovation in HEIs and the process focuses on creating and sharing knowledge. Findings by Sadeghi Boroujerdi, Hasani and Delshab (2020) demonstrated that there is a substantial relationship between KM and institutional innovation. Value-creation in HEIs therefore lies in the KM capabilities to share and re-use knowledge.

2.2 Technological advances

Technology should therefore be seen as an enabler to higher education functions of creating and sharing knowledge and should not be seen as a replacement for people with valuable knowledge and work experience. In the knowledge-economy, HEIs depend on production, transmission and dissemination of knowledge which is done using the most appropriate technologies. The HEIs, specifically universities play a great role in all these areas. In this 21st century, technology is integrated into teaching, learning and research at almost all HEIs across the world (Christensen and Eyring, 2011; Henriksen, Creely and Henderson, 2021). This technology transforms educational practices by empowering academics with practical skills. Despite the advanced technologies available today on the market, simple technology, which is user-friendly, is preferred to allow academics to communicate and collaborate effectively. Massingham (2014) advises that knowledge-sharing tools be updated regularly to match the rapid technological changes. Arguably, technological advances help HEIs to gain a competitive advantage.

According to Lee (2018), HEIs face serious issues of properly organising and managing knowledge. An effective Knowledge Management System (KMS) supported by information systems in academic institutions will certainly help to make right decisions at right time (Khedhaouria and Jamal, 2015). The integration of an institution's knowledge processes with its business processes of academic delivery and innovation will substantially enhance an institution's performance. We can therefore deduce that upgrading and updating new technology in an academic institution is bound to improve its innovation capabilities. Laudon and Laudon (2020) explain that the role played by Information Technology (IT) in all business operations including academic institutions is to provide a knowledge-sharing platform. Alshehri and Cumming (2020) add that IT-based KM intervention in HEIs prove to be a promising technological management tool that enhances teaching, learning and research.

2.3 Globalisation

The rise in newly established HEIs globally, is another important and visible driver for innovation (Saad, Guermat and Brodie, 2015). Thus, globalisation creates a worldwide network of universities. There is increased demand for improved and better higher education throughout the world (Al-Husseini and Elbeltagi, 2018) and advances in IT have facilitated the delivery of educational services across national borders. Globalisation interconnects institutions across the world and this connection makes HEIs visible to each other. The visibility mentioned here facilitates the necessary knowledge flows between and among academics. HEIs should be recognised globally (Times Higher Education, 2020), and to compete in such a stiff completion, the institutions should continuously try to innovate so that they outperform their competitors. Changes in educational models are some of the notable challenges faced by HEIs, especially in developing countries.

HEIs are multifaceted institutions with different backgrounds, different cultures and different resources. These HEIs face a more interconnected world where knowledge and innovation are essential ingredients for success. Globalisation encourages HEIs to think about the different ways they teach, conduct research and manage the institutions (Saad et al, 2015). Institutions of higher learning cannot exist in isolation as they have to continuously collaborate with their competitors through conferences for example. Thus, for institutions in developing countries to be innovative, they should collaborate in different ways with well-renowned institutions across the world.

2.4 Competitive advantage

With specific reference to HEIs, competitive advantage is defined by Farinha (2018), as the ability of an institution to perform better than its competitors. All institutions of higher learning, globally and in Zimbabwe, are working towards creating and sustaining superior performance. Since knowledge cannot be copied or imitated by institutions to gain competitive advantage, investing in KM should certainly bolster an institution into more competitiveness and innovation. Farooq (2018) advocates that institutions of higher learning continuously strive to create mechanisms that distinguish them from their competitors. It is therefore not an overstatement that competitive advantage drives innovation and is positively related to value-creation. Knowledge acquisition and effective use of such knowledge is the only way HEIs can have competitive advantage (Mahdi, Nassar and Almsafir, 2019). In most HEIs, sustainable competitive advantage lies in the effective channeling of intellectual capital.

Farooq (2018) underscore that the ability of an institution to create and share knowledge is the primary source of competitive advantage. Thus, value-creation in HEIs is delivered by academics with research proficiency. Yazhou and Jian (2017) argue that it is not the stock of knowledge that provides an institution with competitive advantage, but the way knowledge is applied in value-creation. As implied in the generic model of an information system by Laudon and Laudon (2020), value creation starts with input-process-output. In academic institutions, the academic or researcher contributions are considered as inputs, socialisation in academic Communities of Practice as the process and value-creation as the output. Following Nonaka's (1991) seminal advice "….the only time lasting competitive advantage is knowledge…" we find knowledge-based institutions and competitive advantage. It is important to further highlight here that superior knowledge bases result from effective knowledge-sharing and knowledge inventories are the basis for competitive advantage.

From the literature review, we hypothesized that KM facilitates knowledge flow in HEIs which is an essential ingredient to institutional innovation. Upgrading and updating technology in a HEI is bound to improve the innovation capabilities. The next section presents the methodology adopted to complete this study.

3. Research Methodology

A survey strategy was employed to gather data from 240 academics at four HEIs in a developing country in Africa called Zimbabwe. The sample was selected from purposefully selected academics at four HEIs in Zimbabwe, and interestingly, the response rate was 66.6%. The survey quantitatively gathered the different opinions from the academics on the major drivers to innovation in HEIs. It is important to mention here that all the participants were actively involved in higher education functions of teaching, learning and research. The study adopted a survey using online questionnaires because the authors, Bhattacherjee (2012) and Oates (2006) concur that surveys offer honest responses in comparison to other research strategies. Bhattacherjee, (2012) also established that, with surveys, the costs for data gathering are also minimised. Moreover, the strategy permits statistical analysis of variables to ensure that precise results are achieved in answering the research problem.

A questionnaire was developed by the researcher from a thorough literature review on the different factors and variables that could make HEIs more innovative. All the questions on the questionnaire data collection instrument were tested for validity and reliability. According to Leedy and Ormrod (2016), validity of a research instrument describes the extent to which the instrument measures what it is envisioned to measure. In simple terms, reliability means dependability of the research instruments. The reliability described here is expressed statistically, usually as a reliability coefficient, which is attained by establishing the correlation between variables. Reliability is therefore the degree to which results are dependable over time (Yin, 2016). A total of 20 statements were categorised into 4 dimensions which we call drivers for this study labelled: Knowledge Management, technological advances, globalisation and competitive advantage. Propositions were made for each innovation driver. All the questions on the questionnaire were on a Likert scale, ranging from strongly agree (5) to strongly disagree (1).

The responses were collected from the last quarter of 2021 to the first quarter of 2022 using a mailing list. The participants had to click on the web link provided to voluntarily complete the questionnaire and the responses were written to the researcher's Google Drive. It is very important to state that the data gathering process commenced after obtaining an ethical clearance from the university and also after getting permission from the HEIs in Zimbabwe. The ethical clearance reference number is 2021/CSET/SOC/041, valid for 5 years from 14 September 2021 to 14 September 2026. To conform to the ethical principles in research, the participant information sheet and a consent form were provided and the participants partook out of their own volition, thus there was no coercion. To protect the anonymity of the research participants, the data was analysed collectively using Microsoft Office Excel 2019 and Statistical Package for Social Sciences (SPSS) as the researcher was conversant with both packages.

4. Discussion of results

The data which was collected using an online questionnaire was loaded into a spreadsheet for quantitative data analysis. At first, the researcher had to check that the items on the questionnaire measured the intended constructs and could be replicated yielding the same or similar results. Reliability tests were conducted on all the drivers for innovation associated with this study and the outcomes are presented in Table 1 below.

Table 1: Reliability of factors using Cronbach's Alpha

		Innovation drivers			
		Knowledge Management	**Technological Advances**	**Globalisation**	**Competitive Advantage**
	Cronbach's Alpha	**0.61**	**0.74**	**0.68**	**0.81**
Knowledge Management	KM1	0.61			
	KM2	0.67			
	KM3	0.93			
	KM4	0.76			
	KM5	0.62			
	KM6	0.66			
Technological Advances	TA1		0.85		
	TA2		0.63		
	TA3		0.76		
	TA4		0.77		
	TA5		0.81		
Globalisation	GL1			0.53	
	GL2			0.62	
	GL3			0.71	
	GL4			0.83	
Competitive Advantage	CA1				0.75
	CA2				0.79
	CA3				0.62
	CA4				0.74
	CA5				0.84

The reliability tests were performed per factor and they confirm the appropriateness of the data collected and analysed. On the Knowledge Management construct, Cronbach's Alpha yielded 0.61; technological advances yielded 0.74; globalisation yielded 0.68 and competitive advantage produced 0.81 as shown in Table 1 above. According to Salkind (2015), Cronbach's Alpha above 0.6 is acceptable although other scholars advocate for higher values of 0.90 to 0.95 to perform inferential statistics. In line with Salkind (2015)'s suggestion, the researcher therefore performed only descriptive statistics to evaluate the major drivers to innovation in HEIs. The data was amassed using a Likert scale questionnaire to assess the different opinions of the academics on the various concepts geared towards innovation in HEIs. Table 2 below presents a summary of the 240 responses obtained from academics on the major drivers to innovation in higher education institutions (Knowledge Management, technological advances, globalisation and competitive advantage). Table 2 below, shows the average of responses on the different propositions for each innovation driver.

Table 2: Summary of responses on the innovation drivers in higher education institutions

Drivers to innovation	Summary of responses				
	Strongly Agree (5)	Agree (4)	Not Sure (3)	Disagree (2)	Strongly Disagree (1)
Knowledge Management	47%	32%	15%	6%	0%
Technological Advances	44%	30%	13%	6%	7%
Globalisation	42%	28%	7%	13%	10%
Competitive Advantage	25%	25%	33%	10%	7%

Figure 1 below shows the summary of responses followed by a detailed discussion of the responses from the academics. In Figure 1 below, positive responses are those where the participants strongly agreed and agreed respectively to the different propositions on a specific driver. Neutral reflects on the responses where participants were not sure or indecisive on the suggestions. Negative is a combination of participants who disagreed and strongly disagreed with the different propositions on a specific innovation driver.

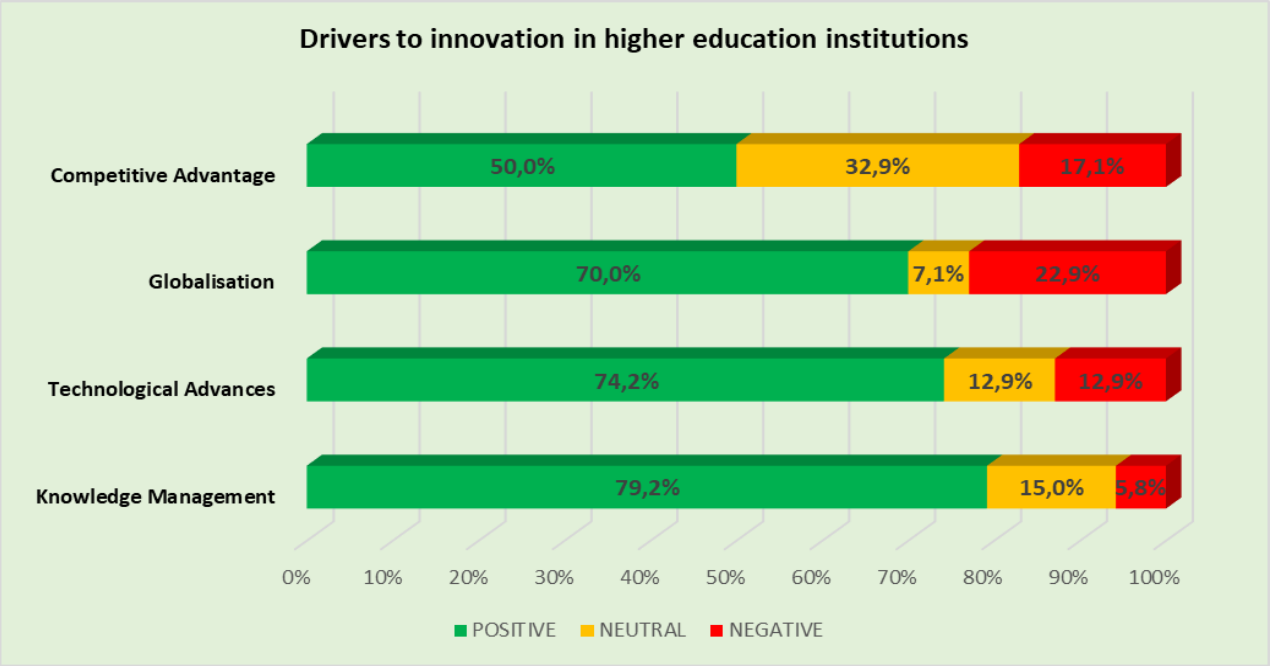


Figure 1: Drivers to innovation in higher education institutions

Based on the mean from the submissions by the academics, we can deduce that KM is an important driver to innovation in HEIs of developing countries. As can be seen from Figure 1 above, an overwhelming 79.2% of the participants responded positively to the propositions on the KM constructs driving innovation in HEIs. Just 15% of the participants were indecisive if KM could bring about innovation in HEIs and only 6% had negative views on the propositions. The key resource in KM is people with relevant work experience (Dayan, Heisig, and Matos, 2017). In addition, KM aids in the continuous transformation of individual learning to institutional learning. It has been also established in literature (Givens and Stocker, 2020) that KM boosts collaboration and knowledge-sharing. From the findings collected, presented and analysed, we can underscore that KM through knowledge-sharing and collaboration is a weighty concern in HEIs. Empirical evidence in this study has positively confirmed that KM increases the learning and innovation capabilities of academics at HEIs of developing countries. The study also established that KM offers practical ways to capture and store an institution's knowledge while academics are concerned about the generation of new knowledge. We can therefore extrapolate that KM is an important driver to innovation and this is imperative for institutional survival and growth.

Innovation in HEIs could also be triggered by several technologies. Information Technology (IT) provides a platform for collaborative knowledge-sharing which is very vital in almost all HEIs. Laudon and Laudon (2020) adds that the role played by IT in all business operations, including academic institutions, is to provide a knowledge-sharing platform. Technology is integrated into teaching, learning and research at almost all HEIs across the world (Henriksen, Creely and Henderson, 2021) and this technology should be updated regularly. It

emerged from this study that upgrading and updating new technology improves an academic institution's innovation capabilities. A staggering, 74.2% of the academics settled on the premise that technology enables higher education functions of creating and sharing knowledge. Findings also confirmed that technology cannot replace academics with valuable knowledge and experience. We can therefore generalise that technology is an enabler to higher education functions and can help those institutions gain a competitive advantage. Based on the empirical evidence, we can conclude that technological advances are a great driver to innovation in higher education where majority of the participants responded positively to the propositions on technological advances bringing about innovation in HEIs.

Globalisation is one of the drivers to innovation in HEIs as it creates a worldwide networks of universities. Majority of the participants settled that HEIs cannot exist in isolation. This finding demonstrates that international collaboration between HEIs enable researchers to access additional expertise, gain new perspectives on research practices and build relationships with other scholars in specific fields. The academics can therefore form Communities of Practice for collaborative knowledge-sharing. Collaboration helps HEIs to innovate and adapt in a time of rapid and continuous change. The global recognition of an institution's reputation is very vital to a point that 70% of the academics supported the proposition. Only 7.1% of the academics were indecisive and 22.9% had negative views on the different propositions. We can therefore infer that globalisation connects institutions across the world and this networking makes universities visible to each other. There is increased demand for improved and quality higher education throughout the world, hence the need to collaborate both locally and internationally.

Competitive advantage was also confirmed to be an important driver to innovation in HEIs. McClure (2015) posits that knowledge is a very important resource that offers competitive advantage in HEIs. Superior knowledge bases result from effective knowledge-sharing and interestingly, 50% of the academics concur that superior knowledge bases results from effective knowledge-sharing. From this finding, we can infer that HEIs should develop knowledge-sharing strategies as a means to gaining a competitive advantage. In the related literature, Farooq (2018) established that knowledge inventories are the anchor for competitive advantage and in this study, participants confirmed that knowledge inventories form the basis for competitive advantage in HEIs. We can therefore argue that it is not the stock and archive of knowledge that provides an institution with competitive advantage, but the way knowledge is applied in value-creation. The ability of an institution to create and share knowledge is therefore the primary source of competitive advantage.

5. Study contribution and conclusion

The study contributes towards an understanding that, in the information and knowledge society that we live in, the source of welfare is knowledge. Constant innovation is germane for all HEIs and the most important engine for such innovation is knowledge. From the findings, we can underscore that KM through knowledge-sharing and collaboration is at the centre of prerogatives in HEIs. This collaboration with experts both locally and internationally in different fields certainly provides a way to tap new knowledge which is central in bringing about innovation. Technology transforms educational practices by empowering academics with practical skills in HEIs. In spite of the advanced technologies available today on the market, simple technology which is user-friendly is preferred to allow effective communication and collaboration by the academics. An effective Knowledge Management System (KMS) supported by IT in HEIs may help in the decision making processes.

HEIs should be recognised globally, and to compete in such a stiff completion, they should continuously strive to innovate so that they outperform their competitors. The institutions should always collaborate with their competitors through knowledge-sharing in their Communities of Practice. Since knowledge cannot be copied or imitated by institutions to gain competitive advantage, investing in KM should certainly bolster an institution into more competitiveness and innovation. It is therefore not an exaggeration that competitive advantage drives innovation and is positively related to value-creation in HEIs. The major limitation in this study is that the drivers to innovation discussed are not the be-all and end-all. The drivers discussed could help HEIs in developing countries to be innovative. Further studies can explore other social and technical factors which may possibly improve HEIs capabilities of capturing and using knowledge effectively. In conclusion, the study recommends the implementation of KM practices including creation of Communities of Practice as a means to improving innovation capabilities of the institutions.

References

Al-Husseini, S. and Elbeltagi, I. (2018) "The role of knowledge-sharing in enhancing innovation: A comparative study of public and private higher education institutions in Iraq", *Innovations in Education and Teaching International,* Vol 55, No.1, pp 23-33.

Alshehri, A. and Cumming, T. M. (2020) "Mobile Technologies and Knowledge Management in Higher Education Institutions: Students' and Educators' Perspectives", *World Journal of Education,* Vol 10, No.1, pp 1-12.

Bhattacherjee*,* A. (*2012*) *Social Science Research: Principles, Methods, and Practices.* USF Tampa Bay, Open University Press.

Cancino, C. A., Merigo, J. M. and Coronado, F. C. (2017) "A bibliometrics analysis of leading universities in innovation research", *Journal of Innovation and Knowledge,* Vol 2, pp 106-124.

Chidambaranathan, K. and Swarooprani, B. S. (2017) "Analysing the relationship between organizational culture and knowledge management dimensions in higher education libraries", *Journal of Librarianship and Information Science,* Vol 49, No.1, pp 57–68.

Christensen, C. M. and Eyring, H. J. (2011) *The Innovative University: Changing the DNA of Higher Education from the Inside Out.* San Francisco, CA: Routledge.

Dayan, R., Heisig, P. and Matos, F. (2017) "Knowledge management as a factor for the formulation and implementation of organization strategy", *Journal of Knowledge Management*, Vol. 21, No. 2, pp. 308-329.

Dee, J. R. (2016) *Universities, Teaching and Learning.* In Organizing Academic Work in Higher Education: Teaching, Learning and Identities. New York, NY: Routledge.

Farinha, L., Nunes, S., Ferreira, J. J. and Fernandez, A. (2018) "Understanding the foundations of global competitive advantage of nations. Competitiveness Review" *International Business Journal,* Vol 28 No.5, pp 503-517.

Farooq, R. (2018) "Developing a conceptual framework of knowledge management", *International Journal of Innovation Science*, Vol 1, pp 1757-2223.

Girard, J. P. and Girard, J. L. (2015) "Defining knowledge management: Towards an applied compendium", *Online Journal of Applied Knowledge Management*, Vol 3, No.1, pp 1 – 20.

Givens, T. E. and Stocker, G. (2020) "Time for Change and Solutions: Consolidation and Alliances in Higher Education" [online] https://www.linkedin.com/pulse/time-change-solutions-consolidation-alliances-higher-ed-terri-givens/

Henriksen, D., Creely, E., Henderson, M. (2021) "Creativity and technology in teaching and learning: a literature review of the uneasy space of implementation", *Education Tech Research Development,* Vol 69, pp 2091–2108.

Khedhaouria, A. and Jamal, A. (2015) "Sourcing knowledge for innovation: Knowledge reuse and creation in project teams", *Journal of Knowledge Management,* Vol 19, No.5, pp 932–948.

Laudon, K. C. and Laudon, J. P. (2020) *Management Information Systems: Managing the Digital Firm.* 14th edition. New York: Pearson.

Lee, J. (2018) "The Effects of Knowledge-sharing on Individual Creativity in Higher Education Institutions: Socio-Technical View", *Administrative Sciences,* Vol 21, No.2, pp 2076-3387.

Lee, S. M. and Trimi, S. (2018) "Innovation for creating a smart future", *Journal of Innovation and Knowledge,* No 3, pp 1-8.

Leedy, P. O. and Ormrod, J. E. (2016) *Practical Research: Planning and Design.* 12th edition. Boston, Pearson.

Liu, S. (2016) "Introduction to Knowledge Management" [online] http://web.archive.org/web/20160319233812/Introduction_to_Knowledge_Management.html

Mahdi, O. R., Nassar, I. A., and Almsafir, M. K. (2019) "Knowledge management processes and sustainable competitive advantage: An empirical examination in private universities" *Journal of Business Research,* Vol. 94, 320-334.

Massingham, P. (2014) "An evaluation of knowledge management tools: Part 2 – Managing knowledge flows and enablers", *Journal of Knowledge Management,* Vol 18, No. 6, pp 1101–1126.

McClure, K. R. (2015) "Exploring Curricular Transformation to Promote Innovation and Entrepreneurship: An Institutional Case Study", *Innovative Higher Education,* Vol 40, No.5, pp 429–442.

Nonaka, I. (1991) "The Knowledge-Creating Company"", *Harvard Business Review*, Vol 69, pp 96-104.

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

Oates, B. J. (2006) *Researching information systems and computing*. London: Sage.

Obeidat, Y. B., Tarhini, A., Masadeh, R. and Aqqad, N. O. (2017) "The impact of intellectual capital on innovation via the mediating role of knowledge management: A structural equation modelling approach", *International Journal of Knowledge Management Studies,* Vol 8, No.3, pp 273-298.

O'Dell, C. and Hubert, C. (2011) *The new edge in knowledge how knowledge management is changing the way we do business*. Hoboken: Wiley and Sons.

Ramjeawon, P. and Rowley, J. (2017) "Knowledge management in higher education institutions: Enablers and barriers in Mauritius", *The Learning Organisation,* Vol 24, No.5, pp 1-24.

Saad, M., Guermat, C. and Brodie, L. (2015) "National innovation and knowledge performance: The role of higher education teaching and training", *Studies in Higher Education,* Vol 40, No.7, pp 1194-1209.

Sadeghi Boroujerdi, S., Hasani, K. and Delshab, V. (2020) "Investigating the influence of knowledge management on organizational innovation in higher educational institutions", *Kybernetes*, Vol. 49 No.2, pp. 442-459.

Salkind, N. (2015) *Encyclopedia of Measurement and Statistics*. 1st edition. Thousand Oaks: SAGE.

Times Higher Education, World University Rankings. (2020) [online] https://www.timeshighereducation.com/world-university-rankings/2020/

Torugsa, N. and O'Donohue, W. (2016) "Progress in innovation and knowledge management research: From incremental to transformative innovation", *Journal of Business Research,* Vol 69, pp 1610-1614.

Yazhou, W. and Jian, L. (2017) "The mediating effect of knowledge management orientation on human resource management practices and organizational performance", *International Journal on Advances in Information Sciences and Service Sciences*, Vol 19, No.4, pp 80-90.

Yin, R. K. (2016) *Qualitative Research from Start to Finish.* 2nd edition. New York: The Guilford Press.

Young, R. (2013) *Knowledge Management for the Public Sector*. Tokyo, Japan: Asian Productivity Organization.

Using Domain Redefinition to explain Born Global Firms' Behaviour

Margaret Robb, Andrea Reid, Sandra Moffett and Trevor Cadden
Ulster University, Business School, Northern Ireland
Robb-m9@ulster.ac.uk
a.reid@ulster.ac.uk
sm.moffett@ulster.ac.uk
t.cadden@ulster.ac.uk

Abstract: Many academics cite research gaps in the literature concerning the strategies used by Born Global (BG) organisations to enable competitive advantage and business continuance. (Andersson et al 2020; Eggers et al, 2020; Ibeh et al, 2019; Oyna and Alon, 2018). For the purposes of this paper, the definition of the Born Global is taken from Gabrielsson et al, (2008): "the organisation should be an independent small or medium sized business, have a global vision from inception and demonstrate internationalisation with precocity and speed". Purpose: This paper investigates Domain Redefinition (DR) a component of Corporate Entrepreneurship (CE), as a viable construct to explain competitive advantage and business sustainment in Born Global Firms (BG). Design Approach: This paper will take the form of a short literature review, charting the journey through the literature which led to the discovery of the link between Domain Redefinition and Born Global firms. Findings: The shadow of Schumpeter is imprinted within DR, it is the one form of CE whose behaviour prerequisite is the constant drive to create new markets offering unique products and services (Kuratko and Andretsch, 2009).

Keywords: Born Globals, Schumpeter, Evolutionary Economics, Corporate Entrepreneurship, Domain Redefinition, Competitive Advantage,

1. Introduction

This research presents a short but pertinent literature review concerning the strategy blueprint BG firms' employ for sustainment and competitive advantage. Insight gleaned from examining Evolutionary Economic theory and in particular Schumpeter's contribution, elucidated patterns of behaviour, characteristic to the BG firm. The paper begins by documenting the connection between Schumpeter, Corporate Entrepreneurship and Domain Redefinition. The review then moves to examine the similarities between DR and BG firms' strategy.

2. Corporate Entrepreneurship and Schumpeter

There is broad academic consensus that Schumpeter's work contributed to CE theory (Moss, 2007; Barringer and Bluedorn, 1999). Barringer and Bluedorn (1999, p. 422) advise that *"contemporary entrepreneurship research originated in the work of the economist Schumpeter".* Furthermore, Moss, (2007), advises that the concept of CE, is consistent with both the early and later writings of Schumpeter. Schumpeter (1934;1942), purported the "creative destruction" of existing markets namely, actioning the reorganisation of industries and replacing them with new markets offering innovative products, not previously offered by any other firm (Moss, 2007; Parbotee, 2000; Schumpeter, 1934;1942). Schumpeterian entrepreneurship is distinguishable from other entrepreneurial efforts as it changes and redefines the industry the firm operates in. This produces a fundamental shift from the current, established rules of the competition (Moss, 2007; Parbotee, 2000; Stopford and Baden-Fuller, 1994). Madsen and Servais (1997), suggested that BG firms could grow in a way that correlates with Evolutionary Economic theory and proffered that the theoretical conceptualisations could be constructed from an evolutionary approach.

3. Corporate Entrepreneurship

The strategy literature identifies 3 main types of CE (Parbotee, 2000; Stopford and Baden-Fuller,1994): Corporate Venturing (creation of a new business within an existing organisation (Block and Macmillan, 1993; Hornsby et al, 1993; Burgelman, 1983), Corporate Renewal (renewal of an organisation (Zahra, 1996; Beer, Eisentat, Spector, 1990) and a "Schumpeterian like", major change to an industry (Moss, 2007; Parbotee, 2000; Stopford and Baden-Fuller, 1994; Schumpeter, 1934). These 3 categories were further developed by theorists and are now defined as: Sustained Regeneration, Organisation Rejuvenation, Strategic Renewal, Domain Redefinition and External Entrepreneurship (Castriotti, 2021), Covin and Miles, 1999). Organisational Rejuvenation is an introspective action by the firm where internal procedures and strategies are evaluated with the objective of producing a more competitive posture (Dess et al., 2003). Strategic Renewal involves altering the firm's structure, usually at a corporate level. This type of CE is designed to reshape the business and can affect most departments including operational and even pre-existing external relationships (Zahra, 1996;

Stopford and Baden-Fuller, 1994). External Entrepreneurship focuses on discovering new entrepreneurial opportunities (Dess, 2003) and strives to build and maintain strategic relationships in the external environment. Domain Redefinition (DR) focuses on the creation of new, pioneering market arenas which the organisation can potentially exploit. DR is the only form of CE which necessarily results in the creation of new business (Covin and Miles, 1999).

4. Schumpeter and Domain Redefinition

The strategy associated with DR is very similar to Schumpeterian logic (1934). Schumpeterian reasoning when actioned, results in major changes to an industry (Moss, 2007; Parbotee, 2000; Stopford and Baden-Fuller, 1994; Schumpeter, 1934). He advised opening and creating markets as a means of economic growth, offering new and unique niche products, not currently available in the marketplace. Evidence of Schumpeterian influence can be seen at an industry level (Parbotee, 2000; Stopford and Baden-Fuller, 1994). DR is similar to this with Covin and Miles (1999) advising that organisations use DR in a move to imprint the early structure and change to an industry, desiring to set the standard against which later entrants could be compared (Adeyeye, 2016). According to the literature, the main characteristics of companies employing DR include: the constant drive to discover, enter, redefine and position themselves in new markets (Kuratko and Audretsch, 2009; Dess et al 2003; Miles and Covin, 2002**)**. Firms who employ DR *"redefine where and how the competitive game is played"* (Covin and Miles, 1999, p.54). The components found within DR are: bypass strategies and product – market domain (Fahey,1989). The former is depicted in the literature as an "attacking by surpassing competitors" strategy; a means of avoiding direct competitor confrontation, in essence, proactively moving the battle to a new arena. Product – market domain (Coving and Miles, 1999) is where the organisation assumes a pioneering stance, creating an early footprint of an industry. Castriotti et al, (2021), advises that DR has been a neglected subject within the literature but indicated that this is an area which is growing in relevance.

5. Born Globals, Domain Redefinition and Schumpeter

BGs offer new, highly innovative, specialised products and position these in niche markets (Madsen and Servais, 1997; Knight and Cavusgil, 1996). The BG often conforms its product, tapering to the needs of its chosen markets. (Madsen and Servais, 1997). These products are different from those already in the market (Andersson et al., 2020), a strategy originally advised by Schumpeter (1934). This product uniqueness offers dominance in product categories for the BG. According to (Merrilees and Tiesson, 1999), this attracts commercial power and legitimacy. The result is that they proactively create their own "product market-arena" which correlates with DR strategies and in doing so can change an industry (Schumpeter, 1934).

Covin and Miles (1999, p.58), advise that in order to utilise bypass strategies (DR) and successfully install new product markets arenas (DR), "a product like no one else's" is required. This corresponds with Schumpeter's advice regarding the offering of products that are different from what is currently available. and also matches the BG product profile.

6. Conclusion

Madsen and Servais (1997), hinted that BG behaviour has its roots in the Evolutionary Economic Theory. As this literature review developed: from Evolutionary Economic Theory/Schumpeter to Corporate Entrepreneurship and then to DR, the rudiments of Schumpeterian principles were maintained and extrapolated within the DR component of CE. The literature is replete in its description of BG firms: as those who constantly pursue new marketplaces, setting up market arenas in niche areas, with their new, unique and superior products. (Andersson et al., 2020; Knight and Cavusgil, 2004).

We therefore posit that Domain Redefinition is a viable theoretical lens through which to view the phenomenon that is the BG.

7. Further Research

This paper introduces the concept that DR is an appropriate theory lens for explaining competitive advantage and business continuance in BG firms. Further research and data collection is needed to test this hypothesis.

References

Adeyeye, M. M. (2016*) "*Corporate entrepreneurship as a paradigm for successful competition and growth", *Journal of Research in Management and Social Sciences,* Vol 2, No. 2, pp 1-8.

Andersson, S., Awuah, G.B., Aagerup, U. and Wictor, I. (2020) "How do mature born globals create customer value to achieve international growth?", *International Marketing Review*, Vol 37, No. 2, (2), pp 185-211.

Barringer, B. R. and Bluedorn, A. (1999) "The relationship between corporate entrepreneurship and strategic management", *Strategic Management Journal,* Vol 20, No. 5, pp 421-444.

Beer, M., Eisentat, R. and Spector, B. (1990) *The Critical Path to Corporate Renewal*, Harvard Business School Press, Boston.

Block. Z. and MacMillan, I. C. (1993) *Corporate venturing: Creating new businesses within the firm,* Harvard Business School Press, Boston.

Burgelman, R. A. (1983). "A process model of internal corporate venturing in the diversified major firm". *Administrative Science Quarterly,* Vol 28, No. 2, pp 223-244.

Castriotti, M., Loi, M., Marku, E. and Moi, L. (2021) "Disentangling the corporate entrepreneurship construct: conceptualizing through co-words", Scientometrics, Vol 126, pp 2821–2863.

Covin, J.G. and Miles, M.P. (1999) "Corporate entrepreneurship and the pursuit of competitive advantage", *Entrepreneurship theory and practice*, Vol 23, No. 3, pp 47-63.

Dess, G. G., Ireland, R. D., Zahra, S. A., Floyd, S.W., Janney, J. J., and Lane, P. J. (2003) "Emerging issues in corporate entrepreneurship", Journal of Management, Vol 29, No. 3, pp 351–378.

Dixon D, F. (2000) "Schumpeter—Fifty Years Later". *Journal of Macromarketing*, Vol 20, No.1, pp 82-88.

Eggers, F., Niemand, T., Kraus, S., and Breier, M. (2020) "Developing a scale for entrepreneurial marketing, revealing its inner frame and prediction of performance", *Journal of Business Research,* Vol 113, pp 72-82.

Fahey, L., 1989. Bypass Strategy: Attacking by surpassing competitors*, The Strategic Planning Management Reader*, pp.189-193.

Gabrielsson, M., Kirpalani, M., Dimitris's, P., Solberg, C. A. and Scutella, A. (2008) "Born Globals, Propositions to help advance the theory", *International Business Review*, Vol 17, No. 4, pp 385-401.

Hagen, B., Zucchella, A., Cerchiello, P. and De Giovanni, N. (2012) "International Strategy and Performance, Clustering strategic types of SMEs", *International Business Review,* Vol 21, No. 3, pp 369-382.

Hornsby, J. S., Naffziger, D. W., Kuratko, D. F., and Montagno, R. V. (1993) "An interactive model of the corporate entrepreneurship process", Entrepreneurship Theory and Practice Vol 17, No. 2, pp 29–37.

Ibeh, K., Crick, D., Teemed, H. (2019) "International Marketing Knowledge and International Entrepreneurship in the contemporary multi speed global economy", *International Marketing Review,* Vol 36, No. 1, pp 2-5.

Knight, G. A. and Cavusgil, S. T. (2004) "Innovation, Organizational Capabilities, and the Born-Global firm", Journal of International Business Studies Vol 35, pp 124–141.

Kuratko, D.F. and Airtech, D.B. (2009) "Strategic Entrepreneurship: exploring different perspectives of an emerging concept", *Entrepreneurship Theory and Practice*, Vol 33, No. 1, pp 1-17.

Madsen, T.K. and Servais P. (1997) "The internationalisation of Born Globals: an evolutionary process?", *International Business Review*, Vol 6, No. 6, pp 561-583.

Merrilees, B. and Tiessen, J.H. (1999) "Building generalisable SME international marketing models using case studies", *International Marketing Review*, Vol. 16, No. 4/5, pp. 326-344.

Miles MP, Covin JG. (2002) "Exploring the Practice of Corporate Venturing: Some common forms and their organizational Implications", *Entrepreneurship Theory and Practice*. Vol 26, No. 3, pp 21-40.

Moss, L. S. (2007) Corporate entrepreneurship Schumpeter's entrepreneurial function updated, *In:* Forstater, M., Mongiovi, G. and Pressman, S., ed. *Post-Keynesian macroeconomics.* London: Routledge, pp 197-211.

Øyna, S. and Alon, I. (2018) "A review of Born Globals*. International Studies of Management and Organization",* Vol 48, No. 2, pp 157-180.

Parboteeah, P. (2000) "Choice of type of Corporate Entrepreneurship: a process model", Academy of Entrepreneurship Journal, Vol 6, No 1, pp 28-47.

Schumpeter, J. A. (1934) "*The Theory of Economic Development,* Harvard University Press, Cambridge, Massachusetts.

Schumpeter, J. A. (1942) *Capitalism, Socialism and Democracy*, Harper and Brothers, New York.

Stopford, J.M., and Baden-Fuller, C. W. F. (1994) "Creating Corporate Entrepreneurship", *Strategic Management Journal,* Vol 15, No. 7, pp 521-536.

Yang, M. and Gabrielsson, P. (2018) "The interface of international marketing and entrepreneurship research: review synthesis and future direction", *Journal of International Marketing*, Vol 26, No. 4, pp18-37.

Zahra, S. A. (1996) "Governance, ownership, and corporate entrepreneurship: The moderating impact ofindustry technological opportunities", *Academy of Management Journal,* Vol 39, No. 5, pp 1713-1735.

Knowledge Management Models and the Innovativeness of high-tech Companies: The case study

Wiktoria Trzepizur
Faculty of Management, Częstochowa University of Technology, Częstochowa, Polska
wiktoria.trzepizur@pcz.pl

Abstract: The article discusses the problem of the significance of knowledge management in contemporary enterprises. The timeliness of research problems in relation to this issue is confirmed by a comprehensive literature review. The article attempts to define individual knowledge management models and to define the essence of knowledge management in enterprises. These considerations have been extended with innovation which is crucial for 21st century companies. The publication covers empirical research of selected high-tech companies. This sector has been selected due to a noticeable lack of studies in this area. The research method used in the empirical part of the paper is a case study. Two high-tech companies operating in the IT industry have been selected. It has been essential to distinguish the criteria for selecting high-tech companies in the study. The objective of the conducted comparative analysis has been to examine what knowledge management model is used by the specified enterprises and what concept of innovation they have selected. The results of the conducted analyses indicate that enterprises take similar actions. Most of all, this is conditioned by the specificity of the sector and industry in which they operate. The subject matter of the publication is important and up to date, it covers two fundamental components of the operation of contemporary enterprises since both knowledge management and innovation constitute a constantly expanded scientific issue.

Keywords: knowledge management, innovation, high-tech companies

1. Introduction

To identify knowledge management processes, it is necessary to explore the key definition of knowledge. This concept is extensively analyzed in the international subject literature. When defining knowledge, the attention should be paid to the processing process, the result of which is the transformation of different types of messages that eventually become knowledge. It should also be noted that each person creates knowledge of a completely different nature, which is related to the acquisition of the same type of information, since the information received is determined by individual experiences (Kalpič, Bernus, 2006).

Knowledge is also considered in terms of determining the significance of the meaning of *information* and *data*. Information is defined as the result of using data which are the key component of the issue. On the other hand, the data may take all forms, which are categorized differently. However, they have no integral connection until they are used in the issue (Moradi, Vallespir, 2007). Moreover, it is impossible for knowledge to run out. It is its key feature. It is possible that this is the reason for which researchers are constantly extending the meaning of this concept. Simultaneousness is also an important determinant of knowledge in terms of the enterprise. This means that knowledge can be applied at the same time in various enterprises from distant locations (Horzela, Ambrochowicz, 2019). Therefore, knowledge management is defined as the course of acquisition of different types of data and information with an intention to achieve the intended results (Adamczewski, 2017).

In order to comprehensively analyze the issue concerning knowledge management in enterprises, the attention must be paid to the aspect of innovativeness (Chierici et al, 2019). Theoreticians and practitioners of management are constantly modifying the concept of innovation. The key definition was developed by J. A. Schumpeter, focusing on the implementation of new solutions. In the definition of innovation, this author indicated the creation of innovative concepts of a different nature. Therefore, it can be stated that, nowadays, the creation and implementation of innovation is necessary for the proper company's operation (Schumpeter 1960). When referring to the analyzed issues, it should be indicated that the high-tech sector is identified with a high level of innovativeness.

With regard to the above scientific considerations, it should be emphasized that the subject of the relationship between the applied knowledge management models and the innovativeness of high technology enterprises is an important issue in the literature on the subject in the field of management sciences. In the literature on the subject, issues related to knowledge management (Davenport, Prusak, 2000) and those relating to enterprise innovation (Amit, Zott, 2012) are widely described, but separately. Moreover, there is a visible lack of studies that deal in depth with the issues of the relationship between knowledge management models and enterprise

innovation. Therefore, the considerations taken are important and up-to-date due to the fact that matching the elements of knowledge management models in their structure informs about combining them in such a way that they form a well-complex whole, taking into account the logic of operation adopted by a given enterprise. This means that the chances of high-tech enterprises to effectively compete on the global market depend on the correct matching of individual elements in the structure of knowledge management models to innovative activity. The above arguments meant that an attempt was made to make a theoretical analysis and conduct empirical research in order to fill the perceived gap by deepening the understanding of the process of creating innovative activity and knowledge management models of modern high technology enterprises.

In this context, the objective of the study was to conduct the comparative analysis and to investigate what is the knowledge management model applied in selected enterprises and what concept of innovation was chosen by these enterprises. The research method used to accomplish the assumed objective was critical analysis of the subject literature – in the theoretical part and a case study – in an empirical part.

2. The essence of knowledge management in the company of the 21st century

Knowledge management is a range of processes aimed at knowledge acquisition, accumulation, and processing. However, such an approach does not exhaust the complexity of this issue. It should be remembered that knowledge management is most of all directed to such its use so that the entity becomes more competitive in the specific economic environment (Caputo et al, 2019). One cannot forget that knowledge management is inextricably linked to human potential. In times of a dynamic technological progress, all types of novelties, combined with the ingenuity and originality of the human mind result in the creation of a completely new approach in knowledge management of enterprises (Zhao, Ordóñez de Pablos, Qi, 2012).

The indication of overarching objectives to be achieved to determine if the company properly manages knowledge is of the key importance when distinguishing the criteria that define knowledge management. Most of all, entrepreneurs must remember about the continuity of knowledge creation. The previously mentioned competitive advantage is the fundamental benefit from knowledge management in the enterprise (Centobelli, Cerchione, Esposito, 2018). Proper knowledge management in the enterprise translates into much more favorable returns on investment. The enterprise that properly manages knowledge takes all types of actions aimed at limiting the possibility of the loss of knowledge possessed. The aspect of protection of intellectual property is also important since enterprises take various actions to protect knowledge (Oztemel, Arslankaya, KorkusuzPolat, 2011). At the same time, the relationship between the issue of knowledge management and intellectual capital of enterprises can be observed since proper knowledge management in the enterprise is a paradigm in the process of generating intellectual capital. Intellectual capital is interpreted by taking into account many components, but mainly it is identified with knowledge which, when effectively used, is conductive to achieving both financial and non-financial benefits in the enterprise (Łęgowik-Świącik, 2021). As a result, the enterprise achieves the assumed objectives and gains a competitive advantage (Garcia-Perez et al, 2020).

When considering the problem of knowledge management in enterprises of the 21st century, it is worth pinpointing an increase in the use of information technologies. The changes in terms of global technologies to some extent force enterprise to constantly improve their IT infrastructure. The advanced level of all types of IT solutions is conductive to the effective creation, processing, use and sharing of knowledge. A particular role in effective knowledge management in enterprises is played by qualified staff who professionally implement knowledge management processes based on IT solutions (Gumiński, 2020). However, enterprises, when implementing various technological, IT novelties in their internal structure, also create innovation which is crucial in the operation of enterprises nowadays (Amit, Zott, 2012). It can be concluded that the current review of literature indicates the integrity of knowledge management and implementation of innovation in enterprises.

To sum up, it is worth emphasizing that knowledge management in enterprises of the 21st century is an important part of the operation of entities. It should be noted that enterprises apply varied models of knowledge management and innovation, which are characterized by a different specificity of operation. Due to the diversity of knowledge management models used by enterprises it is necessary to characterize their individual types.

3. Diversity of the use of knowledge management models in modern enterprises

There is a wide range of opportunities for the selection of knowledge management models by enterprises. It is worth pinpointing that each type also includes features of innovation. Therefore, it necessary to characterize individual models.

The first concept to be discussed is the process-based approach. In the literature, this model is referred to as the knowledge management paradigm. This theory was developed by T. Davenport and L. Prusak. They identified knowledge creation processes, such as codification and transfer. However, knowledge creation and transfer do not require extensive interpretation as opposed to codification. Most of all, its purpose is to significantly facilitate the use of knowledge, but also to modify it, particularly paying attention to the clarity of the message for those interested (Horzela, Ambrochowicz, 2019). In terms of the company's innovativeness in this model, one should aim at using modern solutions in the process of knowledge codification, e.g., modern Internet platforms or applications.

The concept of the Japanese model focuses mainly on the fact that all the company's employees contribute to the dissemination and creation of knowledge. I. Nonaka and H. Takeuchi are considered the creators of this knowledge management model. This concept distinguishes between explicit and tacit knowledge. The key role in here is played by a range of employee experiences, but also their intelligence and intuitive skills. Several forms of knowledge transformation were identified, including socialization, externalization, combination, and internationalization (Janasz, Janasz, 2018).

The model which includes five compatible components is referred to as a resource-based model. It was developed by D. Leonard-Barton. It is crucial for the interpretation of the assumptions of this concept to pay attention to the fact that these components are linked to the organizational environment and the company's interior. The components of this model are experiment, import of knowledge from the environment, superior skills, implementation of new technologies and tools with a focus on integration and cooperation in terms of solving problems (Janasz, Janasz, 2018). It is worth pointing out that the fundamental strategic resource in this model is knowledge. Enterprises constantly strive to achieve a competitive advantage and it is knowledge that is its key source in the resource-based model (Horzela, Ambrochowicz, 2019).

Contemporary entrepreneurs have an opportunity to use various knowledge management models. The literature resources indicate that the above-mentioned knowledge management models are considered as fundamental in the defined issue. Innovativeness is reflected in each of the characterized models. Therefore, it is necessary to extend the considerations to the aspect of innovation models.

Summing up, it is worth noting that the adoption of the selected knowledge management model in enterprises justifies the argument of a comprehensive approach to the basic processes of running a business by an enterprise. This means that knowledge becomes a critical resource that allows resources to be transformed into key success factors (Soo, Devinney, Midgley, 2002). In this context, knowledge reflects the ability of enterprises to learn and shape an intelligent organization.

4. Exchange of knowledge in the concepts of open and closed innovation

Since innovativeness is the fundamental component of knowledge management in modern enterprises, the two innovation models should be identified.

A characteristic feature in the closed innovation model is most of all the entity's independence throughout the whole process of innovation. This applies to both initial and final stages. Enterprises that decide on such an innovation model do not cooperate with external entities, do not use the experiences of others and do not exchange the knowledge acquired (Sachpazidu-Wójcicka, 2016). Enterprises applying the closed innovation model limit themselves exclusively to the skills and knowledge of their own employees. This is related to a precise recruitment process since, without deriving knowledge from the external environment, enterprises must employ qualified staff. In the case of closed innovation, the enterprise must protect its intellectual property from the external environment (Skrzypek, Sagan, 2018).

The key assumption in the open innovation model is mainly the cooperation of enterprises. In this concept, enterprises are oriented to the exchange of knowledge. Operations are aimed at achieving the highest possible

level of innovation (Wolf et al, 2021). The operation of entities based on the open innovation model may significantly increase funds since enterprises may resell solutions they no longer use to other entities. It also should be noted that enterprises that derive knowledge from the external environment considerably extend the skills and resources of their own knowledge. This is also conductive to creating completely new solutions in a much shorter time (Walecka-Jankowska, Zimmer, 2019).

To sum up, it should be noted that the open innovation model is definitely more effective nowadays, at the same time, the closed innovation model is less frequently used. Depending on which knowledge management model and which innovation model the company chooses, completely different forms of operations will be undertaken. However, knowledge management is related to innovation and the choice of the open or closed innovation model. These actions are characterized by synergy. Therefore, it can be stated that the selection of the knowledge management model results in choosing the innovation model. The adoption of this assumption is justified by the argument that the knowledge management model is an element connecting the company with the client (Chen, Shih, Yang, 2009). Moreover, between the knowledge management model and the innovation model there is a feedback phenomenon, which is manifested in the fact that achieving the adaptation of elements in the knowledge management model to the operating conditions of the enterprise should enable the enterprise to undertake innovative activities (Reagans, Zuckerman, 2008). On the other hand, innovation is the basic element shaping the acquisition of a competitive market position (Teece, 1988), which determines the knowledge management process.

5. Research methodology

The empirical research was carried out based on a case study. The selection of the sample was deliberate and was determined by the availability of data and the internationalization of activities of the surveyed enterprises. Two enterprises from Poland operating in the high-tech industry were selected: Asseco Poland S.A. and WASKO S.A. These entities are listed on the Warsaw Stock Exchange and belong to the WIG-IT Index. The basic criterion for selecting the sample was the availability of data for empirical analysis. After analyzing data from forty websites of companies from the high-tech sector, an attempt was made to contact these companies, direct interview was possible only in two companies. Thanks to the interviews, primary data for empirical research was obtained.

The selection of a case study as a research method was determined by the existence of the research gap in terms of knowledge management models and innovativeness of high-tech companies. This method will make it possible to carefully examine dependencies. A case study is characterized by the occurrence of a range of operations following each other and affecting the correctness, accuracy, detail, and timeliness of research. Due to the specificity of the research conduct, the choice of this method will significantly extend the analyzed and examined phenomenon, considering many areas. Such multidimensional analyses would not be possible when selecting a different research method (Eisenhardt, Graebner, 2007).

5.1 Description of the research sample

To correctly conduct the analyses, it is necessary to characterize the operations of the analyzed entities selected for the case study. The first company is Asseco Poland S.A., and the other one is WASKO S.A.

Asseco Poland S.A. was established in 1989. The company's head office is in Poland. Asseco Poland S.A. has been listed on the Warsaw Stock Exchange since June 1998. This enterprise is a parent company of the Asseco Capital Group. The company manufactures software for various industries. It should be pointed out that Asseco Poland S.A. creates IT systems for banks. Due to the advanced requirements of this sector, the enterprise is among the few ones that undertake such activities. Asseco Poland S.A. creates various IT solutions. Copyright concepts are addressed to different sectors of the economy. At the same time, the company does not limit their activities, but on the contrary, it constantly expands them. Asseco Poland S.A. strengthens its position in foreign markets. (The Financial Statement by Asseco Poland S.A. for the year ended 31 December 2020). It is also necessary to analyze the other company, i.e., WASKO S.A.

WASKO S.A. began its activities in 1999. The head office of the company is in Poland. It has been listed on the Warsaw Stock Exchange since August 2001. It should be pointed out that the WASKO Capital Group was established. The activities of WASKO S.A. cover many areas. They are directed to the complex creation of different types of IT systems and their integration. In terms of services, outsourcing is also provided. The company deals with the introduction of network technologies and design of tele transmission equipment. It

distributes IT infrastructure and equipment from abroad. The operations of this company are extended to the maintenance of software and computer hardware. In addition, WASKO S.A. creates radio lines and data transmission networks. The fundamental components of the company's operations include the collection, storage, and processing of data. The catalogue of the conducted activities of the WASKO S.A. company is significantly more extensive than the one of the first analyzed enterprise. WASKO S.A. strives to expand its activities to foreign markets (The Annual Report by WASKO S.A. for the year ended 31 December 2020).

Both Asseco Poland S.A. and WASKO S.A. are international companies. They are characterized by a strong position in both domestic and foreign markets and the industry they operate in. It should be noted that Asseco Poland S.A. was established earlier, but WASKO S.A. is characterized by the dynamic development.

5.2 The comparative analysis of the analyzed high-tech companies in the context of knowledge management models and innovativeness of individual economic entities

In order to correctly identify high-tech companies, it is crucial to indicate the criteria for their selection (Zakrzewska-Bielawska, 2016):

- expenditure on Research and Development,
- creating innovation,
- cooperation with other entities in the field of science,
- building a competitive advantage,
- possessing qualified staff,
- national and foreign range of operations,
- short life cycle of products and technologies,
- using modern technologies.

The identified criteria for the selection of high-tech companies for the surveyed entities are presented in Table 1.

Table 1: Criteria for the selection of high-tech companies

No.	Criteria	Companies	
		Asseco Poland S.A.	WASKO S.A.
1	Expenditure on Research and Development	✓	✓
2	Creating innovation	✓	✓
3	Cooperation with other entities in the field of science	✓	✓
4	Building a competitive advantage	✓	✓
5	Qualified staff	No info	No info
6	National and foreign range of operations	✓	✓
7	Short life cycle of products and technologies	✓	✓
8	Using modern technologies	✓	✓

✓ This mark indicates the presence of the identified criterion in the company.

Source: Own study based on: https://pl.asseco.com/, https://www.wasko.pl/, The Annual Report by WASKO S.A. for the year ended 31 December 2020, The Financial Statement by Asseco Poland S.A. for the year ended 31 December 2020.

The analysis of Table 1 indicates that, in Asseco Poland S.A. and WASKO S.A., the following are present: expenditure on Research and Development, creating innovation, cooperation with other entities in the field of science, building a competitive advantage, national and foreign range of operations, short life cycle of products and technologies and using modern technologies. The available materials do not allow for determining whether the enterprises have qualified staff, however, the specificity of their operations suggests the need to employ people with the highest professional preferences. The indicated criteria confirm that both enterprises belong to the high-tech sector. The key determinants of knowledge management are presented in Table 2. The analysis of the components considered will allow for determining which management model is applied by the company.

Table 2: Determinants of knowledge management in the companies

No.	Determinants	Asseco Poland S.A.	WASKO S.A.
1.	Creating knowledge	✓	✓
2.	Codification of knowledge	No info	No info

No.	Determinants	Asseco Poland S.A.	WASKO S.A.
3.	Experimenting	✓	✓
4.	Importing knowledge	✓	✓
5.	Overarching skills	✓	✓
6.	Implementing new technologies and tools when paying attention to the aspect of integration (implementing innovation)	✓	✓
7.	Sharing knowledge	✓	✓
8.	Collaboration in solving problems	✓	✓
9.	Involvement of all employees in creating knowledge	No info	No info
10.	Transfer of knowledge	✓	✓

✓ This mark indicates the presence of the identified determinant in the company.

Source: Own study based on: https://pl.asseco.com/, https://www.wasko.pl/, The Annual Report by WASKO S.A. for the year ended 31 December 2020, The Financial Statement by Asseco Poland S.A. for the year ended 31 December 2020.

The conducted analysis of the financial statements and the information on the websites of Asseco Poland S.A. and WASKO S.A. indicate that the enterprises constantly create knowledge. The industry they operate in, to some extent, forces the constant broadening of horizons.

It should be noted that Asseco Poland S.A significantly directs its operations to the field of R+D. In 2020 it achieved the copyright to the computer software developed by its employees. Development activities are financed from the State budget and structural and aid funds. The company has implemented many R+D projects since the beginning of its operations. An example can be the project of SMIT, PSR or AUMIS. Asseco Poland S.A. constantly takes on new challenges which include the project of establishing the R+D Center.

WASKO S.A. has been involved in many research projects for years, for which it allocates a significant part of its profits. It should be noted that the company develops the area of R+D, being supported by the institutions, i.e., the National Center for Research and Development, the Industrial Development Agency, or the State budget, etc. In the years of 2015-2018 WASKO S.A. implemented the project of MILESTONE, Biostrateg and Monitel. The company received the amount of approximately EUR 346 711 for research (the amount of PLN 1.6 million converted at EUR 4.6148). Due to the funding, the enterprise is developing the product which will significantly contribute to the development of operator networks. In 2020 the entity began the development of the NEDAPS platform with the SEC module.

The industry Asseco Poland S.A. operates in is characterized by a high level of innovativeness and the enterprise to a large extent focuses on the implementation of innovation, the evidence of which is the projects implemented. In the case of WASKO S.A., the emphasis is also placed on launching innovation. The implemented systems are characterized by a high level of innovativeness, an example can be the implemented SYZAR system, the task of which is the combination of devices covering road safety. The WASKO S.A. company wants to constantly implement innovation, also in other sectors of the economy.

The Asseco Poland S.A. company does not close itself within its internal structure but uses an opportunity to cooperate with other entities. At the same time, it derives knowledge but also shares it. WASKO S.A. does not limit itself exclusively to its own knowledge, on the contrary, it takes actions of cooperation with the external environment. The available data indicate that both Asseco Poland S.A. and WASKO S.A., in their internal structures, strive for the cooperation of employees in terms of project implementation, at the same time, this translates into the collaboration in terms of solving various problems.

To sum up, it should be indicated that the resource-based knowledge management model is applied in both Asseco Poland S.A. and WASKO S.A.. This is proven by the fact of the presence and integrity of such components as:

- possessing key skills in different structures of the company's operation,
- importing knowledge from the external environment (from other institutions, organizations),
- implementing new technologies and tools while paying attention to the aspect of integration,
- experimenting (an inherent feature of innovative enterprises),
- collaboration in solving problems.

In the resource-based model, an important component is experimenting. It is not specifically indicated in the available sources concerning the analyzed enterprises if experiments are conducted, however, R+D activities are significantly linked to carrying out many different trials before final solutions are reached.

It is worth pinpointing that knowledge is the most important and it is a source of a competitive advantage in the analyzed companies, which constitutes the determinant of their operations according to the resource-based knowledge management model. The identification of the innovation model on the basis of which the enterprises operate is also crucial. The fact of cooperation and exchange of knowledge between entities indicates the use of the open innovation model in both companies.

6. Discussion

The conducted analyses allowed for the identification of the knowledge management model applied by the companies. In both Asseco Poland S.A. and w WASKO S.A., belonging to the high-tech sector, the occurrence of characteristics of the resource-based knowledge management model was observed. When deepening the research with the aspect of innovativeness it was indicated that they apply the open innovation model.

The case study was carried out based on the research which contributed to a broad exploration of the discussed research topic. The data essential for the identification of the knowledge management model and the innovation model were acquired from various materials. This enabled the consideration of the problem considering many areas.

Since the only two high-tech companies were selected to conduct the research, it was not indicated what relationships there are in other enterprises of the analyzed industry. However, it is worth emphasizing that the result of the analyzes is that both entities use the resource model of knowledge management and the open innovation model, which allows to achieve saturation from the analysis. It should noted that this does not mean that all high-tech companies operate in the same way.

Enterprise owners that decide on the implementation of various types of product, process, marketing or organizational innovation are very often unaware of the fact that the innovation model selected by them is significantly related to the knowledge management model. Therefore, the broadly understood knowledge, research and development base and innovations play a key role in the implementation of their development strategy.

7. Conclusions

To sum up, the theoretical considerations indicate the significance of the use of knowledge management in enterprises. Nowadays, it is necessary for enterprises to use the potential provided by knowledge management. It should be remembered that it is a complex process, which requires the entrepreneur, management staff and employees themselves to take many actions. However, this translates into many benefits, which include increasing a competitive advantage, higher financial revenues, and consequently more effective performance of the entire company.

The conducted empirical research into two high-tech companies indicated that the occurrence of knowledge management processes following the resource-based model was observed in both of them. The analysis of the financial and non-financial statements and the websites of the enterprises showed that they are mostly characterized by a high level of knowledge, which is the foundation for the innovativeness of the surveyed enterprises. A very important aspect is the collaboration with external institutions. These companies are at an advanced level in the area of research and development, and the constant creation of innovative solutions translates into the implementation of innovation.

An attempt to pay attention to the aspect of integration of the applied knowledge management model with the innovation model indicated that, based on the publicly available data concerning the analyzed enterprises, the resource-based knowledge management model was combined with the open innovation model. Both WASKO S.A. and Asseco Poland S.A. are characterized by cooperation and exchange of knowledge with the external environment.

The above theoretical and empirical considerations proved that knowledge management and innovativeness are crucial for the effective and appropriate operation of enterprises of the 21st century. High-tech companies apply very extensive procedures of knowledge management, which is mostly determined by the specificity of the sector. The subject matter of the publication is important and up-to-date since it involves the study of the relationship between two fundamental components determining the operation of modern enterprises, i.e., knowledge management and innovativeness, which constitute a constantly expanding scientific issue.

References

Adamczewski, P. (2017) ”Knowledge Management in Intelligent Organizations in Times of the Digital Transformation: Findings of a Study of the Polish SME Sector”, *The WSB University in Poznan Research Journal,* Vol. 75, No. 4*,* pp. 56-59.

Amit, R. and Zott, C. (2012) ”Creating Value Through Business model Innovation”, *MIT Sloan Management Review*, 53 (3), pp. 44-46.

Caputo, F., Garcia-Perez, A., Cillo, V. and Giacosa, E. (2019) ”A knowledge-based view of people and technology: directions for a value co-creation-based learning organisation”, *Journal of Knowledge Management*, pp. 2-5.

Centobelli, P., Cerchione, R. and Esposito, E. (2018) ”Aligning enterprise knowledge and knowledge management systems to improve efficiency and effectiveness performance: A three-dimensional Fuzzy-based decision support system”, *Expert Systems with Applications*, Vol. 91, pp. 107-126.

Chen, C.J., Shih, H.A. and Yang, S.Y. (2009) “The role of intellectual capital in knowledge transfer”, IEEE Transactions on Engineering Management, Vol. 56, No. 3, pp. 402-411.

Chierici, R., Mazzucchelli, A., Garcia-Perez, A. and Vrontis, D. (2019) ’’Transforming big data into knowledge: the role of knowledge management practice”, *Management Decision*, Vol. 57 No. 8, pp. 1906-1907.

Davenport, T.H. and Prusak, L. (2000) *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston-Massachusetts, p. 46.

Eisenhardt, K. and Graebner, M. (2007) ”Theory Building from Cases: Opportunities and Challenges”, *The Academy of Management Journal*, Vol. 50, No. 1, pp. 25-32.

Garcia-Perez, A., Ghio, A., Occhipinti, Z. and Verona, R. (2020) ”Knowledge management and intellectual capital in knowledge-based organisations: a review and theoretical perspectives”, *Journal of Knowledge Management*.

Gumiński, A. (2020) ”A Research Tool for Analysis of Knowledge Management in the Metropolitan Association of Upper Silesia and Dąbrowa Basin”, *Organization and Management: Scientific Quarterly*, Vol. 4, No. 52, pp. 33-45.

Horzela, A. and Ambrochowicz, S. (2019) ”Concept of Knowledge in the Context of Modern Enterprises”, *Organization & Management : Scientific Quarterly*, nr 1 (45), pp. 17-25.

Janasz, W. and Janasz, K. (2018) ”Knowledge Management in a Modern Organisation”, *Studies and Works of the WNEiZ US* nr 52, T. 2, pp. 26-28.

Kalpič, B. and Bernus, P. (2006) ”Business process modeling through the knowledge management perspective”, *Journal of Knowledge Management*, Vol. 10 No. 3, p. 44.

Łęgowik-Świącik, S. (2021) *How Intellectual Capital Shapes the Business Model in Strategic Areas of Enterprise Management.* In European Conference on Knowledge Management, pp. 492-500. Academic Conferences International Limited.

Moradi, M. and Vallespir, B. (2007) ”Knowledge management and enterprise modelling: a complementary view”, IFAC MCPL 2007 The 4th International Federation of Automatic Control Conference on Management and Control of Production and Logistics, p. 68.

Oztemel, E., Arslankaya, S. and KorkusuzPolat, T. (2011) ”Enterprise knowledge management model (EKMM) in strategic enterprise resource management (SERM)”, *Procedia Social and Behavioral Sciences* 24 pp. 870–871.

Reagans, R.E., Zuckerman, E.W. (2008) “Why knowledge does not equal power: the network redundancy trade-off”, *Industrial and Corporate Change*, Vol. 17, No. 5.

Sachpazidu-Wójcicka, K. (2016) ”Open innovation and technology transfer in Polish enterprises”*, Journal of Management and Financial Sciences*, Vol. 9, nr 24, p. 181.

Schumpeter J. (1960) *Theory of Economic Development,* PWN, Warsaw.

Skrzypek, A. and Sagan, S. (2018) ”Open Innovation in Business Models”, *Annales Universitatis Mariae Curie-Skłodowska. Sectio H. Oeconomia*, Vol. 52, nr 6, pp. 100-101.

Soo, C.W., Devinney, T.M. and Midgley, D.F. (2002) *Knowledge Creation in Organizations: Exploring Firm and Context Specific Effects*, INSEAD, Working Papers, 2002/55/MKT, p. 12.

Teece, D.J. (1988) “Capturing Value from Technological Innovation: Integration, Strategic Partnering, and Licensing Decisions”, *Interfaces* , Vol. 18, No. 3, pp. 46-61.

Walecka-Jankowska, K. and Zimmer, J. (2019) ”Open Innovation in the Context of Organisational Strategy”, *Engineering Management in Production and Services*, Vol. 11, nr 3, p. 87.

Wolf, V., Dobrucka, R., Przekop, R. and Haubold, S. (2021) ”Cooperative Innovation Strategies- Review and Analysis”, *LogForum*, Vol. 17, nr 4, pp. 477-484.

Zakrzewska-Bielawska, A. (2016) ”Perceived mutual impact of strategy and organizational structure: Findings from the high-technology enterprises”, *Journal of Management & Organization*, 22(5), pp. 599-601.

Zhao, J., Ordóñez de Pablos, P. and Qi, Z. (2012) ”Enterprise knowledge management model based on China’s practice and case study”*, Computers in Human Behavior*, 28 pp. 324-330.

The Financial Statement by Asseco Poland S.A. for the year ended 31 December 2020.
The Annual Report by WASKO S.A. for the year ended 31 December 2020.
https://pl.asseco.com/ (access: 02.01.2022).
https://www.wasko.pl/ (access: 02.01.2022).

Organisational Knowledge Sustainability

Vivien Vágner and Andrea Bencsik
University of Pannonia, Veszprém, Hungary
vagner.vivien@gtk.uni-pannon.hu
bencsik.andrea@gtk.uni-pannon.hu

Abstract: The objective of the research aims to develop a theoretical model to illustrate the knowledge sustainability. It is an essential and up to date area, but there is only a few academic research on it at the moment. One of the objectives of writing this piece is to help for organisations to be able to identify the key knowledge that is important and relevant to them (which should and must be preserved for future generations), and to determine who possesses this knowledge. Knowledge that has become redundant needs to be shared with staff and organisations, which requires a correct definition of organisational memory. In this way, it is worth considering how to share the knowledge that will be needed in the long term between different generations, a task that can be particularly challenging given the digital divide. The long-term sustainability of organisations can be achieved through knowledge management, although the sustainability of knowledge is a precondition for the symbiosis of this relationship. Specifically, it is valuable to explore how can the sustainability of knowledge be solved, what kind of knowledge management tools, leadership behaviour or cultural background is required? Practically, in our study search for the answer to the question of how knowledge management can promote organisational sustainability, and how organisations can use knowledge management tools to influence the attitudes and actions of employees in relation to knowledge sustainability. It is necessary to explore the concepts of sustainability and knowledge. The authors present the meaning of the junction of these two words (Knowledge + Sustainability). Based on this exploration, the authors present their definition of knowledge sustainability and a possible analytical model. The authors analyse which success factors contribute most to making knowledge sustainable. One of the major findings of the research the relationship between trust, ethics, and knowledge sustainability. In addition, the authors sought to present the research model they have developed.

Keywords: sustainability, knowledge, knowledge sustainability, knowledge management, ethics

1. Introduction

The topic of our research is organisational knowledge sustainability for the long-term survival. The objective of the research is to develop a theoretical study with different positions on the terms knowledge sustainability. It is an essential area, but there is only a few research on it at the moment.

As Baker (2001) said “by ignoring the past we will be frequently guilty of reinvention”. This sentence consists of the essence of the organisational knowledge sustainability. It is necessary to survival. Organisations must sustain their knowledge, otherwise we must start again. The successful organisation not just sustain their knowledge, they develop it. The most successful companies are knowledge-based, they develop intensively, and their employees are highly motivated.

Nowdays, organisational knowledge sustainability has a paramount importance due to the changes in the environment such as COVID-19, war situation, supply chain stagnation, increasing global competition, the speed of information, knowledge obsolescence, dynamics of product and process innovations. If organizations want to be successful, even in these circumstances, then they need to understand the importance of knowledge, knowledge management. Organizations need to develop plans on how to achieve their goal, spending time and energy on power plants. It is important to consider knowledge management as one of the main drivers of organizational performance and as one of the most important resources for the survival and prosperity of organizations. For these reasons, the effective maintenance of knowledge is vital for organizations. In this research, the authors search the answer to the question of how knowledge management can promote organisational sustainability, and how organisations can use knowledge management tools to influence the attitudes and actions of organisational members in relation to knowledge sustainability. First of all, the authors exemine the concepts of sustainability and knowledge, then they demonstrate a definition of the knowledge sustainability. The concept of knowledge management, its main orientations and its implementation will be described. The authors present the organisational knowledge sustainability model.

In sustainability science, a growing literature has emphasized knowledge co-production, or meaningful collaboration between producers and users of knowledge, as a driver of knowledge use (Clark et al., 2016).

Knowledge and the management of knowledge is regarded as an important features for organisational survival; while the key to understanding the successes and failures of knowledge management within organisations is the identification of resources that allow organisations to recognize, create, transform and distribute knowledge. Organisations that effectively manage and transfer their knowledge are more innovative and perform better (Riege, 2007). Successful organisations now understand why they must manage knowledge, develop plans as to how to accomplish this objective and devote time and energy to these efforts. This is because knowledge management has been described as a key driver of organisational performance (Bousa, Venkitachalam, 2013), and one of the most important resources for the survival and prosperity of organisations (Teece, Pisano, Shuen, 1997; Kamhawi, 2012). Therefore managing and utilizing knowledge effectively is vital for organisations to take full advantage of the value of knowledge. The attention and importance given to the acquisition of knowledge management in literature as well as practice in the past years is also of necessity due to changes in the environment such as increasing globalization of competition, speed of information and knowledge aging, dynamics of both product and process innovations, and competition (Greiner, Bo¨hmann and Krcmar, 2007).

In the following the authors introduce the definition of sustainability, knowledge, and knowledge sustainability.

The authors have not found a widely accepted definition or model of knowledge sustainability in the literature.

In this research, the authors aim to fill this gap.
Research questions:
Q1: How can knowledge sustainability be solved, what knowledge management tools, managerial behaviour or cultural background support is needed to achieve this?
Q2: How can the concept of knowledge management promote the sustainability of organisational operations?

2. Literature Review

2.1 Definition of Sustainability

To interpret organizational knowledge sustainability, it is important to discuss the concept of sustainability.

Literature provides several definitions of the sustainability. There are many different viewpoints on this concept and how it can be achieved. Sustainability is a conceptual, ethical, and political view that transcends respect for the quality of the environment inasmuch as it includes: the disappearance of poverty through its progressive reduction, the equality of the sexes, the promotion of health, rural transformation, human rights, cultural understanding and peace, responsible production and consumption, respect for cultural diversity and access, with equal opportunities to Information and Communication Technologies. (Ponce, 2018).

2.1.1 Sustainable Development

As mentioned above, numerous definitions of sustainable development are attainable. Sustainable development could be introduced as a process. In 1987 the World Commission on Environment and Development defined sustainable development as ‘‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’’ (Brundtland, 1987). Sustainable development emphasizes the evolution of human society from the responsible economic point of view, in accordance with environmental and natural processes. Therefore, the political dimensions are central elements. Furthermore, in a sustainable development paradigm the limitations of economic, societal, and environmental resources are considered in order to contribute to present and future generations’ welfare and can be applied on local, regional, national and international levels, based on political will (Glavic, 2006). The term Sustainable Development is widely used in the current political and environmental discourses. According to Barbosa (2014) the vagueness of the term allows it to be appropriated by different social groups with different positions regarding development. Part of the imprecision is inherent in the concept itself, which depending on the approach and by whom is the approach may take different connotations.

2.1.2 Dimension of Sustainability

Existing studies among the three traditional dimensions of sustainability, the environmental one has been widely investigated. From the analysis of the literature, it is possible to identity nine main sub-dimensions of environmental sustainability:

1. materials
2. energy
3. water
4. biodiversity
5. emissions
6. waste
7. product and services
8. compliance
9. transport (Arena, 2009).

In literature, the underlying principle of environmental ethics is that nature has intrinsic value. This means that nature and its parts are not merely means for accomplishing one's purposes but are ends in and for themselves. The nature of human action has changed so dramatically in our times that it calls for a radical change in ethics as well. Previously, all dealing with the non-human world was ethically neutral. Ethical significance belonged to the direct dealing of man with man, including man dealing with himself: all traditional ethics is anthropocentric (Lijo, 2015).

Many contributions investigated the environmental dimension in terms of resources (water, materials, and energy) consumption and depletion and pollution (biodiversity, emission and waste). Also, dimensions concerning human behaviour and activities (e.g., product and service, compliance and transport) have been considered by many authors.

Arena (2009) described social sustainability six main sub-dimensions for analysis:

1. work practices and adequate working conditions
2. diversity and equal opportunities
3. relations with the community
4. social policy compliance
5. consumer health and safety
6. human rights (Arena, 2009).

There is a debate about what is sustainable development and sustainability, and thus, different societal actors "read" the concept of form as most convenient to them (Barbosa, 2014).

Sustainable competitive advantage requires an adaptation of the firm's knowledge capabilities over time, to overcome the continuous and discontinuous changes in the technological and market environment (Teece, 2007). However, recently new studies indicate that long term competitive advantage has become increasingly diffcult to sustain (Wiggins and Ruefi 2005; D'Aveni et al. 2010); these studies suggest concatenating a sequence of advantages over time (Wiggins and Ruefi 2005).

2.2 Definition of Knowledge

The next concept needed to interpret organizational knowledge maintenance is knowledge.

Based on the research objectives, the author analyses the classification of knowledge and the term of knowledge. Many studies attempt to describe the term of knowledge.

Davenport (1998) determined that knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

"Knowledge" is increasingly recognized as being of central importance to organizations in the contemporary knowledge society. Changes in the workings of capitalism, the advent of advanced communication technologies,

the complexity of social and cultural changes, the shrinking of the world due to increasing globalization, intensifying competition – all these factors and more point towards an increasing need for placing ‘‘knowledge’’ at the centre of the philosophy of the contemporary knowledge society (Blackler et al., 1993).

After the review the terms of sustainability and knowledge, the authors define the concept of knowledge sustainability.

2.3 Definition of Knowledge Sustainability

The authors define knowledge sustainability as follows.

The aim of knowledge sustainability is to preserve and develop data, information, and knowledge, building on the necessary knowledge in the organisation. It aims to focus on useful and important information and to reduce unnecessary information. The focus of knowledge sustainability is on the future, which is a priority area for knowledge sharing between generations, supported by various management tools. Trust and ethical organisation are prerequisites for this process to work.

3. Knowledge Management

Knowledge management is a multidisciplinary field. Knowledge management involves psychology, epistemology, and cognitive sciences. Its aim is to enable people and organisations to cooperate, and to distribute, develop, use and recycle knowledge (Bencsik, 2016).

Knowledge management has emerged as a specific academic field; it combines several sub-disciplines and has become an independent academic field (Ma and Yu, 2010). It was described by Du Plessis (2007) as a multifaceted approach integrating many different fundamental elements of the organization and a dynamic process (Brito, 2020). In recent decades, knowledge management has been one of the most influential and visible novel approaches to the art and science of management (Inkinen,2015). Nowadays knowledge management is a widely based discourse, promoted by academics, consultants, practitioners, and business press alike (e.g. Scarbrough et al., 2005). Knowledge management emerged as a discipline for formalizing organizational practices that would guide an individual through the skill acquisition journey as effectively and efficiently as possible (Al-Gharaibeh, 2021). The knowledge management research identifies several knowledge management processes including knowledge creation, knowledge acquisition, knowledge sharing, knowledge storage, and knowledge application (Gumus 2007).

4. Research Model

After reviewing the concepts of sustainability and knowledge, defining organizational knowledge sustainability, the authors created a model for knowledge sustainability.

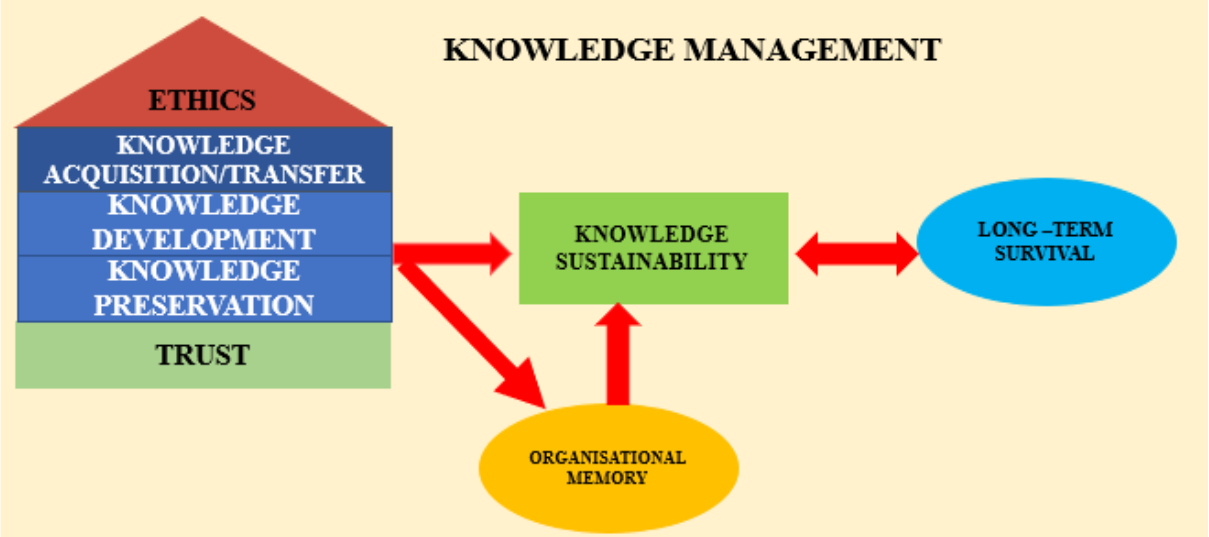


Figure 1: Model of organisational knowledge sustainability

Source: Own editing

The framework for the process of organizational knowledge sustainability is provided by knowledge management. The model is based on the Probst model, from which the authors highlighted the most important elements in terms of knowledge sustainability, which are the acquisition / sharing of knowledge, the development of knowledge and the preservation of knowledge. The result of organizational learning is organizational memory, which together with the mentioned elements supports the sustainability of knowledge and thus long-term survival. In order for the process of organizational knowledge sustainability to be successful, leadership and the organizational culture it forms have an important role to play. This is a fundamental criterion without which the theoretical model will not work in practice.

Considering that although all elements of knowledge management support organisational sustainability, the author looks at the following key elements: knowledge acquisition, knowledge development, knowledge retention, ethics and trust. The model summarizes the process of organisational sustainability.

4.1 Knowledge Development

The knowledge development step is a factor that directly influences competitiveness (Kuo, 2019).

Knowledge development consists of all the management intended to produce new internal or external knowledge on both the individual and the collective level (Probst, 1998). The speed and extent of development depends on the availability of material, technological and financial resources, but in its essence development is a human process that is determined by the response of people to their external environment (Jacobs, 2000).

Knowledge development is a key element of the knowledge sustainability process. Organisations need to have up-to-date and relevant information.

4.2 Knowledge Preservation

After knowledge has been acquired or developed, it must be carefully preserved. To avoid the loss of valuable expertise, companies must shape the processes of selecting valuable knowledge for preservation, ensuring its suitable storage, and regularly incorporating it into the knowledge base (Probst, 1998). Knowledge preservation is one of the most important step in the process of knowledge sustainability. The phase of knowledge preservation includes the action of recording, systematisation, storing and refreshing. Knowledge-based systems store describable explicit forms of knowledge in a problem area, or they are used to store expert knowledge that enables the management of a narrower issue(Lesniak & Zima 2018).

4.3 Knowledge Acquisition

Considering that the cycle of knowledge acquisition is dynamic. According to Gardoni (2015) knowledge is thus not static but dynamic, it is in constant evolution. Elaborate information is a synthesis with levels of different processing, including disciplines and offering a more or less global solution of the treated topic. In the case of knowledge acquisition, through formal and informal channels, we can obtain useful information that leads to the people whose knowledge we need (Jaina et al, 2016).

4.4 Ethics

Ethics provide the basis for the whole process of knowledge sustainability. An ethical organisation can ensure the appropriate environment for knowledge sustainability.

4.5 Organisational Trust

Current studies show that inter-organizational trust is the cornerstone of business partnerships and nurtures the intention of knowledge acquisition and sharing outside organizational boundaries (Panteli, 2005). Pavlou (2002) defines inter-organizational trust as the subjective belief with which organizational members collectively assess that a population of organizations will perform potential transactions according to their confident expectations, irrespective of their ability to fully monitor them (Chen, 2014).Prior research suggests trusting beliefs can reduce their perceptions of uncertainty and risk, thereby enhancing their behavioural willingness (McKnight et al., 2002). Organisational trust is an essential element in the process of knowledge sustainability. Without trust organisational members doesn't share the relevant information.

5. Discussion

This research can provide a basis for a deeper understanding of the knowledge sustainability. After reviewing the studies, the authors created their concept of knowledge sustainability.

This study utilized the grounded theory research method to explore the relationship between knowledge management, knowledge development, knowledge preservation, knowledge acquisition, ethics and trust.

Therefore, this research attempts to analyse how these mentioned elements help to reach the knowledge sustainability and the long- term survival.

Finally the authors have created our own knowledge sustainability model based on knowledge management models.

6. Future research directions

As a continuation of the research, the authors intend to use the Delphi method. It is planned to seek the opinion of experts in the field of knowledge management in connection with the two rounds of knowledge sustainability. In the first round, the authors formulate open-ended questions. Once the responses are received, they are recorded and analyzed using ATLAS content analysis software. Based on the analysis, the corner points are outlined, so a questionnaire is compiled based on this. The questionnaire will be sent to these professionals. The collected data is then to be analyzed using SPSS software.

Using the Delphi method in two circles, the aim is to get to know the opinions of experts in the field regarding the sustainability of knowledge, to find out the tools, methods, problems, solutions, current and expected trends. The research aims to examine the three major groups involved in knowledge management, which are faculty / researchers working at the university; the range of consultants: HR consultants, interim managers; corporate sector: large corporations. The authors aim to test the model of organizational knowledge sustainability based on the opinions of professionals; be able to provide a widely accepted definition of knowledge sustainability; you can compare these three groups to find out what knowledge sustainability means in different areas.

Acknowledgement

The research is supported by the Research Centre at Faculty of Business and Economics (No PE-GTK-GSKK A095000000-4) of University of Pannonia (Veszprém, Hungary).

References

Al-Gharaibeh, R., Mostafa, A. (2021). Knowledge Sharing Framework: a Game- Theoretic Approach. *Journal of the Knowledge Economy*.12(1), 2-10.

Arena, M., Terzi, S. (2009). A state of the art of industrial sustainability: Definitions, tools and metrics. *International Journal of Product Lifecycle Management*.4(1-3), 214-220.

Baker, M. (2001). Marketing. London, UK:Routledge.

Barbosa, G., Drach, P., Corbella, O.(2014). A Conceptual Review of the Terms Sustainable Development and Sustainability. *International Journal of Social Sciences*. 3(2), 3-8.

Bencsik, A. (2016). *Knowledge Management Initiatives and Strategies in Small and Medium Enterprises.* Hershey, US: IGI Global.

Brundtland, G., Khalid, M., Agnelli, S., Al-Athel, S.A., Chidzero, B., Fadika, L.M.(1987): *Our common future: the World commission on environment and development*. Oxford, UK: Oxford University Press.

Blackler, F. (1995). Knowledge, Knowledge Work and Organisations: an Overview and Interpretation. *Organization Studies*, 16(1) 49-70.

Brito, E., Pais, L., Dos Santos, N. R., Figueiredo, C. (2020). Knowledge management, customer satisfaction and organizational image discriminating certified from non-certified (ISO 9001) municipalities. *International Journal of Quality and Reliability Management*, 37(3), 451–469.

Chen, Y.H., Tzu-Pei, L., Yenb, D.C.(2014). How to facilitate inter-organizational knowledge sharing: The impact of trust. *Information and Management*, 51(5), 568-578.

Davenport, T.H., Prusak L. (1998). *Working Knowledge*. Harvard, US: Harvard Business School Press.

D'Aveni, R. A., Dagnino, B. G., & Smith, K. G. (2010). The age of temporary advantage. *Strategic Management Journal*, 31(13), 1371–1385.

Du Plessis, M. (2007), "The role of knowledge management in innovation", *Journal of Knowledge Management*, 11(4), 20-29.

Glavic, P., Lukman, R. (2007). *Rewiev of sustainability terms and their definitions.* Maribor, SI: University of Maribor.

Greiner, M.E., Bo¨hmann, T and Krcmar, H. (2007). A strategy for knowledge management. *Journal of Knowledge Management*, 11(6) 3-15,

Gumus, M. (2007). The effect of communication on knowledge sharing in organizations. *Journal of Knowledge Management Practice*, 8(2), 16-25.

Inkinen, H. T., Kianto, A., Vanhala, M. (2015). Knowledge management practices and innovation performance in Finland. *Baltic Journal of Management*, 10 (4), 432–455.

Jaina, A.K., Nandakumarb, K. & Ross, A. (2016). 50 years of biometric research: Accomplishments, challenges, and opportunities. *Pattern Recognition Letters*, 79 (8), 80-105.

Kamhawi, E. M. (2012). Knowledge management fishbone: A standard framework of organisational enablers, *Journal of Knowledge Management*, 16(5).

Kuo, K. (2019). Deep Triangle: A Deep Learning Approach to Loss Reserving. *Risks* , 7(3), 97.

Lesniak, A., Zima, K. (2018). Cost Calculation of Construction Projects Including Sustainability Factors Using the Case Based Reasoning (CBR) Method. *Sustainability*, 10(5), 1608.

Lijo, J. (2015). Converging sustainability definitions: industry independent dimensions. *Word Journal of Science, Technology and Sustainable Develpoment*, 12(3), 12-22.

, D.H., Choudhury V, Kacmar C.(2002). Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research*, 13 (3), 334-359.

Ma, Z., Yu, K.H. (2010). Research paradigms of contemporary knowledge management studies: 1998-2007. *Journal of Knowledge Management*, 14(2), 175-189.

Panteli, N., Sockalingam, S. (2005). Trust and conflict within virtual inter-organizational alliances: a framework for facilitating knowledge sharing. *Decision Support Systems*, 29(4), 599-617.

Pavlou P.A. (2002). Institution-based trust in inter-organizational exchange relationships: the role of online B2B marketplaces on trust formation. *Journal of Strategic Information Systems*, 11 (3–4), 215-243.

Ponce, S. R., José, A., Cancio, P., Sánchez, J.E. (2018). The capabilities approach and values of sustainability: Towards an inclusive Pedagogy*, Journal of Innovation and Knowledge*, 3(2018), 76-81.

Riege, A. (2007). Actions to overcome knowledge transfer barriers in MNCs. *Journal of Knowledge Management*, 11(1), 48-67.

Scarbrough, H., Robertson, M., Swan, J. (2005). Professional media and management fashion: the case of knowledge management. *Scandinavian Journal of Management*, 21(2), 197-208.

Teece, D. F., Pisano, G. and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28(13), 1319–1350.

Wiggins, R. R., & Ruefi, T. W. (2005). Schumpeter's ghost: Is hypercompetition making the best of times shorter? *Strategic Management Journal*, 26(10), 887–911.

Exploring Knowledge-Hiding Methods and Reasons in a Small Chinese Family Business

Bo Wen, Scott Foster and Khalid Abbas
Liverpool John Moores University, Liverpool, UK
B.wen@2018.ljmu.ac.uk
S.Foster@ljmu.ac.uk
K.M.Abbas@ljmu.ac.uk

Abstract: In the highly competitive business environment, family businesses represent the backbone of the economy in various countries; meanwhile, they face tremendous survival challenges. Knowledge, particularly tacit knowledge, is the key to organisational survival because the hard-to-imitate characteristics could create value and technology innovation. However, it is challenging for family businesses to obtain tacit knowledge because it resides in people's minds; and compared with sharing, people prefer hiding it for self-protection. In recent years, knowledge hiding has increasingly attracted scholars' and practitioners' attention but few in the family business context. Hence, this research aims to investigate how and why the employees hide tacit knowledge in the small family business. The present study used the Self-determination theory (SDT) as the theoretical foundation to explain knowledge hiding behaviours from the motivational perspective. The single case study was conducted in China, as Chinese family business has distinctive cultural characteristics influencing knowledge hiding. Data were collected and analysed from 22 participants in a small Research and Development company through semi-structured interviews and thematic analysis. The findings revealed that skilled employees used various methods to hide knowledge, such as pretending not to know, using no time as an excuse, and hiding the core knowledge. The reasons for knowledge hiding primarily reflected the unfair issues between the family and non-family employees in terms of the favouritism of the owner-manager toward the family employees, no bonus and '996' timetable (people need to work from 9:00 am to 9:00 pm and 6 days per week) for the non-family members. Theoretically, this study contributes to understanding knowledge hiding behaviours by analysing motivations within SDT and corporate contextual influences in the small family business. These findings facilitate enhancing the owner-manager's awareness of the effects of unfairness on knowledge hiding and providing practical solutions to the unfairness and knowledge hiding among employees, as this has immense implications in any business.

Keywords: small family business, knowledge hiding, individual motivation, self-determination theory, unfairness, family involvement

1. Introduction:

In the highly competitive business environment, family businesses comprise the bulk of firms in the socioeconomic landscape in nations worldwide (Cunningham, 2020). Concurrently, family businesses encounter tremendous survival challenges (Motoc, 2020). Particularly, small-sized family businesses have outstanding survival issues due to a lack of sustainable innovativeness and resources (human resources, financial resources and knowledge resources) to secure competitiveness (Zhou, 2019). Almost 30% of small businesses can survive in the first five years of start-up (Mas-Verdú, Ribeiro-Soriano and Roig-Tierno, 2015). According to the Chinese National Academy of Development and Strategy (2019), 60% of small businesses had shut down within the first five years, and only 10% of them can survive after ten years. With this backdrop, small family businesses must seek effective methods to enhance their survival abilities and competitiveness.

Knowledge is the primary contributing factor to the survival of small family businesses in knowledge management literature because transferring knowledge is potent to expand the collective wisdom, strengthening the competitive advantages (Hadjielias, Christofi and Tarba, 2021). The small family businesses pervade a wealth of tacit knowledge sources (Motoc, 2020). Most tacit knowledge sources are possessed by skilled employees (Motoc, 2020). Nonetheless, it is challenging for small family businesses to obtain tacit knowledge from skilled employees (Cunningham, 2020). On one side, the distinct corporate context, such as the restrictive conditions and family involvement in business management, brings about the bottleneck of attracting and maintaining a skilled workforce (Cunningham, 2020). Small family businesses have less established incentive mechanisms to maintain their talents (Zhou, 2019). Conflicts between family and non-family members sourced from family involvement can bring about internal competition, thereby causing knowledge hiding (Botero et al., 2021). On the other, unlike explicit knowledge written in the documents, tacit knowledge resides in people's minds (Nonaka and Takeuchi, 1995). As such, people more easily hide tacit knowledge than explicit (Hwang, 2012). Besides, whether to hide it relies on individual motivations (Pereira and Mohiya, 2021). Compared with

knowledge sharing, people may more prefer hiding it for self-protection (Peng, 2013). Therefore, it is significant to construe why people in small family businesses hide their tacit knowledge.

Since Connelly et al. (2012) firstly proposed knowledge hiding as a separate research area in 2012, it has drawn an increasing amount of attention from scholars and practitioners (Chatterjee et al., 2021; Hadjielias, Christofi and Tarba, 2021; Pereira & Mohiya, 2021; Yang and Lee, 2021; etc.). Nevertheless, knowledge hiding research is still "in its infancy stage" (Pereira and Mohiya, 2021, p.369), especially in the family-business context (Hadjielias, Christofi and Tarba, 2021). Furthermore, self-determination theory (SDT) is extensively applied to understand individual motivations in the knowledge sharing field (Halvari et al., 2021 etc.) rather than the knowledge-hiding area (Yang and Lee, 2021). Hence, this study aims to address this gap by investigating how and why the skilled workers hide their tacit knowledge at a small family business in China based on SDT.

2. Theoretical lens and foci

2.1 Tacit knowledge

Existing studies concerning knowledge are primarily built on the distinction of Polanyi (1966): explicit and tacit knowledge. Explicit knowledge is easily codified and written in documents, whereas tacit knowledge is embedded in people's minds and hard to record and transfer (Nonaka and Takeuchi, 1995). Then, Nonaka and Takeuchi (1995) posited a model to explore the process of knowledge conversion between tacit and explicit states and discovered that this process starts from tacit knowledge at the individual level (Nonaka and Takeuchi, 1995). Tacit knowledge seems to be the fundamental construct of knowledge activities (Nonaka and Takeuchi, 1995). Besides, tacit knowledge from skilled employees is vital to the survival and development of small family businesses due to their personal and dynamic nature (Motoc, 2020). Therefore, this study draws upon the scope of individual-tacit knowledge from skilled professionals.

2.2 Knowledge hiding

Knowledge hiding is not simply short of sharing but "an attempt to retain and hide the knowledge that has been requested by someone else" (Connelly et al., 2012, p.65). In this sense, individual motivations play a pivotal role in knowledge-hiding behaviour (Halvari et al., 2021). Connelly et al. (2012) also portrayed three methods to hide knowledge: evasive, rationalised, and playing dumb. In detail, evasive hiding refers to providing incorrect or misleading information; rationalised hiding occurs when individuals explain not sharing; and playing dumb is when individuals pretend not to know or ignore the request for knowledge from others (Connelly et al., 2012).

Despite knowledge hiding being researched within the last decade, Pereira & Mohiya (2021) posited that knowledge-hiding studies are in their early stage. In family-business research, Hadjielias, Christofi and Tarba (2021) have provided the first empirical evidence on knowledge hiding. Consequently, this research follows the classification of Connelly et al. (2012) to study knowledge hiding in small family businesses.

2.3 Family involvement and knowledge hiding

It is indispensable that knowledge hiding behaviour is affected by the small family-business context (Chatterjee et al., 2021). The most overt characteristic is family involvement in business operation and management; that is, members from the same family govern the company (Botero et al., 2021). Foremost, the family's leading role affects corporate culture and varied activities, including knowledge movements (Motoc, 2020). Corporate culture manifested that the founders' beliefs could be inherited and developed by the following leaders (Botero et al., 2021). In China, the family values outstandingly highlight the commitment and working harmony among corporate members, characterised by collectivism (Zhang, Luo and Nie, 2017). Therefore, Chinese employees working in a collective culture may not perform a behaviour that will damage group benefits (Zhang, Luo and Nie, 2017). If knowledge hiding potentially destroys the group's interests, collective culture would reduce the happening of knowledge hiding.

Furthermore, influenced by family involvement, owner-managers' leadership could invoke personal preference and favouritism (Lin, 2013). Personal preference lies in family relationships and paternalistic leadership, whilst favouritism emerges from differential management (Lin, 2013). Zhou (2019) stated that the owner-managers in Chinese family businesses are challenging to treat non-family and family members equally concerning promotion, salary, and trust. These unequal treatments of family employees can cause an internally competitive environment (Motoc, 2020). It may lead to knowledge hiding as a result of the individual need to protect knowledge ownership (Peng, 2013). Additionally, family businesses may not value satisfying talented people's

psychological needs via reward systems (Zhou, 2019). Gradually, employees feel excluded and distrusted, and thereafter, they are more likely to hide knowledge (Hadjielias, Christofi and Tarba, 2021).

2.4 Self-determination theory (SDT)

SDT is a critical theory to explain human behaviours by the extent to which basic psychological needs are fulfilled, driven by intrinsic or extrinsic motivation (Ryan and Deci, 2000). Extrinsic motivations, such as rewards and reputation, are the goal-oriented reasons for a behaviour (Ryan and Deci, 2000). Instead, intrinsic motivations from an interest in the activity are associated with an inherent desire for autonomy, competency and relatedness with other people (Gagne & Deci, 2005). Perceived autonomy concerns one's desire to self-regulate their actions, varying with their values and lifestyle (Haas, 2019). Perceived competency lies with one's ability to be exerted (Haas, 2019). Finally, perceived relatedness involves people's sense of belonging and meaningfulness to others (Haas, 2019).

The extant literature has discovered varied motivational drivers for knowledge hiding. For instance, time pressure and competitiveness render people prone to hiding knowledge (Chatterjee et al., 2021). Job insecurity and lack of rewards may increase the possibility of knowledge hiding (Halvari et al., 2021). Huo et al. (2016) underpinned this viewpoint that knowledge hiding occurs when people feel threatened to lose their knowledge ownership. Stenius et al. (2016) discovered that identified motivation based on SDT is the best predictor of tacit knowledge sharing; however, if the sense of importance is missing, it may cause knowledge withholding. On the contrary, external motivation is not associated with knowledge sharing but is positively concerned with knowledge hiding (Stenius et al., 2016). Nevertheless, even if prior studies have found numerous motivational drivers for knowledge hiding, most of them are aligned with knowledge sharing (Stenius et al., 2016). Few apply SDT to independent knowledge-hiding research (Yang & Lee, 2021). Therefore, SDT is adopted as the theoretical foundation in this study.

3. Methods

This study applies a multi-qualitative research method in a single case study to investigate mechanisms and reasons for knowledge hiding in family businesses via understanding the meaning and views of the participants. The case study is an accredited company by the local government regarding its knowledge innovation and employees' learning and developing programmes. Knowledge hiding much depends on their motivations (Halvari et al., 2021); therefore, the qualitative approaches are available for participants to respond to the questions regarding knowledge hiding.

We undertook a cross-sectional documentation analysis followed by semi-structured interviews. The sample included twenty-two skilled employees. The participants were the purposive sampling, screened from three hierarchies (owner-manager, managers, and employees) and different groups (the senior and the young; the family and non-family members). Some participants were often assigned as lecturers or mentors to guide newcomers or apprentices/subordinates. Some of them were selected by the owner-manager and department managers as “role models” to give a speech at the yearly-end conference. Overall, all participants had rich experience in undertaking knowledge sharing practices.

All the participants have used pseudonyms as their names, for example, owner meaning the owner-manager; Mg meaning the manager; and Em meaning the employee. The numbers 1-10 stand for the ordinal number of each manager and employee, as depicted in Figure 1.

A template analysis approach was used to analyse all qualitative data. The entire data transcription, coding and analysis processes were achieved whereby Nvivo 12. At last, two themes and two sub-themes were integrated into the final template, as shown in Figure 2.

No.	Age	Tenure (vear)	Positions	Group (Family or Non-Family)	Coding
1	29	4.5	HR	Non-F	Em1
2	45	12	group leader	Non-F	Mg1
3	38	3	international business specialist	Non-F	Em2
4	57	27	manager	Non-F	Mg2
5	45	20	owner	F	Owner-manager
6	33	9	group leader	Non-F	Mg3
7	31	6	cashier	F	Em3
8	26	3	worker	Non-F	Em4
9	28	4	worker	Non-F	Em5
10	28	4	sales	Non-F	Em6
11	32	5	sales	Non-F	Em7
12	33	11	quality tester	Non-F	Em8
13	43	15	manager	Non-F	Mg4
14	65	38	accounting manager	F	Mg5
15	53	20	manager	Non-F	Mg6
16	48	19	manager	F	Mg7
17	48	9	group leader	F	Mg8
18	57	20	manager of the quality management system	F	Mg9
19	65	22	senior engineer	F	Mg10
20	52	8	manager	F	Mg11
21	25	5	sales	F	Em9
22	34	11	worker	Non-F	Em10

Figure 1: Demographic profile of the participants

Main themes
1. Methods of Knowledge hiding Telling others no time Pretending not to know Hiding core aspects of knowledge
2. Reasons for Knowledge hiding 2.1 Corporate context of family involvement: Collective corporate culture with a 'big family' value Favouritism of owner-manager toward the family members Low compensation and '996' timetables for non-family employees
2.2 Individual motivations for hiding: Intrinsic Motivation: Negative feels toward the colleagues and company Extrinsic Motivation: a lack of monetary incentives

Figure 2: Final template

4. Findings

4.1 Theme One: Methods of knowledge hiding

The participants used varied methods to hide knowledge when other people consult knowledge, for example, using no time as an excuse, pretending not to know and hiding core aspects of knowledge. Using no time as an excuse was not a deliberate hiding behaviour, as the participants might not make time to communicate with their co-workers regarding knowledge and technology. This was expressed by one of the participants:

> *"We have the '996' timetable, meaning we need to work from 9:00 am to 9:00 pm, and six days per week. Due to this, if my colleagues ask for help when I am in the middle of my job, I will honestly tell them I have no time. However, if I am available, I would like to give them a hand." (Mg9).*

Conversely, pretending not to know and hiding core knowledge was an intentional hiding behaviour in that the skilled employees did not want their colleagues to obtain their knowledge. The main reason was to protect themselves. The participant provided this viewpoint:

> *"Each member is a competitor to me. I cannot tell them my core knowledge because it will threaten my career development. If they request my expertise, I will tell them I have no ideas either" (Em7).*

As the above findings presented, the experienced employees in the case-study company often hid knowledge from other colleagues through the three methods: using no time as an excuse, pretending not to know and hiding core aspects of knowledge. The purpose of knowledge hiding behaviours was self-protection.

4.2 Theme Two: Reasons for knowledge hiding

The reasons why the skilled employees hid knowledge were analysed from the corporate context and individual motivations. These reasons mainly represented unfair conflicts between the family and non-family employees.

4.2.1 The corporate context of the family involvement

Family involvement played an overt role in forming the collective corporate culture and favouritism of the owner-manager toward her family members, which led the non-family to hide their knowledge. First, the collective corporate culture in the studied company highlighted a 'big family' value. The family people identified this value as the family beliefs deeply affected their perceptions. By contrast, even though agreeing with the 'big family' value, most non-family people felt stressed when the top managers excessively emphasised it and pushed them to behave following this value. As a result, they opted to hide knowledge. A non-family manager demonstrated this:

> *"Some top managers required to use their names to register the patents instead of mine. In fact, they did nothing. Meanwhile, they also told me that: 'all the knowledge should belong to the firm, as the company is our big family'. This unfair excuse makes me hide knowledge."* (Mg2)

Another outstanding example was the favouritism toward her family members. As most non-family employees stated, the owner-manager provided her relatives with a series of privileges, including higher compensations, more flexible working hours, and more managerial power than the non-family employees. These unfair situations resulted in knowledge hiding among the non-family members. While had realised the negative influences on knowledge hiding behaviours, the owner-manager conveyed a dilemma to deal with these issues:

> *"Respect for seniority, as a fine Chinese tradition, is quite important in our family. When my father handed over the company to me, he asked me to treat my family members well. Therefore, I have to provide better treatments for them. I confess it may cause non-family employees' dissatisfaction and knowledge hiding, which is bad for my business. Now, I am taking actions to lessen their authority, but it takes time."*

Furthermore, the non-family employees experienced low compensations and strict '996' timetables, affecting them to hide knowledge. Only a couple of the non-family employees could attain the annual bonus. They all admitted their salaries stayed low, and no bonus was set up in their monthly wage. Besides, the '996' timetables represented that the employees often worked overtime (9 am-9 pm per day and 6 days per week). It engendered the non-family members' imbalance between life and work. However, this rule only worked for the non-family employees rather than the family members. The following statements from the non-family participants stated the above circumstances:

"The owner-manager's relatives can come to work later or leave earlier than us without deducting wages. It makes us unhappy, but no one dares to propose against it." (Mg2)

"The 996 working schedules made me born out every day. I only had one day off per week. I prefer hiding knowledge to have a good rest." (Em2).

In brief, the results demonstrated that knowledge hiding mostly occurred among the non-family members due to a series of unfair issues caused by the family involvement. The unfair issues included the privileges for the family members out of favouritism of the owner-manager and unequal treatment for the non-family members, such as low-level compensations and strict working hours. Therefore, the non-family employees usually chose to hide knowledge.

4.2.2 Individual Motivation for knowledge hiding

The unfair issues drove the non-family employees to have a sense of distrust, pressure and dissatisfying feelings. Hence, these negative emotions became their motivations for knowledge hiding. More specifically, a sense of distrust of the non-family people arose from their worries of losing knowledge. Contributing knowledge could increase this risk. Besides, most knowledge sharing activities increased the extra workload for the non-family members. Thus, without equal wages and bonuses, they preferred to hide knowledge. Meanwhile, low-level compensations, the '996' working hours and privileges of the family members brought about pressure and dissatisfying emotions to their autonomy of work. The following quotations illustrated these situations:

"Knowledge sharing tasks are beyond my job duties. However, there is no bonus on our monthly wage. Therefore, why should I do the extra workload? If sharing too much, the learner could steal my knowledge. So, hiding knowledge is a wise choice in the office." (Em1).

"No matter how hard I work, the top managers do not want to offer a bonus. They only care about their interests. Besides, following this crazy timetable, my life is not a life. I felt that I am a just working machine. Therefore, why shouldn't I hide knowledge to play dumb?" (Em3).

As concluded, the unfairness caused by the family involvement generated the non-family people's motivations for knowledge hiding, including a sense of distrust and negative emotions toward their co-workers and company. Accordingly, it influenced the occurrence of knowledge hiding. Conversely, All the family members stated that nothing made them hide knowledge because they worked and shared knowledge to better achieve the common goals for their family and business.

5. Discussion

5.1 Methods of knowledge hiding

The experienced employees in the case-study company often hide knowledge through the three methods: using no time as an excuse, pretending not to know and hiding core aspects of knowledge. This result is concerned with the classification of Connelly et al. (2012). Precisely, using no time as an excuse tends to be the rationalised hiding because the skilled employees give an explicit explanation for those asking for help (Connelly et al., 2012). Furthermore, pretending not to know and hiding core aspects of knowledge are playing-dumb methods because they behave unknown or omit the core knowledge to protect themselves (Connelly et al., 2012). Hence, it indicates that the experienced workers primarily used playing-dumb and rationalised methods to hide their tacit knowledge. However, no evident evasive hiding has been found in the studied company.

The above situations occur primarily due to the collective corporate culture. Zhang, Luo and Nie (2017) discovered that Chinese employees in the collective culture might not do something that will damage organisational benefits. Evasive hiding is detrimental to the collective interests of this company because delivering false knowledge to mislead other people will "*make my colleagues get into the trouble at work" (Em6)*. The skilled employees do not hide knowledge in an evasive-hiding way. Therefore, these findings provide valuable evidence on knowledge-hiding methods in the small family business context.

5.2 Reasons for knowledge hiding

Knowledge hiding exposes the unfair conflicts between the family and non-family employees. The unfairness is mainly caused by family involvement in business management. It is determined by the nature of family businesses (Botero et al., 2021). The owner-manager and her family members govern the business operation and internal management. They value the 'big family' culture from this family tradition. Accordingly, they expect all individual and organisational behaviours to be instrumental to the 'big family'. This culture, on the positive side, influences all family people to hide nothing because of the same goals for their family and business (Botero et al., 2021). However, on the negative side, the top managers use the 'big family' as an excuse to persuade the non-family members to quit their knowledge ownership when registering the patents (Huo et al., 2016). Therefore, knowledge hiding more naturally and often occurs among non-family members than among family people.

Further, the unfair issues involve the privileges of the family members and unfair treatment for the non-family members, such as low-level compensation and strict working hours. These findings are consistent with Zhou (2019). Owner-managers in Chinese family businesses are challenging to treat non-family and family members equally concerning promotion, salary, and trust (Zhou, 2019). Therefore, the owner-manager provides her family members with high compensation, flexible working hours and authority but delivers the low-level compensation and a strict '996' timetable for the non-family people, although she knows the adverse outcomes caused non-family people's knowledge hiding toward the company.

Finally, the unfair conflicts trigger the non-family people's motivations for knowledge hiding. Differential treatments enable the non-family people to distrust their colleagues because their knowledge may be learned and taken away by others (Lin, 2013). Within SDT, distrust refers to people's intrinsic motivation to relatedness (Gagne & Deci, 2005), which involves people's sense of belonging (Haas, 2019). Besides, time pressure caused by the '996' timetable concerns the people's intrinsic autonomy, namely one's desire to self-regulate their actions according to their values and lifestyles (Haas, 2019). The non-family members do not have sufficient working autonomy in the '996' timetable due to an imbalance the work and life. At this point, distrust and psychological pressure from unfair treatments are intrinsic motivations for the non-family employees' knowledge hiding, as these motivations enable fulfilling their internally psychological balance and interest (Gagne & Deci, 2005). Finally, low compensations inspire non-family people to hide knowledge because sharing knowledge is an extra workload, but they cannot obtain corresponding returns. Performing knowledge hiding, a goal-oriented behaviour, cannot be satisfied by external incentives (Ryan and Deci, 2000). Thus, a lack of external incentives could be considered extrinsic motivations for knowledge hiding in this study. Consequently, these findings facilitate understanding knowledge-hiding motivations based on SDT.

6. Conclusions

This study investigated how and why skilled employees hide their tacit knowledge in a Chinese small family business. The skilled employees often hide their knowledge by playing-dumb and rationalised approaches. The reasons for knowledge hiding mainly source from the unfair conflicts between the family and non-family people, which are caused by the family involvement in business operation and management. In the meantime, the unfairness triggers the non-family members' motivation for hiding knowledge.

6.1 Contributions

This study mainly makes three prominent contributions to the knowledge-management literature and the family-business context. First, it addresses the gap in studying knowledge hiding in the family-business literature (Hadjielias, Christofi and Tarba, 2021) by probing the methods and reasons for knowledge hiding from the skilled people's perspectives. The playing-dumb and rationalised approaches are the main methods for knowledge hiding in the studied small family business, rather than evasive hiding. The primary reasons were the collective corporate culture and unfairness between the family and non-family employees. Consequently, it provides valuable evidence on learning the methods and reasons for knowledge hiding in the small family business context.

Second, the present study proposes the theoretical concepts of intrinsic and extrinsic motivations for knowledge hiding. In this project, distrust and psychological pressure are the intrinsic motivation for knowledge hiding because these motivations enable fulfilling their internally psychological balance and interest in relatedness and autonomy (Gagne & Deci, 2005). In contrast, a shortage of external incentives for the non-family people is the external motivation because sharing knowledge is an extra workload, but they cannot obtain corresponding

returns. Performing knowledge hiding, a goal-oriented behaviour, cannot be satisfied by external incentives (Ryan and Deci, 2000). However, currently, studies have used SDT to analyse knowledge-hiding behaviours (Yang & Lee, 2021), and most knowledge-hiding research has perceived the motivations for hiding as one of the antecedents, other than an independent motivational perspective (Halvari et al., 2021; Connelly et al., 2012). Hence, this research contributes to theoretical advancements in construing knowledge-hiding motivations through intrinsic and extrinsic motivations based on SDT.

Finally, this project makes contextual contributions to knowledge management and Chinese family businesses literature. The 'big-family' value influenced by family involvement and characterised by the collective culture brings about the positive effects on non-hiding behaviours for the family and negative influences on the knowledge hiding for the non-family members simultaneously. It extends the knowledge of knowledge hiding behaviours in knowledge management and Chinese family businesses literature from contextual and cultural dimensions.

6.2 Implications

For practitioners, this study underscores that decision-makers in small family businesses should take action to improve knowledge hiding in the long and short terms. First, it is necessary to create a fair working environment within the "big family" culture. Resolving unfair issues between the family and non-family groups takes time because it is not easy to change the "family" value in a short period. Second, in the short run, practitioners need to consider increasing the rewards and adjusting the working hours for the employees because the dearth of rewards and long working hours engenders people's intrinsic motivations of knowledge hiding.

6.3 Limitations

The present study has several limitations, which will envisage recommendations for further investigations. At first, although using a multi-qualitative research method in a single case study could produce in-depth and robust understandings of knowledge hiding, it may limit the generalisation to a broader context (Easterby-Smith et al., 2021). Second, a single case study was conducted in China. Thus, it is possibly hard to infer similar outcomes in other countries. Significantly, the current study discovered the effects of the collective culture on knowledge hiding, which varies from other types of cultures.

References

Botero, I. C., Martínez, A. B., Sanguino, G. and Binhote, J. (2021) "The family's effect on knowledge sharing in family firms", [online], *Journal of Knowledge Management,*
https://doi.org/10.1108/JKM-08-2020-0653

Chatterjee, S., Chaudhuri, R., Thrassou, A. and Vrontis, D. (2021) "Antecedents and consequences of knowledge hiding: The moderating role of knowledge hiders and knowledge seekers in organisations", *Journal of Business Research*, Vol 128, pp 303-313.

Connelly, C. E., Zweig, D., Webster, J. and Trougakos, J. P. (2012) "Knowledge hiding in organisations", *Journal of Organizational Behavior*, Vol 33, No. 1, pp 64-88.

Cunningham, J. (2020) "Identifying as an outsider: implications for non-family in small family firms", *The International Journal of Human Resource Management*, Vol 31, No. 22, pp 2785-2807

Gagné, M. and Deci, E.L. (2005) "Self-determination theory and work motivation", *Journal of Organizational Behavior*, Vol 26, No. 4, pp 331-362.

Haas, E. J. (2019) "Using self-determination theory to identify organisational interventions to support coal mineworkers' dust-reducing practices", *International Journal of Mining Science and Technology*, Vol 29, No.3, pp 371-378.

Hadjielias, E., Christofi, M. and Tarba, S. (2021) "Knowledge hiding and knowledge sharing in small family farms: A stewardship view", *Journal of business research,* Vol 137, pp 279–292.

Halvari, A. E. M., Ivarsson, A., Halvari, H., Olafsen, A. H., Solstad, B. E., Niemiec, C. P., Deci, E. L. and Williams, G. C. (2021) "A Prospective Study of Knowledge Sharing at Work Based on Self-Determination Theory", *Scandinavian Journal of Work and Organizational Psychology,* Vol 6, No. 1, pp 1-14.

Huo, W., Cai, Z., Luo, J., Men, C., and Jia, R. (2016) "Antecedents and intervention mechanisms: a multi-level study of R&D team's knowledge hiding behaviour", *Journal of Knowledge Management*, Vol 20, No. 5, pp 880-897.

Hwang, Y. (2012) "Understanding moderating effects of collectivist cultural orientation on the knowledge sharing attitude by email", *Computers in Human Behavior*, Vol 28, No. 6, pp 2169-2174

Lin, W. B. (2013) "Research on knowledge sharing and interpersonal relationships: empirical study of family firms and non-family firms", *Quality & Quantity*, Vol 47, No. 1, pp 151-166.

Mas-Verdú, F., Ribeiro-Soriano, D. and Roig-Tierno, N. (2015) "Firm survival: The role of incubators and business characteristics", *Journal of Business Research*, Vol 68, No. 4, pp 793-796.

Motoc, A. (2020) "Knowledge Dynamics in Family Business", *Management Dynamics in the knowledge economy,* Vol 8, No. 2, pp 145–157.

National Academy of Development and Strategy (2019) *The status quo, problems and solutions of Chinese small and micro businesses,* [online], http://nads.ruc.edu.cn/upfile/file/20190729101113_96211_27841.pdf

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York.

Peng, H. (2013) "Why and when do people hide knowledge?" *Journal of knowledge management,* Vol 17, No. 3, pp 398-415.

Pereira, V. and Mohiya, M. (2021) "Share or hide? Investigating positive and negative employee intentions and organisational support in the context of knowledge sharing and hiding", *Journal of business research*, Vol 129, pp 368–381.

Polanyi, M. (1966) *The Tacit Dimension*, Routledge and Kegan Paul, London.

Ryan, R. M. and Deci, E. L. (2000) "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being", *American psychologist*, Vol 55, No. 1, pp 68-78.

Stenius, M., Hankonen, N., Ravaja, N. and Haukkala, A. (2016) "Why share expertise? A closer look at the quality of motivation to share or withhold knowledge", *Journal of Knowledge Management,* Vol 20, No. 2, pp 181-198.

Yang, Q. and Lee, Y. C. (2021) "Why Do People Hide Knowledge in the Online Knowledge Community? An Integrated Framework of Protection Motivation, Self-Determination, and Social Exchange Beliefs", *Sustainability*, Vol 13, No. 17, pp 9885-9109.

Zhang M, Luo, M. F. and Nie, R. (2017) "An analysis of individuals' hiding intention of tacit knowledge in university research team", *Information Studies: Theory & Application,* Vol 40, No. 7, pp 74–79.

Zhou, J. Z. (2019) "A Study of Family Business in China", *Economic studies & analyses*. Vol 13, No, 2, pp 152–160.

Customer Knowledge Management: A Systematic Literature Review and Agenda for Future Research

Victoria Yousra Ourzik
University of Paris Dauphine-PSL, Paris, France
yousra.ourzik@dauphine.eu

Abstract: **Purpose** - Reviewing the literature from 2000 until 2020, this paper aims to analyse the nature of existing research on customer knowledge management (CKM) and outlines a future research agenda. **Design/methodology/approach** – Selected articles on CKM are examined using a structured literature review methodology. The paper analyses 75 articles published from 2000 to 2020 within journals specializing in the fields of management, information systems and marketing. **Findings** – CKM is a research area of growing importance especially in the marketing and IS domains. Findings show different definitions of the construct depending on the examined field. Additionally, qualitative research on customer knowledge management is scarce and there seems to be a lack of understanding concerning CK creation, collection, transfer, and dissemination within the firm. **Originality/value** – The paper integrates the literature on CKM within a framework that links the antecedents, consequences, and moderators. Finally, the review identifies 3 research streams to extend the literature and outline key practical implications: implementation, firm performance and, customer engagement. Paper type - Literature review

Keywords: systematic literature review; customer knowledge management; antecedent; moderators; consequences; research agenda

1. Introduction

First used in 1995 by Andrew Orent in the banking sector, the notion of "customer knowledge" (CK) has become increasingly popular in management literature. Today, customer knowledge is a central concept in business management. According to a Google Scholar search conducted in May 2021, the term "customer knowledge" was cited in 37400 references. Publications on the subject find their application in various fields, especially, management, information systems and marketing.

Customer knowledge is an essential asset for organizations (Kohli & Jaworski, 1990) and consumers are constantly changing (Stuart-Menteth et al., 2006). To organizations, it is crucial to capture those changes and adapt to them. The consumer is deemed to be “individualistic” in the 1980s, “hedonistic” in the 1990s and “creative” in the 2000s. Today, consumers are considered active “co-creators”, capable of agency in their market (Cova & Cova, 2009; Leclercq et al., 2016). Hence the importance of developing customer knowledge management for researchers and practitioners alike. By proposing a systematic review of the literature covering twenty years of research on the subject, this article paints a comprehensive and up- to-date picture on customer knowledge management. Based on 75 articles published in major academic journals, this review seeks to contribute to the theoretical foundations of the construct of CK and provide an agenda for future research. Through this systematic review of the literature, we seek to answer the following questions:
RQ1. How is the CKM literature developing?
RQ2. What are the antecedents and consequences of CKM investments?
RQ3. What is the future of CKM research?

The paper is structured as followed. First, we examine the number of articles published on CK, the methodology used and their research field. Second, we propose a transdisciplinary definition of the construct. Third, we integrate the literature on CK into a framework that links the antecedents, consequences, and moderators. In closing, we propose an agenda for future research and managerial implications from this body of research.

2. Methodology

The Systematic Literature Review (SLR) has been introduced in management research as a methodology for literature review to develop a scientific synthesis in response to a specific question. The SLR differs from the traditional narrative review in the sense that it adopts a transparent, scientific, and reproducible process that aims to minimize bias (Tranfield et al., 2003). The choice of a systematic type of literature review is due to the desire to synthesize the state-of-the-art on customer knowledge to create a solid understanding as well as foundations for future research. We conduct the searches using EBSCO. The EBSCO catalog contains 375 multidisciplinary databases and covers a wide range of academic subjects. The first query on the EBSCO search

engine with "customer knowledge" resulted in 907 articles published between 2000 and 2020. Non-peer-reviewed articles were excluded. As a result, we obtained a total of 509 articles. To make sure only high-quality research articles are selected, we referred to the Australian Business Deans Council's (ABDC) Journal Quality List and selected only articles in categories A*, A or B. The ABDC ranking is regularly updated and vouch for the quality of the corpus. To keep the SLR tractable, we selected the fields of research: Management (1503), Marketing/Tourism/Logistics (1505) and Information Systems (806). Only 170 articles were left. All articles had to be downloaded and checked before being sorted. After a thorough reading of the articles, 95 articles were excluded because they are duplicates or do not treat of customer knowledge as a focal construct. Thanks to this protocol, 75 articles were found to be relevant and make up the final corpus of our study. The construction of this procedure is inspired by similar approaches adopted in other systematic reviews (Narayanan et al., 2011; Nill & Schibrowsky, 2007).

3. Data description

For each of the seventy-five articles selected, the following were coded: theoretical framework, proposed definition, methodology, antecedents, consequences, moderators of customer knowledge and, suggested avenues for future research. Our choice to review customer knowledge literature entailed two selection decisions: first, we limited the search to articles published between 2000 and 2020. We began from the year 2000 because the market orientation perspective that paved the way for customer knowledge development within firms slowly created momentum in late 1980s, when the Marketing Science Institute (MSI) organized a conference covering the issue of "Developing a marketing orientation" in April 1987. Hence we found that articles in this area dates back to 2000. Second, we limited the review to top publication outlets in the ABDC list. The word-cloud in **Figure 1** gives an overview of the content of the examined literature. A word that appears frequently in the corpus appears larger.



Figure 1: Word-cloud of the prominent words in the examined literature

Table 1: Top publication outlets and their respective number of articles on customer knowledge management

Name of the journal	Year of publication																				Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Business Process Management Journal				1		1						1								1		4
Decision Support Systems		1												1						1		5
European Journal of Marketing								1			1										2	2
European Management Journal			1		1	1								1								3
Industrial Marketing Management				1		1				1	2				1					1		7
Information & Management															3						2	5
International Journal of Information																						
Management									1										1	1		3
International Journal of Technology																						
Management								1				1										2
Journal of Business & Industrial																						
Marketing									1					1			1	1				4
Journal of Business Research							1									1	1			2		5
Journal of Consumer Psychology											1											1
Journal of International Marketing													1									2
Journal of Knowledge Management																			1		1	2
Journal of Marketing					1	1			1	1												4
Journal of Marketing Management						1																1
Journal of Product Innovation																						
Management					1	1									1							3
Journal of Retailing																					1	1
Journal of Service Research			1			1													1			3
Journal of Services Marketing																				1		1
Journal of the Academy of Marketing																						
Science				1	1												2			1		6
Management Science		1																				1
Marketing Science		1								1												2
MIS Quarterly						1						1						1				3
Strategic Management Journal		1				1																2
Technovation						1	1						1									3
Total	1	4	2	3	3	10	2	2	4	4	4	3	2	4	5	1	4	2	3	8	4	75

Figure 2 summarizes the research methods most commonly used. Sixty-two articles followed quantitative empirical methodoloy and explored hypotheses and variables in relationship with customer knowledge management. Qualitative research based on in-depth interviews and content analysis is used less frequently in customer knowledge. Only thirteen articles in the selected corpus used qualitative methodology.

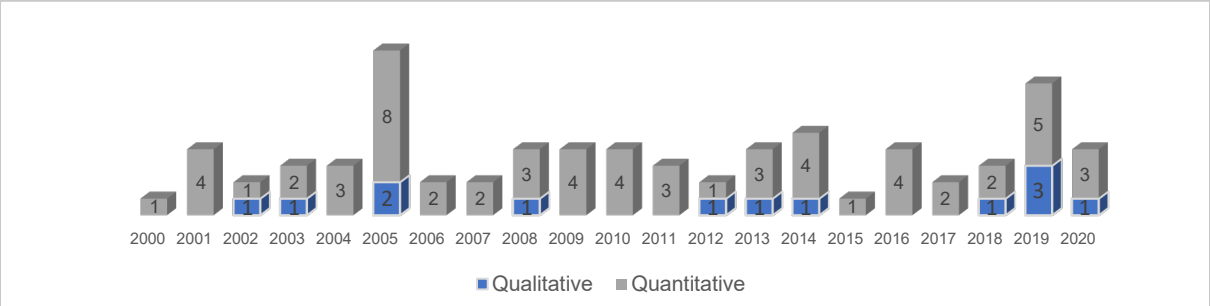


Figure 2: No. of articles published per research method

Figure 3 illustrates the distribution of the number of articles on customer knowledge by research field. Marketing remains the main research field (53% of total publications), followed by Information Systems (35%), and Management (12%).

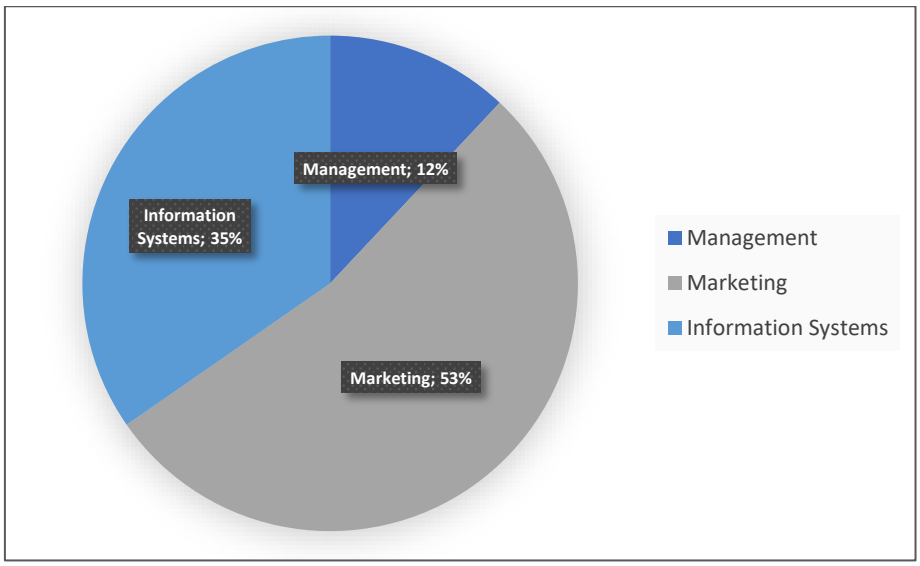


Figure 3: No. of articles published on CKM by category

Through our analysis, we identified different theoretical lenses used in customer knowledge management research (see **Table 2**). Of all papers we analysed, eight papers used either resource-based view, knowledge-based view or both, two used service dominant logic, social cognitive theory, relational view and social capital theory. A small percentage of the remaining papers apply theories such as Information-processing theories of choice, Microfoundation research and Consumer learning theories. Most of the customer knowledge studies neither specifically mention any theoretical framework nor use subjectively elements and concepts of various theories.

4. Conceptualization

After careful examination of the literature, it appears that definitions given to customer knowledge (CK) and customer knowledge management (CKM) are fragmented and vary from one article to another. **Table 3** illustrates definitions of customer knowledge, as they appeared in the literature, in a chronological order.

Table 2: Theories used in customer knowledge management articles

Theory	Articles	References
Resource based view	8	(Auh & Menguc, 2006; Campbell, 2003; Garrido-Moreno et al., 2014; Gibbert et al., 2002; Jayachandran et al., 2004b; Khodakarami & Chan, 2014; Lopez-Nicolas & Molina-Castillo, 2008; Ray et al., 2005)
Knowledge based view	8	(Cui & Wu, 2016; Garrido-Moreno et al., 2014; Goyal et al., 2020; Jayachandran et al., 2004; Massey et al., 2001; Salomann et al., 2005; Stein & Smith, 2009; Yli-Renko et al., 2001)
Service dominant logic	2	(Mahr et al., 2014; Santos-Vijande, López-Sánchez, et al., 2016)
Social cognitive theory	2	(Homburg et al., 2009; Tang & Marinova, 2020)
Information-processing theories of choice	1	(Capraro et al., 2003)
Microfoundation research	1	(Tang & Marinova, 2020)
Consumer learning theories	1	(Lu & Vir Singh, 2017)
Relational view	2	(Tang & Marinova, 2020; Yli-Renko et al., 2001)
Social capital theory	2	(Yli-Renko et al., 2001; H. Zhang et al., 2020)

Table 3: Definitions of customer knowledge in the literature

Definition	Authors
Customer knowledge management is about gaining, sharing, and expanding the knowledge residing in customers, to both customer and corporate benefit.	(Gibbert et al., 2002)
Customer knowledge development (...) is, the development of an understanding of customer preferences.	(Joshi & Sharma, 2004)
Customer knowledge refers to the activities within an organization focused on the generation, analysis, and dissemination of customer-related information for the purpose of strategy development and implementation.	(Jayachandran et al., 2004)
CKM is the application of knowledge management (KM) instruments and techniques to support the exchange of knowledge between an enterprise and its customers enabling the company to make appropriate strategic business decisions.	(Lopez-Nicolas & Molina-Castillo, 2008)
Customer knowledge – comprising knowledge about and from customers (…)	(Chari et al., 2016)
Customer knowledge refers to the knowledge about customer's needs, preferences, and behaviors.	(Tang & Marinova, 2020)

Definitions in **Table 3** suggest a dual perspective between customer and organization. On the one hand, CK is the knowledge organizations gather on their customers (Chari et al., 2016; Gibbert et al., 2002; Jayachandran et al., 2004a; Joshi & Sharma, 2004; Tang & Marinova, 2020). On the other hand, CK is the knowledge customers have on the product or organization (Puligadda et al., 2010). More in line with the first meaning, researchers distinguish between knowledge *from* customers (Chari et al., 2016; Gibbert et al., 2002; Jayachandran et al., 2004a) and knowledge *about* customers (Chari et al., 2016; Jayachandran et al., 2004a; Joshi & Sharma, 2004; Tang & Marinova, 2020). The first focuses on information collected *from* customers for instance on product usage conditions or competition during interviews or on social media. The latest focuses on psycho-demographic and behavioural information collected *about* customers during their customer journey for CRM purposes.

Building upon this, we propose that *customer knowledge is a multidimensional construct that encompasses (1) knowledge received from customers, (2) knowledge collected about customers and (3) knowledge created for customers. CKM refers to all activities that aim at enhancing customer knowledge collection, generation, and dissemination within the organization.*

5. Theoretical framework

The CK transfer is a two-way information flow involving both organizations and customers. It can flow from customers to organizations or from organizations to customers. Note that customers also create and exchange knowledge when they interact with one another about the product or the organization (**Figure 4**). In this section we aim at investigating factors influencing CKM. To that end, we integrate CK literature in a theoretical model linking antecedents, consequences, and moderators (**Figure 4**).

5.1 Antecedents

Review of the selected studies indicates 4 antecedent factors to CKM (**Figure 4**). *CKM strategy* is highlighted by researchers as a key antecedent factor (Cui & Wu, 2016). This management strategy embodies customer knowledge as a value creating asset. Customers are considered knowledge partners and efforts to acquire, analyse, and diffuse CK inside the organization are encouraged. Senior management needs to be committed to CKM and define a clear communication line, both horizontally and vertically, so that knowledge from, for and about customers flows between persons holding the same position as well as between supervisors and subordinates. Joshi & Sharma (2004) add that given the evolving state of CKM activities, organizations must be strategically flexible when assigning budgets to them. The precise estimation of a budget is problematic, thus, granting access to resources other than the initial budget is a requirement for effective customer knowledge development.

Employees play a major role in providing information to customers and collecting knowledge *from* and *about* them. That is especially the case for front-line employees (Joshi & Sharma, 2004; Santos-Vijande, López-sánchez, et al., 2016). The ability of a customer-facing employee to collect CK depends on two variables : competence and motivation (Homburg et al., 2009b; Menguc et al., 2013). Menguc et al. (2013) scrutinized the case of customer-facing salespeople to study the link between task and gratification. How salespeople combine their efforts, share information with each other, and create customer knowledge is a result of the task-outcome interdependency. For those reasons, the authors recommend (1) tying individual salespeople's rewards to the team's performance and (2) creating a team structure that has both high task and outcome interdependence.

Next, *organizational support* appears as a third antecedent factor to CKM. Information systems literature insists on the implementation of business intelligence infrastructures such as CRM and other software and hardware systems to facilitate customer data collection, processing, and dissemination within the organization (Piccoli & Yves, 2005). On the other hand, marketing literature insists on the ability to recognize and measure the value of customer knowledge (Yli-Renko et al. 2001).

The last driver of CKM raised by the review is *inter-functional cooperation* (Menguc et al., 2013; Mithas et al., 2011). CKM is transdisciplinary and many departments within the organization intervene in activities of knowledge acquisition, analysis, and diffusion. Menguc et al. (2013) encourage firms to pay close attention to cross-functional coordination. Should employees acquire CK, they need to be able and willing to share it with others (Yli-Renko et al. 2001). According to Mithas et al. (2011) among all other functions, knowledge exchanged between customer service and IT is the most critical and should be facilitated.

5.2 Consequences

It is reasonable to argue CKM is not the ultimate goal for organizations but rather a means to an end (Salojärvi et al., 2010), that is, market performance. Based on our analysis, organizations may expect many consequences from CKM implementation. Existing research points at customer satisfaction, customer relationship, sales and new product development (NPD) performance. And also, technological distinctiveness, innovation acceptance and fastest decision-making process (**Figure5**).

The current environment is characterized by a paradigm shift insofar as CKM is not about creating value *for* customers; rather, it is about co-creating value *with* customers. Traditionally, companies perceived customers as passive recipients of their offerings (Mahr et al., 2014). CKM requires to consider customers as active partners who can participate in the firm's process of value creation (Mahr et al., 2014).

CKM positively influences *customer relationships, sales* (Menguc et al., 2013), and *customer satisfaction* (Homburg et al., 2009). By analysing collected data on customers, organizations develop their understanding of existing customers needs, as well as future market trends (Santos-Vijande, López-sánchez, et al., 2016). As a

consequence, CKM influences positively on customer satisfaction (Homburg et al., 2009b; Lu & Vir Singh, 2017; Puligadda et al., 2010) and improves *NPD performance* (Joshi & Sharma, 2004; Mahr et al., 2014; Tang & Marinova, 2020; Yli-Renko et al., 2001).

Lu and Vir Singh (2017) examined the case of customer support platforms. According to the researchers, companies would gain much at offering their clients crowdsourcing customer service. A crowdsourced (or collaborative) customer service is a platform in which clients can ask questions and they are answered by more experienced customers who share their experience. This type of platform benefits to both companies, that can collect customer experience information and save on moderating costs, and clients, as they can have quicker responses to their requests (Lu & Vir Singh, 2017). In line with this, customer knowledge process, by enhancing awareness of customer needs, is likely to ensure that the *decision-making process is faster* (Jayachandran et al., 2004). More specifically, the capacity to respond to a customer query depends on two variables: expertise and speed. Customer knowledge is positively associated with these two variables and reduces risk-taking in the response to the customer (Jayachandran et al., 2004a; Lu & Vir Singh, 2017).

Customers, as current and future buyers, are the most important external source of knowledge for the innovation process (Prahalad and Ramaswamy, 2004). Information acquired from customer interactions allows organizations to develop knowledge on technical specificities of the product and increase their capacity to conceive products that are significantly different from competition (Yli-Renko et al., 2001). For those reasons, CKM is said to be a facilitator of *technological distinctiveness* (Bonner et al., 2004; Yli-Renko et al., 2001) and *innovation acceptance* (Joshi & Sharma, 2004; Mahr et al., 2014; Santos-Vijande, López-sánchez, et al., 2016).

5.3 Moderators

We distinguish 3 moderators that influence the link between CKM antecedents, CK transfer process and CKM consequences (**Figure 4**). First, the frequency of interaction with the customer (Yli-Renko et al., 2001). Second, the nature of the exchanged knowledge (Cui & Wu, 2016). Third, information available to customers on alternative options (Capraro et al., 2003).

The extent to which a firm can acquire knowledge depends on:(1) the ability to recognize and assess the value of the knowledge, (2) repeated interaction with the customer and (3) willingness to share information (Yli-Renko et al., 2001). Social interaction increases the process of information acquisition. So, the more organizations interact with customers the more knowledge they can expect to get.

CK transfer process relies on a two-way information flow involving both organizations and customers (Figure 4). The knowledge can be exchanged between customers. It can flow from customers to organizations or, the other way around, from organizations to customers.

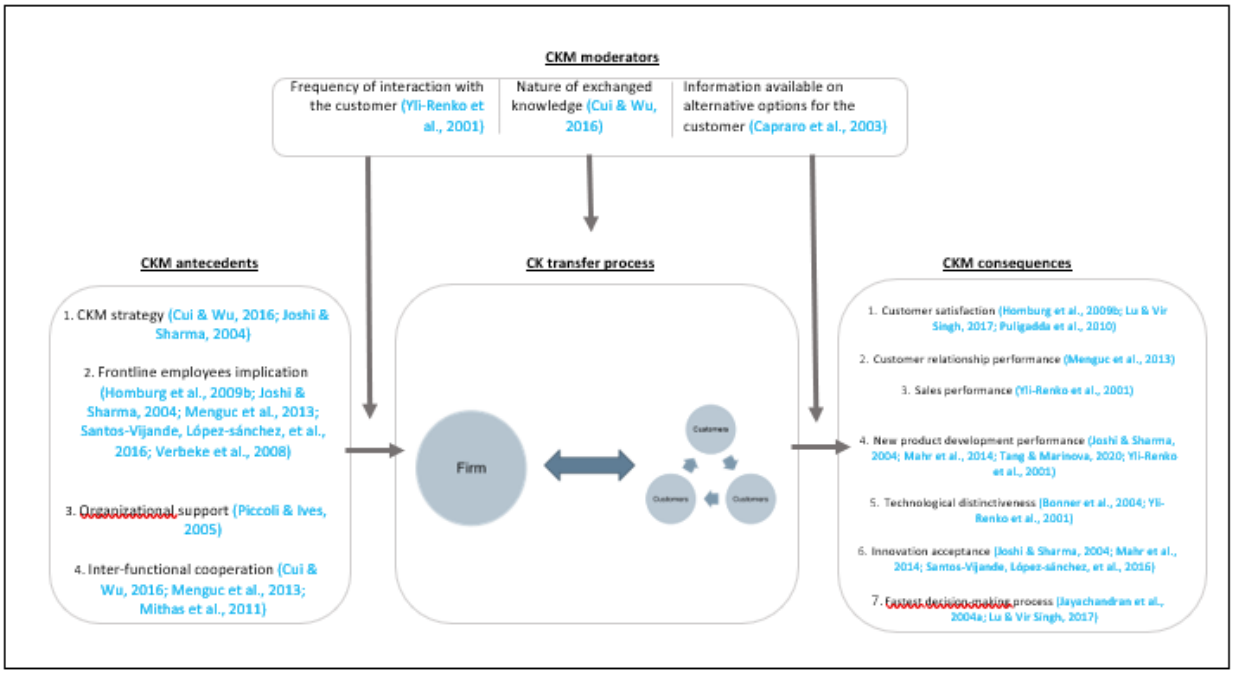


Figure 4. Theoretical framework

6. Conclusion

6.1 Research agenda

Based on the coding of the selected articles, we can extract various avenues for future research. **Table 3** synthetises a research agenda regarding customer knowledge management. Overall, researchers call for more qualitative and longitudinal research on the effects of customer knowledge (Auh & Menguc, 2006; Tang & Marinova, 2020; Yli-Renko et al., 2001). This supports findings in **Figure 2** as out of 75 articles composing the corpus, only 15% make use of qualitative methodology.

We encourage future researchers to explore the different stages of CKM implementation. More precisely, what are the monetary and temporal investments required for companies to establish CKM processes? Also, future studies should examine more closely the links between CKM and firm performance. For instance, one aspect is the use of CKM in digital environments (Jaziri, 2019). Lastly, very little research has been carried out about the link between CKM development and customer trust. Organizations should understand not just how to implement it but also how customers feel regarding the way their information is used. Subsequently, future studies could examine the role of trust (Tang & Marinova, 2020) and the factors that foster customers' participation in the customer knowledge development (Joshi & Sharma, 2004).

6.2 Contributions

This literature review integrates twenty years of research on customer knowledge. In this article, we propose a transdisciplinary review of the construct. The research is based on a careful analysis of 75 articles published between 2000 and 2020. Each article is in the A*, A or B category of the ABDC quality list. To keep our analysis tractable, we focused solely on three business categories: (1503) Management, (1505) Information Systems, and (806) Marketing. We analysed the frequency of publications to see how dynamic research on CKM is, and we note that the pace is steady and continuous. We examined the source of the selected articles, only to find out CK is mainly a marketing and IS construct as 90% of published articles on CK come from either marketing or IS literature. Next, the content analysis of the corpus (985 pages) sheds a light on the numerous definitions given to CK. Definitions coded in the literature are fragmented and contain some nuances. Thus, we propose an integrative and unified definition of the construct. Then, the SLR integrates literature about CK on a theoretical model linking antecedent factors, consequences, and moderators. Lastly, the systematic literature review concludes with a research agenda which highlights avenues for future research.

6.3 Limitations

Despite the systematic approach based on content analysis, this research work has a certain limitation. In order to guarantee the quality of the review, corpus selection was restricted to top academic journals only. Scholars should keep in mind that other articles on customer knowledge management exist outside of this scope and could provide valuable and complementary insights on the studied construct. We hope this article provides an added value to both researchers and encourages them to pursue more research on this prevailing topic.

Table 3: Suggested future research questions

No.	Research stream	Future research questions	Authors
1.	**Implementation**	Co-creation takes place at several stages of the new product development process. More specifically, what is its role at each stage?	(Z. Zhang, 2011)
2.		How does an organization build market-sensing capabilities? What are the antecedents to market response capabilities that allow an organization to maintain long-term relationships with customers?	(Jayachandran et al., 2004)
3.		How is the assimilation phase of the acquired knowledge articulated?	(Yli-Renko et al., 2001)
4.		What are the monetary and temporal investments needed for firms to develop CKM?	(Mahr et al., 2014)
5.	**Firm performance**	How to develop customer knowledge to generate disruptive innovations?	(Johansson et al., 2019)
6.		How is customer experience knowledge used in digital environments? How do managers voice their knowledge of customer experience?	(Jaziri, 2019)
7.		What is the causality between customer orientation and organizational performance (employ longitudinal data)?	(Auh & Menguc, 2006)
8.		What is the impact of CKM strategy on key accounts performance (B2B)	(Chari et al., 2016)
9.	**Customer engagement**	What role does trust play in knowledge transfer? How can the norm of reciprocity affect the sharing of knowledge between clients, within the organization and finally between client and organization?	(Tang & Marinova, 2020)
10.		To what extend are customers' views different from the way things are done inside organizations?	(Gibbert et al., 2002)
11.		Which factors foster customers' participation in the process of customer knowledge development?	(Joshi & Sharma, 2004)
12.		How do customer-related factors moderate the main effects of organizational actions on customer knowledge development?	(Joshi & Sharma, 2004)

References

Auh, S., & Menguc, B. (2006). Diversity at the executive suite: A resource-based approach to the customer orientation - Organizational performance relationship. *Journal of Business Research*, *59*(5), 564–572. https://doi.org/10.1016/j.jbusres.2005.10.006

Bonner, J. M., Walker, O. C., & Jr, Ã. (2004). *Selecting Influential Business-to-Business Customers in New Product Development: Relational Embeddedness and Knowledge Heterogeneity Considerations*. 155–169.

Campbell, A. J. (2003). Creating customer knowledge competence: Managing customer relationship management programs strategically. *Industrial Marketing Management*, *32*(5), 375–383. https://doi.org/10.1016/S0019-8501(03)00011-7

Capraro, A. J., Broniarczyk, S., & Srivastava, R. K. (2003). Factors influencing the Likelihood of customer Defection : The Role of Consumer Knowledge. *Journal of the Academy of Marketing Science*, *31*(2), 164–175.

Chari, S., Tarkiainen, A., & Salojärvi, H. (2016). Alternative pathways to utilizing customer knowledge: A fuzzy-set qualitative comparative analysis. *Journal of Business Research*, *69*(11), 5494–5499. https://doi.org/10.1016/j.jbusres.2016.04.160

Cova, B., & Cova, V. (2009). Les figures du nouveau consommateur : une genèse de la gouvernementalité du consommateur. *Recherche et Applications En*, *24*(3).

Cui, A. S., & Wu, F. (2016). Utilizing customer knowledge in innovation: antecedents and impact of customer involvement on new product performance. *Journal of the Academy of Marketing Science*, *44*(4), 516–538. https://doi.org/10.1007/s11747-015-0433-x

Garrido-Moreno, A., Lockett, N., & García-Morales, V. (2014). Paving the way for CRM success: The mediating role of knowledge management and organizational commitment. *Information and Management*, *51*(8), 1031–1042. https://doi.org/10.1016/j.im.2014.06.006

Gibbert, M., Leibold, M., & Probst, G. (2002). Five styles of Customer Knowledge Management, and how smart companies use them to create value. *European Management Journal*, *20*(5), 459–469. https://doi.org/10.1016/S0263-2373(02)00101-9

Goyal, S., Ahuja, M., & Kankanhalli, A. (2020). Does the source of external knowledge matter? Examining the role of customer co-creation and partner sourcing in knowledge creation and innovation. *Information and Management*, *57*(6), 103325. https://doi.org/10.1016/j.im.2020.103325

Homburg, C., Wieseke, J., & Bornemann, T. (2009a). Implementing the Marketing Concept at the Employee-Customer Interface: The Role of Customer Need Knowledge. *Journal of Marketing*, *73*(4), 64–81. https://doi.org/10.1509/jmkg.73.4.064

Homburg, C., Wieseke, J., & Bornemann, T. (2009b). Implementing the Marketing Concept at the Employee – Customer Interface : The Role of Customer Need Knowledge. *Journal of Marketing*, *73*(July), 64–81.

Jayachandran, S., Hewett, K., & Kaufman, P. (2004a). Customer Response Capability in a Sense-and-Respond Era : The Role of Customer Knowledge Process. *Journal of the Academy of Marketing Science*, *32*(3), 219–233.

Jayachandran, S., Hewett, K., & Kaufman, P. (2004b). Customer response capability in a sense-and-respond era: The role of customer knowledge process. *Journal of the Academy of Marketing Science*, *32*(3), 219–233. https://doi.org/10.1177/0092070304263334

Jaziri, D. (2019). The advent of customer experiential knowledge management approach (CEKM): The integration of o ffl ine & online experiential knowledge. *Journal of Business Research*, *94*(September 2017), 241–256. https://doi.org/10.1016/j.jbusres.2018.05.029

Johansson, A. E., Raddats, C., & Witell, L. (2019). The role of customer knowledge development for incremental and radical service innovation in servitized manufacturers. *Journal of Business Research*, *98*(February), 328–338. https://doi.org/10.1016/j.jbusres.2019.02.019

Joshi, A. W., & Sharma, S. (2004). Customer Knowledge Development : Antecedents and Impact on New. *Journal of Marketing*, *68*(October), 47–59.

Khodakarami, F., & Chan, Y. E. (2014). Exploring the role of customer relationship management (CRM) systems in customer knowledge creation. *Information and Management*, *51*(1), 27–42. https://doi.org/10.1016/j.im.2013.09.001

Kohli, A. K., & Jaworski, B. J. (1990). Market Orientation : The Construct , Research Propositions and Managerial Implications. *Journal of Marketing*, *54*(2), 1.

Kraus, S., Breier, M., & Dasí-Rodríguez, S. (2020). The art of crafting a systematic literature review in entrepreneurship research. *International Entrepreneurship and Management Journal*. https://doi.org/10.1007/s11365-020-00635-4

Leclercq, T., Hammedi, W., & Poncin, I. (2016). Dix ans de co-création de valeur : une revue intégrative. *Recherche et Applications En Marketing*, *31*(3), 29–66. https://doi.org/10.1177/0767370116638270

Lopez-Nicolas, C., & Molina-Castillo, F. J. (2008). Customer Knowledge Management and E-commerce: The role of customer perceived risk. *International Journal of Information Management*, *28*(2), 102–113. https://doi.org/10.1016/j.ijinfomgt.2007.09.001

Lu, Y., & Vir Singh, P. (2017). Is a core – periphery network good for knowledge sharing ? A structural model of endogenous network formation on a crowdsourced customer support forum. *MIS Quarterly*, *41*(2), 607–628.

Mahr, D., Lievens, A., & Blazevic, V. (2014). The value of customer cocreated knowledge during the innovation process. *Journal of Product Innovation Management*, *31*(3), 599–615. https://doi.org/10.1111/jpim.12116

Massey, A. P., Montoya-Weiss, M. M., & Holcom, K. (2001). Re-engineering the customer relationship: Leveraging knowledge assets at IBM. *Decision Support Systems*, *32*(2), 155–170. https://doi.org/10.1016/S0167-9236(01)00108-7

Menguc, B., Auh, S., & Uslu, A. (2013). Customer knowledge creation capability and performance in sales teams. *Journal of the Academy of Marketing Science*, *41*, 19–39. https://doi.org/10.1007/s11747-012-0303-8

Mithas, S., Ramasubbu, N., & Sambamurthy, V. (2011). H OW I NFORMATION M ANAGEMENT C APABILITY. *MIS Quarterly*, *35*(1), 237–256.

Piccoli, G., & Ives, B. (2005). IT dependent strategic initiatives and sustained competitive advantage : a review and synthesis of the literature. *MIS Quarterly*, *29*(4), 747–776.

Puligadda, S., Grewal, R., Rangaswamy, A., & Kardes, F. R. (2010). The role of idiosyncrastic attribute evaluation in mass customization. *Journal of Consumer Psychology*, *20*(3), 369–380. https://doi.org/10.1016/j.jcps.2010.04.003

Ray, G., Muhanna, W. A., & Barney, J. B. (2005). Information technology and the performance of the customer service process: A resource-based analysis. *MIS Quarterly: Management Information Systems*, *29*(4), 625–652. https://doi.org/10.2307/25148703

Salojärvi, H., Sainio, L. M., & Tarkiainen, A. (2010). Organizational factors enhancing customer knowledge utilization in the management of key account relationships. *Industrial Marketing Management*, *39*(8), 1395–1402. https://doi.org/10.1016/j.indmarman.2010.04.005

Salomann, H., Dous, M., Kolbe, L., & Brenner, W. (2005). Rejuvenating Customer Management: How to make knowledge for, from and about customers work. *European Management Journal*, *23*(4), 392–403. https://doi.org/10.1016/j.emj.2005.06.009

Santos-Vijande, M. L., López-sánchez, J. Á., & Rudd, J. (2016). Frontline employees ' collaboration in industrial service innovation : routes of co-creation ' s effects on new service performance. *Journal of the Academy of Marketing Science*, *44*, 350–375. https://doi.org/10.1007/s11747-015-0447-4

Santos-Vijande, M. L., López-Sánchez, J. Á., & Rudd, J. (2016). Frontline employees' collaboration in industrial service innovation: routes of co-creation's effects on new service performance. *Journal of the Academy of Marketing Science*, *44*(3), 350–375. https://doi.org/10.1007/s11747-015-0447-4

Stein, A., & Smith, M. (2009). CRM systems and organizational learning: An exploration of the relationship between CRM effectiveness and the customer information orientation of the firm in industrial markets. *Industrial Marketing Management*, *38*(2), 198–206. https://doi.org/10.1016/j.indmarman.2008.12.013

Stuart-Menteth, H., Wilson, H., & Baker, S. (2006). Escaping the channel silo Researching the new consumer. *International Journal of Market Research*, *48*(4), 415–438.

Tang, Y. (Elina), & Marinova, D. (2020). When less is more: the downside of customer knowledge sharing in new product development teams. *Journal of the Academy of Marketing Science*, *48*(2), 288–307. https://doi.org/10.1007/s11747-019-00646-w

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, *14*(3), 207–222. https://doi.org/10.1111/1467-8551.00375

Verbeke, W. J., Belschak, F. D., Bakker, A. B., & Dietz, B. (2008). When Intelligence Is (Dys) Functional for Achieving Sales Performance. *Journal of Marketing*, *72*(July), 44–57.

Yli-Renko, H., Autio, E., & Sapienza, H. J. (2001). Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. *Strategic Management Journal*, *22*(6–7), 587–613. https://doi.org/10.1002/smj.183

Zhang, H., Gupta, S., Sun, W., & Zou, Y. (2020). How social-media-enabled co-creation between customers and the firm drives business value? The perspective of organizational learning and social Capital. *Information and Management*, *57*(3), 103200. https://doi.org/10.1016/j.im.2019.103200

Zhang, Z. (2011). Customer knowledge management and the strategies of social software. *Business Process Management Journal*, *17*(1), 82–106. https://doi.org/10.1108/14637151111105599

Masters Research Papers

Factors Affecting m-learning Continuance: From the Perspectives of flow Theory and Stimulus-Organism-Response Theory

Chen-Cheng Chang
National Chin-Yi University of Technology, Taichung, Taiwan
4b031009@gm.student.ncut.edu.tw

Abstract: With the continual impact and deterioration of the pandemic disease of COVID-19 around the world, teaching classes in person that was a key part of learning style now was unavailable to be utilised by universities' lecturers and it seemed that such situation would remain unavailable for some time to come. Fortunately, the good news is that there has been a trend over the past decades that the increasing number of universities has established and moved partly to online courses and most of the students have learned how information and communication technologies (ICTs) can help them study effectively. Previous research on E-learning has proven that the challenges of studying online can be even more daunting for both lecturers and students who have to suddenly change their learning patterns from the classrooms to the virtual ones. This is mainly because the suddenness of this change makes it difficult for lecturers to fully prepare to lecture in the virtual learning environment. In light of the above-mentioned facts, this research proposes a novel model and integrates flow theory into the theory of technology acceptance model (TAM), based on stimulus–organism–response (S-O-R) theory, the SOR model has been widely used in previous studies of online customer behaviour, and the model theory includes three components: stimulus, organism, and response. Assuming that stimuli contained in the external environment cause people to change, which in turn affects their behaviour. This research explores deeply what factors stimulate and affect learners mobile learning (M-learning) continuance (individual responses). Consequently, our research model provides a new lens for M-learning through the S-O-R theory and suggests that the TAM model affects students' flow experiences and satisfaction, which in turn, influences engagement and M-learning continuance.

Keywords: Mobile Learning (M-learning), Flow Theory, Technology Acceptance Model (TAM), Stimulus–Organism–Response (S-O-R)

1. Introduction

With the ever-accelerating development of Information and Communication Technologies (ICTs), relevant mobile applications' technologies have been gradually paid more attention to users for obtaining diversified services, such as mobile payment, mobile learning, mobile banking, etc. (Rafique et al., 2018). Mobile learning is regarded as a new way of education and has been widely used in various educational fields. Turning the perspective to the users of mobile learning, as people's demands for learning have increased, and they anticipate using mobile devices to learn at any spare time (such as commuting time) or any place (such as various public transportation). Having considered the importance of continuous education and learning as mentioned above, universities are trying their best to cultivate students in order to increase their competitive advantages (Sen and Bhattacharya, 2001; Al-Shihi et al., 2018; Ali and Arshad, 2016). At present, given the growing importance of mobile learning, educational institutes cannot ignore it and actively adopt it to maintain their competitive advantage.

With the spread of the COVID-19 pandemic by the end of 2020, e-learning has been regarded as an alternative education system which help students continue to learn in educational institutions (Roman and Plopeanu, 2021). In response to the spread of epidemic diseases, users and education providers have realized that mobile learning can not only acquire the knowledge they need, but also reduce the contact with the crowd. Therefore, the importance of mobile learning development cannot be ignored. In Taiwan, the majority of universities have shifted from offline courses to online ones. Yet, the results showed that students' participations in online courses are even lower degree of participation than offline courses. This is mainly because mobile smart devices are easier to make students lose their concentration in the classroom, which is a common problem faced by the Taiwanese education community. We believe that the mobile smart device can be deemed to a double-edged sword which can be used for reverse thinking and can also become a powerful tool for the development of educational mobile learning.

Hence, this research attempts to propose an integrative model through the S-O-R theory which combines TAM model with flow theory. The SOR model includes three components—stimulus, organism, and response. We posit that the stimulation of the information platform (using the TAM model as the antecedents) causes changes in users (including flow theory and user satisfaction) which in turn affects the user's behavioral responses (engagement and continuity of mobile learning). Finally, this research aims to improve students' interest and

continuity in mobile learning by proposing the S-O-R theoretical model. Hoping to help the education sector to provide reference for professors to design courses and to solve the difficulties encountered by students in learning.

2. Literature Review

2.1 TAM Model

The TAM (Davis et al., 1989) can explain users' behavior towards technology adoption(Chang et al., 2017). The TAM (see Figure 1) proposes two independent variables, perceived usefulness and perceived ease of use (Davis et al., 1989). These two variables affect the dependent variables: user attitudes toward technology, usage behavior intention, and actual usage behavior. Among these variables, Perceived Usefulness (PU) and Perceived Ease of Use (PEU) were considered to directly or indirectly explain the results (Marangunić and Granić, 2015).

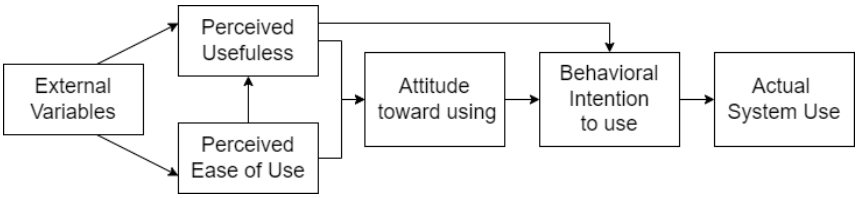


Figure 1: Original Technology Acceptance Model (Davis, 1986).

The TAM model has been widely used to explain individuals' technology acceptance behavior in many countries, such as the United States, Saudi Arabia, South Korea, China, etc. (Rafique et al., 2018 ; Zha et al., 2015 ; Yoon, 2016). Yet, Legris et al. (2003) found that the results of studies using TAM are not completely consistent, and more important factors have not been proposed and future studies may integrate TAM into a wider research model. Vijayasarathy (2004) argues that TAM are more applicable to individuals' decisions making involving technology use choices (e.g. decisions made in the workplace) than situations involving voluntary user choices. This study believes that although the original TAM can discuss the attitude, intention and behavior of information technology users towards technology, it cannot fully demonstrate whether users (students) are willing to continue to use the technology platform for learning and the degree of their participation in learning. Therefore, the S-O-R model will be used in this study to supplement the shortcomings of TAM.

2.2 Stimulus-Organism-Response (S-O-R) model

Mehrabian and Russell (1974) proposed this model in the field of environmental psychology. The S-O-R model consists of three factors: stimulus, organism and response (See Figure 2). This model can view the behavioral consequences of the events. According to previous studies, stimulation is an external force that affects an individual's psychological state (Jacoby, 2002; Peng and Kim, 2014; Young, 2016), and Eroglu et al. (2001) define stimulation as an influence that stimulates an individual. This model conceptualizes behavior, point out that stimulus can affect the physical and psychological levels of individuals in an environment composed of stimulus, as well as affect consumers' cognitive and emotional processes, ultimately leading to behavioral responses (Mehrabian and Russell, 1974).

Organism and response refer to the user's emotional and cognitive states, as well as the entire process of intervening between stimuli and individual responses (Loureiro and Ribeiro, 2011). Xu et al. (2014) further stated that stimulus and behavior are not directly causal, including affective and cognitive variables.

The S-O-R model has been extended many other domains such as consumer behavior (Laato et al., 2020), social media brand engagement (Kamboj et al., 2018), and computer experience (Eroglu et al., 2003). This study will use the SOR model (see Figure. 2) and regard the TAM model as the stimulus for users to use mobile learning, and regard the users who use mobile learning as individuals, resulting in flow experience and satisfaction, which in turn influences the response of users to stimulate learning (the use of mobile learning and continuous learning).

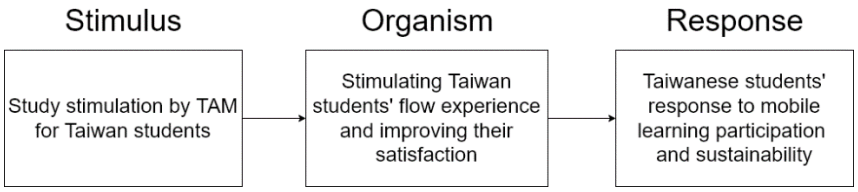


Figure 2: Theoretical framework of the study

Based on the above discussion, this research will delve into how TAM, flow experience, and satisfaction can lead to users' use of mobile learning and learning persistence.

2.3 Flow Experience

The flow theory was first proposed by Csikszentmihalyi (1989), and it is mainly defined as the overall experience of people when they are fully absorbed in action; it is composed of four factors, namely control, attention, curiosity and intrinsic interest. The concept is that when people are in a state of flow, they become so engrossed in the activity they are focusing on that they lose their sense of self, thinking they can manipulate their environment. In subsequent related studies, it was further proposed that the three main characteristics of flow are focused attention, full participation and the experience of inner pleasure (Csikszentmihalyi, 1975; Ghani and Deshpande, 1994; Privette and Bundrick, 1987). Flow theory is considered to be widely used in various fields. In their research, Hsu and Lu (2003) believe that the term "flow" describes the game user's full participation in certain activities, in addition to online, there is no other important thing. Also, this experience of engagement, focus and enjoyment does not only exist in online games. In another study, the researchers confirmed that "flow" is a useful tool not only to understand the user's experience when browsing a website, but also to motivate users to obtain better information interest can even influence positive attitudes and actions (Skadberg and Kimmel, 2004).

2.4 Engagement

"Engagement" can be seen as a person's active participation in a task or an activity (Reeve et al., 2004). Student engagement can be more often seen as a necessary prerequisite for student learning and engagement (Appleton et al., 2008). While academic performance is often seen as an important outcome of student engagement (Krause and Coates, 2008; Johnson and Sinatra, 2012), utility and achievement have also been shown to be related to student engagement. The research definitions according to Fredrick et al. (2004) and Jimerson et al. (2003), participation is divided into the following three types: (1.) Behavioural participation refers to the process by which students participate in the course homework; (2.) Cognitive engagement is the student's thinking and understanding of the topic of the class (e.g. self-regulation or learning goals); and (3.) Emotion or affective behavior is considered interest in learning, a positive attitude or a sense of belonging.

In this age of technological progress, mobile learning has become an emerging teaching model. Most research on technology and student engagement has affirmed the utility of computers and information technology to facilitate student engagement (Hu and Kuh, 2001; Nelson Laird and Kuh, 2005; Robinson and Hullinger, 2008). Robinson and Hullinger (2008) found a correlation between taking online courses and improving students' computer skills. Although most online courses do not require students to have a high level of computer skills to complete the course, students should be familiar with basic information skills such as the use of software such as email, participating in online chat, posting to discussion boards, word processing and forms...etc. When implemented through an active, inquiry-based learning pedagogy, online learning can also stimulate students to use higher-level skills such as problem solving, collaboration, and motivation (Duderstadt et al., 2002).

3. Research model & Proposition

3.1 Research model

In order to comprehensively understand factors that affect the mobile learning engagement and learning continuity, this study propose a novel model through the S-O-R theory (see Figure 3) which further increases emotional and cognitive variables (flow experience and satisfaction) as the critical variables. We hope the proposed model can advise to the education community to shape a positive and enjoyable virtual learning environment.

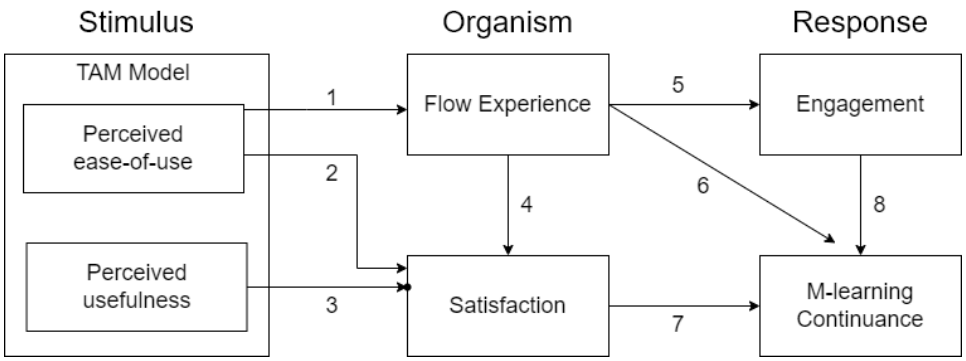


Figure 3: Research model

3.2 Proposition

3.2.1 TAM model

TAM is mainly composed of perceived ease of use and perceived usefulness. The two factors have the following meanings in this study :(1) Perceived ease of use means that mobile learning platforms can be easily operated by students. (2) Perceived usefulness means that the use of mobile learning platform helps improve the learning efficiency and quality of mobile learning students. According to Zhou (2013), flow experience can reflect the balance between challenges and skills. Rettie (2001) pointed out that there is a positive relationship between perceived ease of use and flow. Kiili (2005) also found that when the technology is easy to use, individuals may more easily fall into the state of flow. Thus, perceived ease of use increases the likelihood that mobile learning users will achieve a flow experience. According to Lin(2008) 's research on satisfaction and loyalty of virtual communities, it is pointed out that perceived ease of use has a significant impact on users' satisfaction with using websites. In this study, we hypothesise that there is a positive correlation between the perceived ease of use of mobile learning platform and the satisfaction of using mobile learning platform. On the other side, by exploring past studies, perceived usefulness has a significant impact on user satisfaction (Arbaugh 2000; Chiu et al. 2009). Students' perception of the usefulness of mobile learning platforms may improve e-learning efficiency and generate satisfaction. As mentioned above, this research concludes that:

Proposition 1. Perceiving the ease of use of the platform is positively related to flow experience of m-learning.
Proposition 2. Perceived ease-of-use of the platform is positively related to the satisfaction of using mobile learning platforms.
Proposition 3. Perceived usefulness of the platform is positively related to satisfaction of using mobile learning platforms.

3.2.2 Flow experience

When exploring the previous literature, we can found that the behavior of consumers in the virtual environment has many positive consequences, including satisfaction and behavioral intention (Novak et al., 2000). Consumer satisfaction is usually defined as the result of the realization, as opposed to the expected the actual experience (Hernon and Whitman, 2001). In the context of e-commerce, Szymanski and Hise (2000) conceptually defined satisfaction as the cumulative product of discrete experiences with service providers. In other words, media user satisfaction is a function of a set of discrete experiences in the media environment. Customers' positive emotional experiences (e.g. flow) affect their satisfaction with environmental features including virtual environments (Kim and Ko, 2019). Therefore, the following Proposition 4 is proposed.

Next, flow is a mental state characterized by focused attention and enhanced enjoyment (Shernoff et al., 2003). In flow experience, the individual ignores other thoughts and becomes absorbed in the activity. People believe that flow states are intrinsically beneficial because they have complete control over their behavior without distraction, and completely immersed in the process (Mollen and Wilson,2010). The term participation is similar to flow experience, reflecting a state of complete concentration on a challenging activity, with no mental energy to distract attention and all attention focused on the relevant stimulus (Hamari et al.,2016). Thus, the following Proposition 5 is posited.

Then, the relationship between attitude and behavior has been explored in different studies on flow experience. In the study of MOOC (Massive open online courses), Zhao et al. (2020) confirmed that the higher the level of flow experience, the higher the continuous intention, reveal the importance of flow experience in influencing learners' behavior. Rodriguez-ardura and Meseguer-Artola (2016) proved that the cognitive state of flow of users is an important part of the m-learning experience, and this is mediated by attitude, leading to users' continued use. Hence, we propose Proposition 6.

Proposition 4. User's flow experience is positively influences satisfaction of using mobile learning platforms.
Proposition 5. User's flow experience is positively influences engagement with using mobile learning platforms.
Proposition 6. User's flow experience is positively influences M-learning continuance.

3.2.3 Satisfaction

Yan et al. (2021) showed that, in the continuous use study of health applications, if a user is satisfied with a health application, he/she is more likely to utilize it continually. According to Oliver's (1980) theory, satisfaction is positively correlated with future intention, directly or indirectly through its influence on attitude. Thus, we propose the following Proposition 7.

Proposition 7. Satisfaction is positively related to M-learning continuance.

3.2.4 Engagement

According to Expectation Value Theory (Eccles, 2005; Wigfield and Eccles, 2000), participation in a task is based on expectations of success, interest, achievement value, utility value, and relative cost. Among them, interest and relative cost may be closely related to whether people choose to participate or not (Eccles, 2005). Students who felt that the feedback they gave when they asked questions and talked to lecturers could help them increase their sense of engagement. This will increase their enjoyment in it and improve their desires to continue into the future (Guo et al.,2016). Therefore, as mentioned above, we propose the following Proposition 8.

Proposition 8. Engagement has a significant effect on M-learning continuance.

4. Ongoing research

Having considered that the limitation posed by the quantitative approach which is expected to be used in this research might be insufficient to permit a comprehensive understanding of all the complex and abstruse factors affecting students' M-learning continuous behaviour within Taiwanese universities, this research will then utilize thematic analysis to analyse the qualitative data. Finally, the full article containing the entire work is expected to be finished by July 2023.

References

Ali, R.A., & Arshad, M. (2016) "Perspectives of students' behavior towards mobile learning (M-learning) in Egypt: an extension of the UTAUT model", *Engineering, Technology & Applied Science Research*, Vol 6, No.4, pp 1109-1114.

Al-Shihi, H., Sharma, S.K. and Sarrab, M. (2018) "Neural network approach to predict mobile learning acceptance", *Education and Information Technologies*, Vol 23, pp 1805-1824.

Appleton, J. J., Christenson, S. L., & Furlong, M. J. (2008) "Student engagement with school: critical conceptual and methodological issues of the construct", *Psychology in the Schools*, Vol 45, No.5, pp 369-386.

Arbaugh, J.B. (2000) "Virtual classroom characteristics and student satisfaction with Internet-based MBA courses", *Journal of management education*, Vol 24, No.1, pp 32–54.

Chang, C.-T., Hajiyev, J., & Su, C.-R. (2017) "Examining the students' behavioral intention to use e-learning in Azerbaijan? The general extended technology acceptance model for e-learning approach", *Computers & Education,* Vol.111, pp 128–143.

Chang, S.H., Chih, W.H., Liou, D.K., and Hwang, L.R. (2014) "The influence of web aesthetics on customers' PAD", *Computers in Human Behavior,* Vol 36, pp 168-178.

Chiu, C.M., Lin, H.Y., Sun, S.Y. and Hsu, M.H. (2009) "Understanding customers' loyalty intentions towards online shopping: an integration of technology acceptance model and fairness theory", *Behaviour & Information Technology*, Vol 28, No.4, pp 347–360.

Csikszentmihalyi, M. (1975) *Beyond boredom and anxiety*, San Francisco, CA: Jossey-Bass.

Csikszentmihalyi, M., LeFevre, J. (1989) "Optimal experience in work and leisure", *Journal of Personality and Social Psychology*, Vol 56, No.5, pp 815–822.

Davis FD, Bagozzi RP, Warshaw PR. (1989) "User acceptance of computer technology: a comparison of 2 theoretical models", *Management Science*, Vol 35, pp 982–1003.

Duderstadt, J., Atkins, D., & Houweling, D. (2002) *Higher education in the digital age: Technology issues and strategies for American colleges and universities*. Westport, CT: Praeger.

Eccles, J. S. (2005) *Subjective task value and the Eccles et al. model of achievement-related choices*. In A. J.

Eroglu, S. A., Machleit, K. A., and Davis, L. M. (2001) "Atmospheric qualities of online retailing", *Journal of Business Research*, Vol 54, No.2, pp 177–184.

Eroglu, S.A., Machleit, K.A., Davis, L.M. (2003) "Empirical testing of a model of online store atmospherics and shopper responses", *Psychol. Marketing*, Vol 20, No.2, pp 139–150.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004) "School engagement: potential of the concept, state of evidence", *Review of Education Research*, Vol 74, No.1, 59-109.

Ghani, J. A., and Deshpande, S. P. (1994) "Task characteristics and the experience of optimal flow in human–computer interaction", *Journal of Psychology*, Vol 128, No.4, pp 381–391.

Guo, Z., Xiao, L., Van Toorn, C., Lai, Y. and Seo, C. (2016) "Promoting online learners' continuance intention: An integrated flow framework", *Information & Management*, Vol 53, No.2, pp 279–295.

Hamari, J., Shernoff, D.J., Rowe, E., Coller, B., Asbell-Clarke, J. and Edwards, T. (2016). "Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning", *Computers in Human Behavior*, Vol 54, pp 170–179.

Hernon, P., & Whitman, J. R. (2001) *Delivering satisfaction and service quality: A customerbased approach for libraries*, Chicago, IL: American Library Association.

Hsieh, J.K., Hsieh, Y.C., Chiu, H.C., and Yang, Y.R. (2014) "Customer response to website atmospherics: task-relevant cues, situational involvement and PAD", *Journal of Interactive Marketing*, Vol 28, No.3, pp 225-236.

Hsu, C.L. and Lu, H.P. (2003) "Why do people play on-line games? An extended TAM with social influences and flow experience", *Information and Management*, Vol 41, 2004, pp 853–868.

Hu, S., & Kuh, G. D. (2001) "Computing experience and good practices in undergraduate education: Does the degree of campus ''wiredness" matter?", *Education Policy Analysis Archives*, Vol 9, No.49.

Jacoby, J. (2002) "Stimulus-organism-response reconsidered: An evolutionary step in modeling (consumer) behavior", *Journal of Consumer Psychology*, Vol 12, No.1, pp 51–57.

Jimerson, S. R., Campos, E., & Greif, J. L. (2003) "Toward and understanding of definitions and measures of school engagement and related terms", *California School Psychologist*, Vol 8, No.1, pp 7– 27.

Johnson, M., & Sinatra, G. M. (2012) "Use of task-value instructional inductions for facilitating engagement and conceptual change", *Contemporary Educational Psychology*, Vol 30, pp 51–63.

Kamboj, S., Sarmah, B., Gupta, S., and Dwivedi, Y. (2018) "Examining branding co-creation in brand communities on social media: Applying the paradigm of Stimulus-organism-response", *International Journal of Information Management*, Vol 39, April, pp 169–185.

Kiili, K. (2005) "Digital game-based learning: Towards an experiential gaming model", *Internet and Higher Education,* Vol.8, No.1, pp13–24.

Kim, D., Ko, Y.J. (2019) "The impact of virtual reality (VR) technology on sport spectators' flow experience and satisfaction", *Computers in human behavior*, Vol 93, pp 346–356.

Krause, K., & Coates, H. (2008) "Students' engagement in first-year university", *Assessment & Evaluation in Higher Education*, Vol 33, No.5, pp 493-505.

Laato, S., Islam, N.A.K.M., Farooq, A., Dhir, A.(2020) "Unusual purchasing behavior during the early stages of the COVID-19 pandemic: the stimulus-organism-response approach", *J. Retailing Consum. Serv,* Vol 57, No. 102224, pp 1–12.

Legris, P., Ingham, J., & Collerette, P. (2003) "Why do people use information technology? A critical review of the technology acceptance model", *Information & management,* Vol. 40, No.3, pp 191-204.

Lin, H.F. (2008) "Antecedents of virtual community satisfaction and loyalty: an empirical test of competing theories", *Cyberpsychology & behavior*, Vol 11, No.2, pp 138–144.

Loureiro, S., and Ribeiro, L. (2011) *The effect of atmosphere on emotions and online shopping intention: Age differentiation*, Australian and New Zealand marketing academy conference.

Marangunić, N., and Granić, A. (2015) "Technology acceptance model: A literature review from 1986 to 2013", *Universal Access in the Information Society*, Vol 14, No.1, pp 81–95.

Mehrabian, A., and Russell, J. A. (1974) *An Approach to Environmental Psychology*, Cambridge, MA: MIT Press.

Mehrabian, A., Russell, J.A. (1974) *An Approach to Environmental Psychology,* the MIT Press.

Mollen, A., & Wilson, H. (2010) "Engagement, telepresence and interactivity in online consumer experience: Reconciling scholastic and managerial perspectives", *Journal of Business Research*, Vol 63, pp 919-925.

Nelson Laird, T. F., & Kuh, G. D. (2005) "Student experiences with information technology and their relationship to other aspects of student engagement", *Research in Higher Education*, Vol 46, No.2, pp 211–233.

Novak, T.P., Hoffman, D.L., and Yung, Y.F. (2000) "Measuring the customer experience in online environments: a structural modeling approach", *Marketing Science*, Vol. 19, No. 1, pp 22-42.

Oliver, R.L., (1980) "A cognitive model for the antecedents and consequences of satisfaction", *Journal of Marketing Research*, Vol 17, pp 460–469.

Parboteeah, D. V., Valacich, J. S., and Wells, J. D. (2009) "The influence of website characteristics on a Consumer's urge to buy impulsively", *Information Systems Research*, Vol 20, No.1, pp 60-78.

Peng, C., and Kim, Y. G. (2014) "Application of the stimuli-organism-response (S-O-R) framework to online shopping behavior", *Journal of Internet Commerce*, Vol 13, No.3–4, pp 159–176.

Privette, G., and Bundrick, C. M. (1987) "Measurement of experience: construct and content validity of the experience questionnaire", *Perceptual and Motor Skills*, Vol 65, pp 315–332.

Rafique, H., Anwer, F., Shamim, A., & Minaei-bidgoli, B. (2018) "Factors affecting acceptance of mobile library Applications : Structural equation model", *Libri -International Journal of Libraries and Information Services*, Vol 68, No.2, pp 99–112.

Rafique, H., Anwer, F., Shamim, A., and Minaei-bidgoli, B. (2018) "Factors affecting acceptance of mobile library Applications : Structural equation model", *Libri -International Journal of Libraries and Information Services*, Vol 68, No.2, pp 99–112.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004) "Enhancing students' engagement by increasing teachers' autonomy support", *Motivation and Emotion*, Vol 28, No.2, pp 147–169.

Rettie, R. (2001) "An exploration of flow during Internet use", *Internet Research: Electronic Networking Application and Policy,* Vol 11, No.2 , pp. 103–113.

Robinson, C. C., & Hullinger, H. (2008) "New benchmarks in higher education: Student engagement in online learning", *Journal of Education for Business*, Vol 84, No.2, pp 101–108.

Rodríguez-Ardura, I. and Meseguer-Artola, A. (2016) "E-learning continuance: The impact of interactivity and the mediating role of imagery, presence and flow", *Information & Management*, Vol 53, No.4, pp 504–516.

Roman, M. and Plopeanu, A.P. (2021) "The effectiveness of the emergency eLearning during COVID-19 pandemic. The case of higher education in economics in Romania", *International Review of Economics Education*, Vol 37, pp 100218.

Sen, S., & Bhattacharya, C.B. (2001) "Does doing good always lead to doing better? Consumer reactions to corporate social responsibility", *Journal of Marketing Research*, Vol 38, No.2, pp 225-243.

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2003) "Student engagement in high school classrooms from the perspective of flow theory", *School Psychology Quarterly*, Vol 18, pp 158-176.

Skadberg, Y. X., and Kimmel, J. R. (2004) "Visitors' flow experience while browsing a web site: its measurement, contributing factors, and consequences", *Computers in Human Behavior*, Vol 20, pp 403 – 422.

Szymanski, D. M., & Hise, R. T. (2000) "E-satisfaction: An initial examination", *Journal of Retailing*, Vol 76, No.3, pp 309–322.

Vijayasarathy, L. R. (2004) "Predicting consumer intentions to use on-line shopping: The case for an augmented technology acceptance model", *Information and Management*, Vol 41, No.6, pp 747–762.

Wigfield, A., & Eccles, J. S. (2000) "Expectancy–value theory of achievement motivation", *Contemporary Educational Psychology*, Vol 25, pp 68–81.

Xu, J., Benbasat, I., Cenfetelli, R.T. (2014) "The nature and consequences of trade-off transparency in the context of recommendation agents", *MIS Q*, Vol 38, No.2, pp 379–406.

Yan, M., Filieri, R., Raguseo, E. and Gorton, M. (2021) "Mobile apps for healthy living: Factors influencing continuance intention for health apps", *Technological Forecasting and Social Change*, Vol 166, pp 120644.

Yoon, H. (2016). "User acceptance of mobile library applications in academic Libraries : An application of the technology acceptance model", *The Journal of Academic Librarianship*, Vol 42, No.6, pp 687–693.

Young, G. (2016) "Stimulus–organism–response model: SORing to new heights", *Unifying causality and psychology*, pp 699–717.

Zha, X., Zhang, J., and Yan, Y. (2015) "Comparing digital libraries in the web and mobile contexts from the perspective of the digital divide", *Journal of Librarianship and Information Science*, Vol 47, No.4, pp 330–340.

Zhao, Y., Wang, A. and Sun, Y. (2020) "Technological environment, virtual experience, and MOOC continuance: A stimulus–organism–response perspective", *Computers & Education*, Vol 144, pp 103721–.

Zhou, Tao. (2013) "The effect of flow experience on user adoption of mobile TV", *Behaviour & Information Technology*, Vol. 32, No.3, pp 263–272.

How to Implement Knowledge Management in Financial Institutions? A Flowchart for Practice (FIGCIF)

Darci De Borba
PUCRS, Brazil
Darci17@gmail.com

Abstract: We developed a framework for implementing knowledge management in financial institutions using a positivist and exploratory approach through qualitative research with 27 professionals in the field. The proposal is innovative due to the lack of structures that combine performance measures, KM pillars, KM processes, critical factors in the implementation and the suggestion of each of the factors according to the maturity level of KM Implementation. A flowchart is proposed for the practical application of the knowledge constructed. FIGCIF supports improvement: in acquiring knowledge resulting from academic work, in increasing tacit knowledge, in formulating instructions and normative manuals to improve understanding and use, in selecting information systems to have the ability to deliver information by through its set of rules and interaction between processes and in the defense of financial investments, aiming to generate confidence in the adoption of KM in banking institutions.

Keywords: Knowledge Management, Knowledge Implementation, Framework, Banking

1. Introduction

Knowledge is currently positioned as a basis of economy, utilizing technology as a tool to make different types of actions viable (De Borba *et al.*, 2020). Therefore, the organizations that seek to find the best strategies to create, deliver and capture value for business recognize knowledge as one of the main sources of innovation and differentiation (Oztemel and Arslankaya, 2012). This relevance means that Knowledge Management (KM) has begun to occupy a central position in business models with a focus on value creation (Al-Debei and Avison, 2010). KM is recognized as a discipline which, through its own processes, serves the purpose of increasing knowledge and generating value for stakeholders (Ragab and Arisha, 2013). These stakeholders can belong to various sectors of society, especially, the banking sector.

Academic interest in banking business models has been maintained over time. Such aspects as digital transformation, increase in bad payers and image crisis have created unprecedented managerial challenges in the banking sector (Esteban-Sanchez, de la Cuesta-Gonzalez and Paredes-Gazquez, 2017). Armed with the recognized aggressivity of the sector, which seeks to reach and maintain the levels of profit that characterize them, banks invest in knowledge as an asset with the potential to furnish solid competitivity (Tan *et al.*, 2010).

Research into KM in recent years is divided into two significant stages. In the first, the focus is the definition of KM scope and understanding of the processes. This is where we find Nonaka's (1994) contributions which, among other things, propose the cycle of knowledge encompassing actions of socialization, externalization, combination and internalization. In the second, more recent stage, knowledge is understood as an asset (Chen, Liang and Lin, 2010). Research along this line utilizes a view based on knowledge (KBV - *Knowledge Based View*), investigating the effects of KM on performance and organizational capacities.

The implementation of KM appears with different challenges, especially in the banking segment, where, compared to other sectors, the gaps in KM are even bigger (Hung, Chou and Tzeng, 2011). The literature brings together frameworks and models that promise to help in the solution for problems related to the implementation of KM. However, as frameworks tend to suffer influence from the sector to which they are destined, alternatives adapted to the implementation of KM in the banking segment are missing, those which consider its financial, technological, regulatory characteristics and, above all, the speed at which the banking sector is modified (Ferhan, Onur and Gozlu, 2010; Hung, Chou and Tzeng, 2011; Liao *et al.*, 2012; Abbas *et al.*, 2013; De Borba, Chaves and Oliveira, 2022).

One of the main points in this gap comes precisely from the lack of plans for practical implementation, given that the prevalent characteristic of frameworks is the high degree of theoretical abstraction. Faced with the importance of KM for the generation of value and the scarcity of artifacts specifically developed for financial

institutions, the objective of this article is to propose a framework for the implementation of KM in financial institutions.

2. Theorical reference

2.1 Knowledge management processes

The change in thinking caused by the increase in importance of knowledge implies a new approach to innovation in the organizational environment, as there is no longer space for the paradigm of the organization as a system for the processing of information or the solving of problems (Al Ahbabi *et al.*, 2019). New challenges demand the acceptance of the role of creator, which companies need to assume in the face of a knowledge society. This role basically passes through four processes, (Nonaka, 1994): 1) creation, 2) storage, 3) sharing and 4) application of knowledge.

The dimensions relative to the creation of knowledge accept the role of the individual and, more precisely, their commitment to the process of knowledge creation. Consequently, this creation of knowledge can be understood as a continuous dialogue between tacit and explicit knowledge (Nonaka, 1994). Explicit knowledge is that which can be codified and stored in various formats, in manuals for example, and therefore the assumption is that it can be transferred without losses (Stevens, 2010). On the other hand, tacit knowledge is more related to the experiences of an individual and their opinions, so storing it can be difficult. (Grant, 2007).

The storing of knowledge is the process that will form organizational memory, whose recording will be done through physical systems formally and informally retained as values, norms and beliefs, which are associated with the organizational culture and structure (Alavi and Dorothy, 2001). Gonzalez and Martins (2017) relate five forms of knowledge storage: 1) individuals who make up the organization, 2) the culture defines the path for thinking and feeling, 3) the process of transformation of work methods, 4) the set of rules, hierarchies and attributions and 5) the environment that promotes the process of sharing. Information technology (IT) appears as a key tool, offering support and conditions for codification, creation of directories and the creation of knowledge networks (Alavi and Leidner, 1999).

Knowledge sharing encompasses knowledge transfer or dissemination activities from one person, group or organization to another; including the tacit and explicit dimensions (Al Ahbabi *et al.*, 2019). Knowledge sharing is sometimes identified in KM models as a process of the distribution of knowledge. In this article the option was to utilize the term “sharing” on account of its being used more frequently and to be better able to identify the set of actions that comprise it.

The process of applying knowledge has the role of applying knowledge in the sense of generating value for an organization. It is the process that will direct the knowledge captured and stored for some purpose. The application of knowledge becomes more evident when associated with decision-making processes, whether they are at operational, tactical or strategic levels (Al Ahbabi *et al.*, 2019). The process is identified at times in the models as utilization of knowledge, but our option was to use the term ‘application’ as we understood that it has wider coverage and more frequent use.

2.2 Knowledge management implementation frameworks

There are several KM frameworks that were developed over time by individuals and organizations. Frameworks can be classified as prescriptive or descriptive (Rubenstein-Montano *et al.*, 2001). Those classified as prescriptive will furnish a view on the types of KM procedures, without lingering on specific details of the procedures that should be put into practice. On the other hand, the structures classified as descriptive identify relevant KM attributes because of their influence in the success or failure of KM initiatives. After a systematic literature review, we located (Chen, Liang and Lin, 2010; Lee and Lan, 2011; Wu *et al.*, 2012; Oztemel and Arslankaya, 2012; Tsai *et al.*, 2012; Moradi, Aghaie and Hosseini, 2013; Singh and Gupta, 2014; Martínez-Martínez, Cegarra-Navarro and García-Pérez, 2015; Allal-Chérif, Bidan and Makhlouf, 2016; An *et al.*, 2017; De Borba and Chaves, 2021).

Faced with these findings, this article seeks to bring together the main frameworks published in the past ten years according to the parameters presented at the beginning of the chapter. The main objective is to contemplate the support offered by the frameworks created so that, on being integrated with the data and

analyses obtained in the research that will be carried out, it will be possible to prescribe a model for the implementation of KM in banks in the light of the literature and the best practices already utilized.

2.3 Maturity models in KM

In previous sections it was explained that the implementation of KM is generally guided by an implementation structure. The set of guiding principles that seek to represent the orientations and directions on how to operate KM in companies was named as implementation framework (Wong and Aspinwall, 2004). This structure is guided by stages that can be extracted from maturity models. The models presented in this section were suggested by revisers of scientific magazines to whom the articles that preceded and collaborated with this research were submitted.

Oliveira, Caldeira and Romão (2012) conducted research with 11 Portuguese companies in order to apply a structure to classify the level of KM maturity based on the factors identified. In their article, the authors suggest that KM is an evolutionary process. The initial motivation for these sample companies was to prevent the loss of knowledge by a worker leaving or protect the knowledge in some way. However, other motivating factors were mapped: increase in efficiency, creation of unique image for clients and innovation.

It is worth highlighting here that the factors present in each of the four phases are cumulative, that is, they continue to be present and are necessary in the phases that follow. Organizations cannot manage to focus on all factors simultaneously, and empirical evidence suggests the relevance of these factors associated with the beginning of each stage, since the implementation of KM is seen as an evolutionary process (Oliveira, Caldeira and Batista Romão, 2012).

3. Method

The research adopted a positivist paradigm, in which the phenomenon investigated is considered independent of its observation. Faced with the general and specific objectives set out, this work was conducted by means of qualitative research. In the first phase, 27 semi-structured interviews were held with different professionals involved in the KM area or in KM activities in four different banks in the country. The interviewees were selected on a non-probabilistic, intentional basis, according to the definitions in Lancaster *et al.*, (2005). Data collection was carried out through individual interviews, for which the selected participants occupied the following groups: professionals from support areas, agencies and the knowledge area or equivalent. The interviews were held during a period of 45 days, remotely, using Cisco Webex® software. In the second phase, the interviews were transcribed and analyzed by means of content analysis. Bardin's (2006) perspective was utilized for the content analysis, by bringing together a set of techniques for communications analysis. This perspective was utilized at this stage of the research in an exploratory way. Nvivo®. Software was used in order to operationalize the content analysis.

3.1 Interviewee characteristics

The interviewees were selected from domestic banks operating in at least three Brazilian states which had adopted some type of KM initiative. Five companies from the Brazilian banking sector were then invited to participate, four of which accepted the invitation. In all, 27 professionals from different areas were interviewed. The selection of professionals was the free choice of the participating companies, with guidelines that the person chosen should work in the unit that centralized KM activities or develop some activity correlated to the object of study. The average length of time for the interviews was 57 minutes. The longest interview was 1h 22m and the shortest was 45 minutes.

In relation to their time in the company, three interviewees had been there for five years, 12 for more than 5 years and up to 10, eight more than 10 years up to 20 and four had more than 20 years service in the company. The interviewees worked in four Brazilian states. Their level in the company was as follows: managerial (10), technical (16) and operational (1). As for their area of operation and function, it was possible to obtain perspectives from different sectors and functions, which contributed to a wider approach to the theme.

The consolidation presented served as a basis for the structuring of the framework presented and of the research instruments in such a way as to supplement and expand the existing studies. The framework was validated by a PhD professor specializing in Strategic Knowledge Management and two master's post-graduates. The validations were sent by e-mail, and the public for validation was selected on account of their intimacy with the field of research. Their suggestions were appropriated directly in the final version.

4. Results analysis

To extract information about the process of knowledge creation from the interviews four questions were dealt with, which covered 1) acquisition of external knowledge 2) identification and treatment of gaps in knowledge 3) incentive for knowledge creation and 4) appropriation of knowledge generated from academic works.

In relation to incentives for knowledge creation, two specific standards were identified: incentive understood as support by the institution for participation in events and on courses, and openings for the participation of users in the demand for or co-creation of knowledge solutions (E11 and E13). As for incentive understood as user participation, open channels of communication with internal units and Wiki, with the mediation of specialists were mentioned (E4 and E5).

To extract knowledge from the interviewees regarding knowledge practices and storage, four structures were dealt with, according to the interview script: practices for an increase in tacit knowledge, knowledge conversion practices, storage routines by user initiative and the existence of storage standards and knowledge updating.

Tacit knowledge is more related to the experiences of an individual and their opinions (Grant, 2007), thus external storage is more difficult. However, it is possible to increase tacit knowledge in the individual. There was some evidence of such practices as mentoring and coaching for managerial and strategic levels, and for technical and operational levels the actions are limited to meetings and workshops (E2, E6, E10, E11, E22, E23 and E37).

The application of knowledge presented just one standard, which is mediation by a unit or group of specialists. This mediation takes place formally, when solutions are submitted to different committees, or also organically through the business schools that appropriate the knowledge generated by the practice for the application of solutions (E1, E2 and E17).

The adoption of KM is a strategy to guarantee the control of knowledge on the part of the company and everything begins with implementation. As interviewee 1 described *"(...) the knowledge was in the hands of third parties and we needed to unify it".* The minimum conditions, difficulties and facilities found presented three standards: technological solutions, company culture and support from people.

The performance measures topic was included in the script to give benefits to the framework that will be proposed, seeing that in the frameworks used as the basis of this research, there was no mention of the ways to measure KM performance. The performance measures presented three standards: financial measures, process measures and development measures. Interviewee 1 mentions that they usually use cost reduction to evaluate using the financial perspective and they measure the use of the knowledge repository as a process measure. On the question of people development, capacities and competencies are measured on the basis of behavioral change. Reflections on people`s results can also be measured from a comparison of performance before and after the application of the knowledge. Similarly, interviewees mentioned that the worker's own perception of development serves as a measure. The presence of knowledge in internal evaluations tends to function as a measure of development, and is adopted as a basis for internal promotions and behavioral evaluations (E5, E6 and E10).

5. Discussion and contributions

The study of KM implementation framework characterization aimed to bring together the main publications in relevant journals with a view to evaluating the direction that research has taken in the different sectors (De Borba and Chaves, 2021). In addition to the ten frameworks studied, field research was conducted in banking institutions to map the KM practices that could contribute to the structure of a descriptive framework for the sector. This field research contributed with thirty additions or alterations in the framework initially proposed.

The empirical research brought learning to the field of study and after reflection and analysis, a framework was structured, now prescriptive, for the implementation of KM in banks. The structure was named Framework for the Implementation of Knowledge Management in Financial Institutions (FIGCIF), as a result of the construction of these elements: KM pillars, processes, implementation, performance and maturity.

5.1 Academic contributions

As for the originality dimension, the research can be classified as incremental, and regarding utility, it can be classified as scientific and practical (Corley and Gioia, 2011). The FIGCIF allows the orientation of new studies in the KM domain in financial institutions and structures it according to a maturity model, thus permitting analysis of the implementation proposal throughout time. The FIGCIF could serve as a basis for quantitative empirical approaches that aim to assess the relevance of the factors listed in the framework and also help in research on maturity models from the perspective of the banking segment. This sector has some specificities, such as: the diversity of areas of knowledge, the intensity of knowledge, the intensity of technologies and an environment of adverse activity and constant change. The elements listed in the FIGCIF were structured according to the KM maturity model proposed by Oliveira, Caldeira and Batista Romão (2012) which, besides presenting a simplified structure, thereby making it easy to apply, concentrated its sample on service organizations. Table 1 structures the elements that compose the FIGCIF throughout the maturity stages proposed by the authors. The framework was validated by two academic specialists in the KM area.

Table 1: The FIGCIF structuring in the maturity model

		Stages in the implementation of KM (Oliveira, et al., 2012, p.13)[1]			
		1) Planning	**2) Initiation**	**3) Development**	**4) Integration**
		(*)	**+ 1**	**+1+2**	**+1+2+3**
3. Implementation		3.1 Alignment of objectives 3.2 Approximation	3.3 Awareness raising 3.4 Project team	3.5 Language	3.6 Maturity
1. KM Pillars	**1.1 People**	1.1.5 Participation	1.1.2 Culture 1.1.4 Leaders	1.1.1 Competition 1.1.3 Incentives	
	1.2 Processes	1.2.3 Demands 1.2.8 Planning 1.2.9 Routines	1.2.2 Capacities 1.2.4 Strategies 1.2.5 Structure	1.2.1 Evaluation 1.2.7 Standardization	1.2.6 Legality
	1.3 Technology	1.3.4 Technological solution	1.3.1 Access	1.3.2 Controls	1.3.3 IT Infrastructure
2. KM Processes	**2.1 Application**	2.1.5 Intensity 2.1.6 Prevention	2.1.1 Use	2.1.3 Feedback 2.1.4 Flow	2.1.2 Evolution 2.1.7 Validation
	2.2 Storage	2.2.7 Curation 2.2.8 Academic works	2.2.1 Filing 2.2.5 Conversion	2.2.2 Updating 2.2.4 Tacit knowledge 2.2.6 Content creation	2.2.3 Autonomy
	2.3 Sharing	2.3.1 Collection and donation 2.3.2 Diffusion	2.3.4 Groups	2.3.3 Diversity	2.3.5 Integration 2.3.6 Protection
	2.4 Creation	2.4.1 Acquisition 2.4.5 Research	2.4.4 Gaps	2.4.3 Schools	2.4.6 Production 2.4.2 Scenarios
4. Performance measures		4.2 Human capital 4.1 Information capital 4.8 Process metrics	4.3 Intellectual capital 4.5 Costs	4.4 Organizational capital 4.6 Innovation 4.9 Result metrics	4.7 Matrix

Source: the author.

***Note**: the stages of maturity are cumulative, therefore the related components in the initial phases continue to be important throughout the process of implementation. In the table the ideal moment for the process to be initiated or better worked on is represented.

Besides contributing to new variables and structures to compose models of academic research, such as business schools and the suitability of language, the FIGCIF innovates in suggesting performance measures applicable to different maturity levels of KM implementation.

5.2 Managerial contributions

Using the reports collected in the environment of empirical research, it is possible to suppose that financial investment and confidence in the adoption of KM in banking institutions encounters managers and professionals who are unaware of formats of performance mediation. Consequently, this article presents some suggestions for forms of mediation that can be used by banks: 1) measuring the reduced cost using a knowledge solution can be more logical than measuring the generation of revenues; 2) comparing commercial performance before and after the application of KM activities; 3) quantifying the new products and solutions developed; 4) using

process metrics that can reflect improvements using KM solutions and 5) measuring staff turnover by sector as a way of justifying implementations of KM solutions individually. The research findings, which were shown in table 1, were organized in a flowchart to facilitate practical implementation, see figure 1.

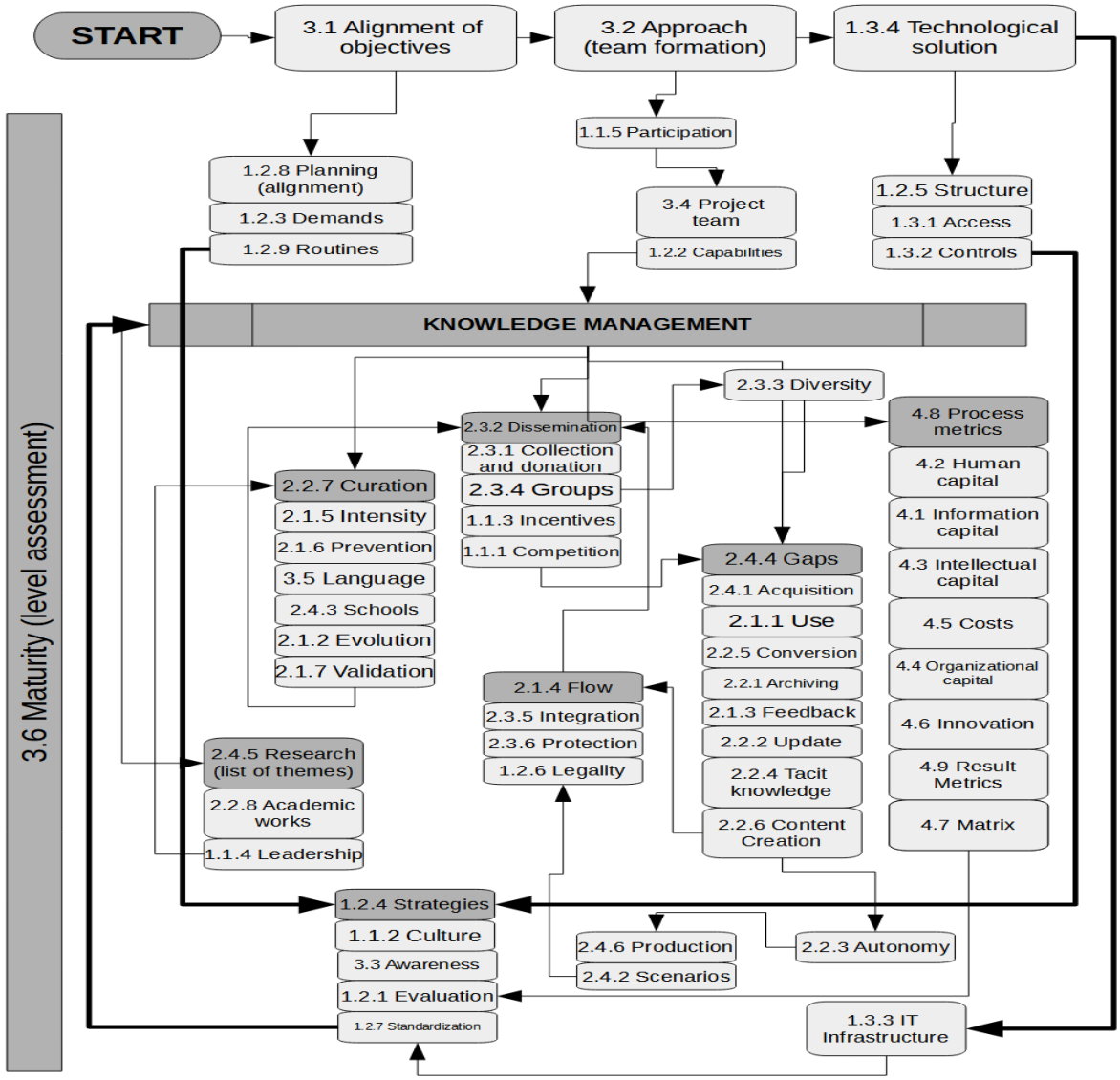


Figure 1: Flowchart for practice (FIGCIF)

Source: the author.

6. Conclusions

From the perspective of the prescriptive and descriptive frameworks studied and the empirical research, it was possible to formulate a framework for the implementation of KM in banks (FIGCIF). This article also presented some limitations: 1) The words utilized for the search for articles that composed the systematic literature review can be limited to the range of articles that are related to the field studied; 2) The criteria for selecting the sample articles that focused on high-impact magazines may have excluded relevant articles; and 3) the transversal sample utilized: considering that the implementation of KM is closely related to the models of maturity in KM, it would perhaps be interesting to research the same companies at different stages of maturity. Future research could investigate structures of KM implementation in wider or more diversely utilized samples of articles and apply the FIGCIF using interventionist approaches such as research-action or Design Science Research.

References

Abbas, F. *et al.* (2013) 'Factors promoting knowledge sharing & knowledge creation in banking sector of Pakistan', *Management Science Letters*, 3(2), pp. 405–414. doi: 10.5267/j.msl.2012.12.031.

Al Ahbabi, S. A. *et al.* (2019) 'Employee perception of impact of knowledge management processes on public sector performance', *Journal of Knowledge Management*, 23(2), pp. 351–373. doi: 10.1108/JKM-08-2017-0348.

Al-Debei, M. M. and Avison, D. (2010) 'Developing a unified framework of the business model concept', *European Journal of Information Systems*, 19(3), pp. 359–376. doi: 10.1057/ejis.2010.21.

Alavi, M. and Dorothy, L. E. (2001) 'E Fficient K Nowledge M Anagement', *MIS Quarterly*, 25(1), pp. 107–136.

Alavi, M. and Leidner, D. (1999) 'Knowledge Management Systems: Issues, Challenges, and Benefits', *Communications of the Association for Information Systems*, 1(February). doi: 10.17705/1cais.00107.

Allal-Chérif, O., Bidan, M. and Makhlouf, M. (2016) 'Using serious games to manage knowledge and competencies: The seven-step development process', *Information Systems Frontiers*, 18(6), pp. 1153–1163. doi: 10.1007/s10796-016-9649-7.

An, X. *et al.* (2017) 'A knowledge management framework for effective integration of national archives resources in China', *Journal of Documentation*, 73(1), pp. 18–34. doi: 10.1108/JD-04-2016-0040.

De Borba, D. *et al.* (2020) 'the Contribution of Knowledge Management To Smart Cities for Innovation: Proposal for a Prescriptive Framework and a Research Agenda', *International Journal of Innovation*, 8(3), pp. 516–540.

De Borba, D. and Chaves, M. S. (2021) 'Uma Análise Integrativa De Frameworks De Implementação Da Gestão Do Conhecimento: Proposta De Uma Agenda De Pesquisa', *Revista Alcance*, 28(2), pp. 258–277. doi: 10.14210/alcance.v28n2.p258-277.

De Borba, D., Chaves, M. S. and Oliveira, M. (2022) 'Knowledge sharing in the banking sector: a systematic literature review and research agenda', *International Journal of Knowledge Management Studies*, 13(1), p. 55. doi: 10.1504/IJKMS.2022.119260.

Chen, D. N., Liang, T. P. and Lin, B. (2010) 'An ecological model for organizational knowledge management', *Journal of Computer Information Systems*, 50(3), pp. 11–22. doi: 10.1080/08874417.2010.11645403.

Corley, K. and Gioia, D. (2011) 'Building theory about theory building: What constitutes a theoretical contribution?', *Academy of Management Review*, 36(1), pp. 12–32. doi: 10.5465/amr.2009.0486.

Esteban-Sanchez, P., de la Cuesta-Gonzalez, M. and Paredes-Gazquez, J. D. (2017) 'Corporate social performance and its relation with corporate financial performance: International evidence in the banking industry', *Journal of Cleaner Production*, 162, pp. 1102–1110. doi: 10.1016/j.jclepro.2017.06.127.

Ferhan, C., Onur, F. A. and Gozlu, S. (2010) 'Benefits of Knowledge Management in Banking', *Journal of Transnational Management*, 15(4), pp. 308–321. doi: 10.1080/15475778.2010.525486.

Gonzalez, R. V. D. and Martins, M. F. (2017) 'Knowledge management process: A theoretical-conceptual research', *Gestao e Producao*, 24(2), pp. 248–265. doi: 10.1590/0104-530X0893-15.

Grant, K. a (2007) 'Tacit Knowledge Revisited – We Can Still Learn from Polanyi', *Electronic Journal of Knowledge Management*, 5(2), pp. 173–180.

Hung, Y. H., Chou, S. C. T. and Tzeng, G. H. (2011) 'Knowledge management adoption and assessment for SMEs by a novel MCDM approach', *Decision Support Systems*, 51(2), pp. 270–291. doi: 10.1016/j.dss.2010.11.021.

Lancaster, G. *et al.* (2005) 'Research methods in management: a concise introduction to'. Available at: https://proformas.ljmu.ac.uk/7500BLWIS.pdf (Accessed: 27 February 2022).

Lee, M. R. and Lan, Y. C. (2011) 'Toward a unified knowledge management model for SMEs', *Expert Systems with Applications*, 38(1), pp. 729–735. doi: 10.1016/j.eswa.2010.07.025.

Liao, S. H. *et al.* (2012) 'Relationships among organizational culture, knowledge acquisition, organizational learning, and organizational innovation in Taiwan's banking and insurance industries', *International Journal of Human Resource Management*, 23(1), pp. 52–70. doi: 10.1080/09585192.2011.599947.

Martínez-Martínez, A., Cegarra-Navarro, J. G. and García-Pérez, A. (2015) 'Environmental knowledge management: A long-term enabler of tourism development', *Tourism Management*, 50(April), pp. 281–291. doi: 10.1016/j.tourman.2015.03.006.

Moradi, M., Aghaie, A. and Hosseini, M. (2013) 'Knowledge-collector agents: Applying intelligent agents in marketing decisions with knowledge management approach', *Knowledge-Based Systems*, 52, pp. 181–193. doi: 10.1016/j.knosys.2013.08.014.

Nonaka, I. (1994) 'A Dynamic Theory of Organizational Knowledge Creation', *Organization Science*, 5(1), pp. 14–37. doi: 10.1287/orsc.5.1.14.

Oliveira, M., Caldeira, M. and Batista Romão, M. J. (2012) 'Knowledge Management Implementation: An Evolutionary Process in Organizations', *Knowledge and Process Management*, 19(1), pp. 17–26. doi: 10.1002/kpm.1381.

Oztemel, E. and Arslankaya, S. (2012) 'Enterprise knowledge management model: A knowledge tower', *Knowledge and Information Systems*, 31(1), pp. 171–192. doi: 10.1007/s10115-011-0414-4.

Ragab, M. A. F. and Arisha, A. (2013) 'Knowledge management and measurement: A critical review', *Journal of Knowledge Management*, 17(6), pp. 873–901. doi: 10.1108/JKM-12-2012-0381.

Rubenstein-Montano, B. *et al.* (2001) 'A systems thinking framework for knowledge management', *Decision Support Systems*, 31(1), pp. 5–16. doi: 10.1016/S0167-9236(00)00116-0.

Singh, R. M. and Gupta, M. (2014) 'Knowledge management in teams: Empirical integration and development of a scale', *Journal of Knowledge Management*, 18(4), pp. 777–794. doi: 10.1108/JKM-11-2013-0450.

Stevens (2010) 'Waves of Knowledge Management: The Flow between Explicit and Tacit Knowledge', *American Journal of Economics and Business Administration*, 2(1), pp. 129–135. doi: 10.3844/ajebasp.2010.129.135.

Tan, N. L. *et al.* (2010) 'Motivational factors in influencing knowledge sharing among banks in Malaysia', *International Research Journal of Finance and Economics*, 44(January), pp. 191–201.

Tsai, W. H. *et al.* (2012) 'Harmonizing firms' knowledge and strategies with organizational capabilities', *Journal of Computer Information Systems*, 53(1), pp. 23–32. doi: 10.1080/08874417.2012.11645593.

Wong, K. Y. and Aspinwall, E. (2004) 'Knowledge management implementation frameworks: A review', *Knowledge and Process Management*, 11(2), pp. 93–104. doi: 10.1002/kpm.193.

Wu, J. W. *et al.* (2012) 'An integrated proactive knowledge management model for enhancing engineering services', *Automation in Construction*, 24, pp. 81–88. doi: 10.1016/j.autcon.2012.02.006.

Non Academic Paper

An Applied Knowledge Framework to Enable Knowledge Reuse in Consulting firms

Evgeniya Ivanova
CORE SE, Berlin, Germany
evgeniya.ivanova@core.se

Abstract: Knowledge is a core product of management consultancies. Consulting firms consider knowledge management to be a core capability for achieving competitive advantage. Knowledge management, especially in project management, faces a lot of challenges that are crucial for the efficiency of work and as a result the success of the projects. According to ISO 30401, there are some knowledge management enablers like human capital, knowledge processes, technology and infrastructure, governance and knowledge sharing culture. Among them are corporate sharing culture, technology and the structure of knowledge which is the most important for companies. The challenges of knowledge management in a consulting business, for example, time saving and efficiency can be solved within the creation of a structured and target-oriented knowledge framework which enables the reuse of knowledge in the whole consulting company. Qualitative methods were used to conceive, design, and to implement the knowledge framework. The approach has involved workshops that included associates, managers, senior consultants, and project directors. This approach enabled the author to record internal requirements and pain points in the current knowledge management base approach, conduct analysis, set priorities, and conceive a new knowledge framework that was able to solve the pain points of consultants and project managers and support them in their daily business. The new framework includes the following components: a flexible structure that adopts itself to defined tagging structure, the storage of knowledge according to the allocation of the content format, and automatically generated statistics to newly upload and download as well as most used files and documents. The results of conducted feedback workshops and interviews showed that the alignment of the new knowledge framework information architecture to the company's service portfolio and user-friendly design enabled a quick and target-oriented search for the documents and awareness of relevant and important information and knowledge and as a result lead to the increased efficiency of project work in the consulting company.

Keywords: knowledge management in consulting firms, knowledge framework, management consultancy knowledge management

1. Introduction

Knowledge management has gained a lot of attention in recent years, not least because of the revolution in communication technology. Information can be distributed faster and faster and employees have more and more options for communication at their disposal. Knowledge management is the core competence of international consulting companies because knowledge is their core asset (Hansen, Nohria and Tierney, 1999) that has been recognized by consulting firms as a key capability to their success (Martiny, 1998).

A relatively large research area of knowledge management is knowledge management in management consultancies or management consulting firms. The literature provides some insights into this field of knowledge management and discusses the differences between knowledge management in consulting firms and knowledge management in general (Wagner, 1992; Wojda and Schwedenwein, 2000). Wojda and Schwedenwein (2000) also deal with knowledge management in consulting firms and define project teams, how they function and how they are usually put together. Additionally, according to ISO 30401 the knowledge management enablers like human capital, knowledge processes, technology and infrastructure, governance and knowledge sharing culture have an impact on the success of knowledge management in the company. To delineate the concept of consulting firms, their tasks and responsibilities must be considered: a consulting company facilitates an interaction process between clients and employees of the consultancy, which is mainly carried out in the form of time-limited projects (Munchus, 1989). The consultant initiates change processes in the client's organisation by providing his expertise in the form of methods, procedures, concepts, problem-solving techniques, and studies (Munchus, 1999).

Knowledge is a key to value creation in almost all industries and organisations and is a key aspect of consulting firms (Sarvary, 1999; Fincham, 1999) because they rely on knowledge as a resource and as a product offering to their clients. During the emergence of the knowledge economy in the 1990s, most international consulting companies placed knowledge management at the core of their strategic agenda (Dunford, 2000; Hansen, Nohria and Tierney, 1999; Lowendahl, Revang and Fosstenlokken, 2001; Sarvary, 1999; Werr and Stjernberg, 2003; Haas and Hansen, 2005). Consultants are the most important asset of their companies and are considered the main

resource, as the company's competitive advantage lies in the consultant's ability and creativity to solve problems and provide solutions for clients (Lowendahl, Revang and Fosstenlokken, 2001). Yet project-based organizations face many challenges to achieving project effectiveness (Ruuska and Teigland, 2009). Since they are unique, goal-oriented systems, where technical, procedural, organizational, and human elements are incorporated, they are therefore composite in their nature (Frame, 1995). Knowledge thus forms a key component of their intellectual capital (Apostolou and Mentzas, 1999). Given their dependence on knowledge as a source of value creation for their customers, efficient knowledge management is a critical aspect in this context (Mas-Machuca and Martínez-Costa, 2012; Powell and Ambrosini, 2012).

To be successful in today's world, global advisory firms need to be knowledge-intensive, apply reuse economies, create knowledge, and deliver quality to keep pace with constant change. They need to learn faster and use knowledge faster than their competitors. To achieve this, they need to organise and manage the processes of knowledge sharing within the organisation effectively and efficiently. Knowledge in the advisory business consists of different forms, depending on the characteristics of the mandates (standard or specific), the sectors concerned (industry, trade, services), the client segments (large, medium-sized, or small enterprises) and the type of advice (management consultancy, auditing, legal advice, financial advice, etc.) (Janicot and Mignon, 2012). For Morris and Empson (1998), knowledge can take one of two different forms: technical knowledge and client knowledge. They claim that technical knowledge includes industry-specific knowledge (generic, generally available and shared with other companies in the industry, formally codified in professional examination curricula), organisation-specific knowledge (company-specific, related to different processes, procedures or products, may be formalised or tacit) and individual knowledge (resulting from the individual's previous experiences, training and unique combination of client engagements).

2. Knowledge Framework

Companies are continuously looking for ways to make their products more attractive and effective. In a study undertaken by Lim (2002), it was found that organizational culture, knowledge management process and technology provide strong support for effective knowledge reuse. As indicated earlier, other researchers also agree that the main components of knowledge management include organizational culture, processes, and technology (Lee and Hong, 2002). One strategy that is frequently deployed is to gather as much information as possible to understand how the user interacts with the product. However, the real challenge lies in how to effectively process this information to identify potential for improvement and opportunities.

Prior studies (Birkinshaw, Nobel and Ridderstrale, 2002) have shown that knowledge management provides challenges in every firm’s context. The first general challenge for a consultancy firm that wants to build an effective knowledge management system is to ensure a high quality of information in the system (Mezher, et al., 2005). If employees of a consulting firm do not feed information into their company's system (Dunford, 2000), this quality can be compromised at a very basic stage. A speciality of a consulting firm is lack of time for knowledge work due to time consuming project work. Consultants should feed lessons learned or solutions they have developed into the databases and make them available to other employees - but "they just don't do it because the main problem is to find the time" (Davenport and Prusak, 1998, p.43).

The second general challenge for a consulting firm seeking to establish an effective knowledge management system is to ensure that the system, once established, is used (Mezher, et al., 2005). Despite the significant commitment of resources to set up such systems, not all consultants are willing to use the systems that have been implemented (Dunford, 2000).

Taking into account these challenges and additionally the knowledge management enabler, according to ISO 30401, the author attempted to find an approach to create an appropriate knowledge system e.g., a knowledge framework that ensures the appropriate format of gained knowhow on the consulting projects, storage in a user-friendly and clear structure as well as providing accessibility and reuse across the whole consulting company.

3. Methodical approach to conceptualize and implement the knowledge framework

This paper proposes an approach on how to conceive, create and implement a target-oriented knowledge management framework that offers a structure of corporate knowledge to enable the accessibility and the effective reuse of corporate knowledge in consulting companies. To obtain a holistic picture of the creation of a

knowledge framework, the author's aim was to conduct the workshops with the employees from different hierarchical levels in the Germany based consulting company to cover all requirements for knowledge and develop an appropriate structure.

3.1 Step 1 - Requirements assessment

The author aimed to include respondents across different hierarchical levels from the most junior up to the senior management level to reflect knowledge management practices and requirements from different perspectives. In this context the employees were divided into groups according to their seniority level. The approach has involved workshops that included associates, managers, senior consultants, and project directors. This approach enabled the internal requirements for knowledge to be recorded as well as the pain points in the current knowledge management base approach in the consulting company. This approach resulted in three workshops being conducted. The first one with the associates, the second with managers and the third one with senior managers and directors. The minimum number of participants in each workshop was 5 employees. The goal was to understand what kind of knowledge, in which format and for which seniority level was needed to reduce work efforts through the reuse of information and knowledge and therefore to increase productivity on the projects. The main questions during the workshops were which search terms does this specific target group use? Where does it look for information? What is important to this group in its research? The results of this comprehensive analysis and workshops turned into the initial concept of the knowledge framework for storage and therefore reuse of information across the whole consulting company.

3.2 Step 2 - Develop information architecture

In the proposed procedure the next step is to develop the information architecture of the knowledge framework based on recorded requirements for knowledge. The design or visualisation does not matter - it is all about the basic framework. The categories, such as, information, content and functions are effectively and efficiently findable and understandable in a good information architecture. The information architecture forms a basis for the design of the framework to ensure its best usability and user experience. To avoid misunderstandings in terminology, the knowledge framework should be aligned to the company strategic service portfolio. This provides the overall understanding of what kind of services the company provides and full transparency of knowledge that can be reused in daily business work. The knowledge framework should ensure not only a sophisticated structure but also enable the search and filter options. The search bar can be used to filter the dedicated documents by applied redirection to a separate search page with new filters. To reduce the costs of any adjustments as a result of the rapidly developing market situation and therefore changing service portfolio, the structure of the knowledge framework should be flexible and adjust itself according to a flexibly defined tagging structure. The structure of the framework is divided into three main clusters: technologies, services and expertise and related to them, a subcluster as shown in Figure 1. The storage of documents takes place according to the allocation of each of the following content formats that were defined during the workshops with employees as required: training, literature, pitch, fact pack, client ready, guideline and methods, templates.

The information architecture must be visualised through design, and this is the next step in the process.

3.3 Step 3 - Design and implementation

According to Pahl, et al. (2006) the main stages in the lifecycle of every product are: product planning and task setting; design and development; production, assembly and testing; marketing, consulting and sales; use, consumption and maintenance; and recycling or disposal.

3.4 Design

Design makes the products easy and intuitive to use and save the time. A good, well-thought-out design helps in the understanding of a product. The purpose of creating a knowledge framework is not only to ensure the storage of important knowledge across the company and make it accessible but also to ensure the usage of the whole product e.g., knowledge framework. To ensure the qualitative design of the final product, the author proposes the following procedure that consists of three main steps:

Step 1 Find a stakeholder and align on expectation level and deliverables
Step 2 Make a review and quality assurance on the first drafts
Step 3 Accept the final design

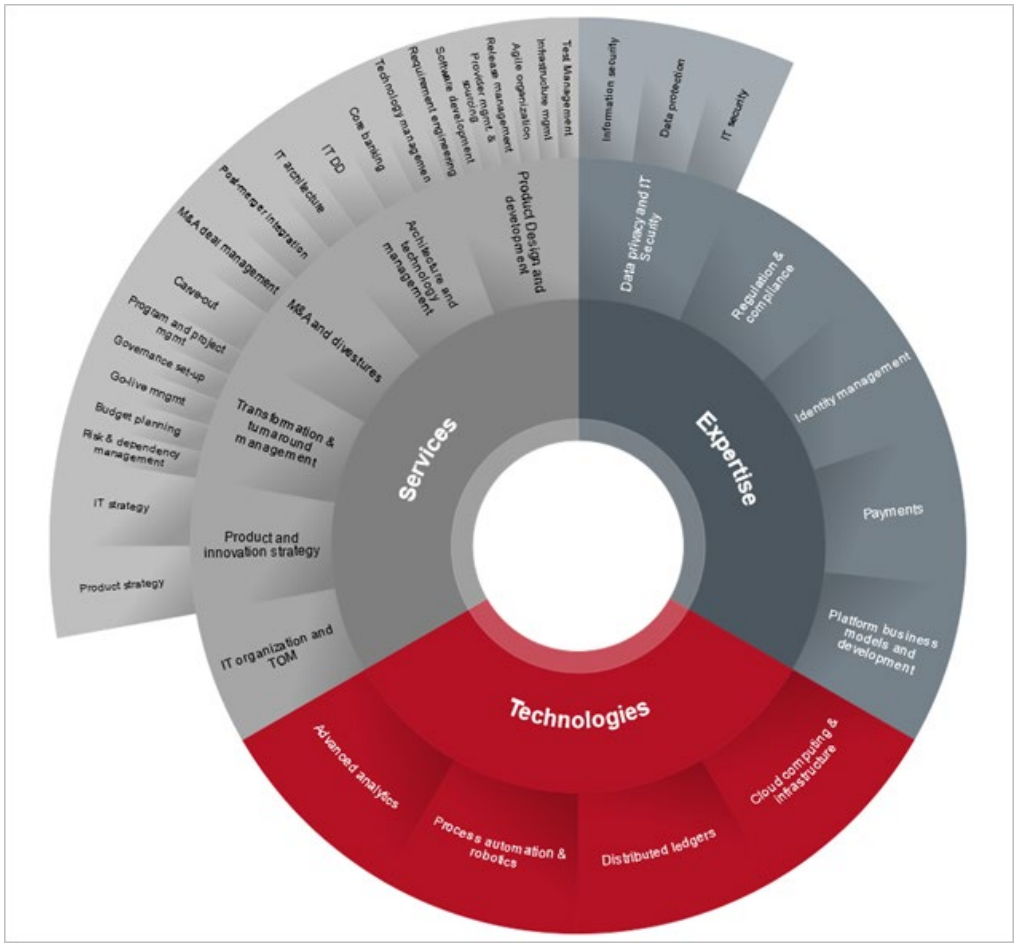


Figure 1: Knowledge framework

3.5 Implementation

The framework shown in Figure 1 is an exemplary solution from a German consultancy. The procedure serves as a methodical basis for creating a knowledge structure as well as an exemplary design which can be applied to all entities.

The final step is implementation of the knowledge framework. To ensure the high quality of the knowledge framework, not to go over budget, the following recommendations are given to reach the result.

Stage 1 Develop a roadmap The roadmap enables visualisation of the overall project, gives an overview of the important milestones, the defined responsibilities for the tasks and the deadline, which enables progress tracking.

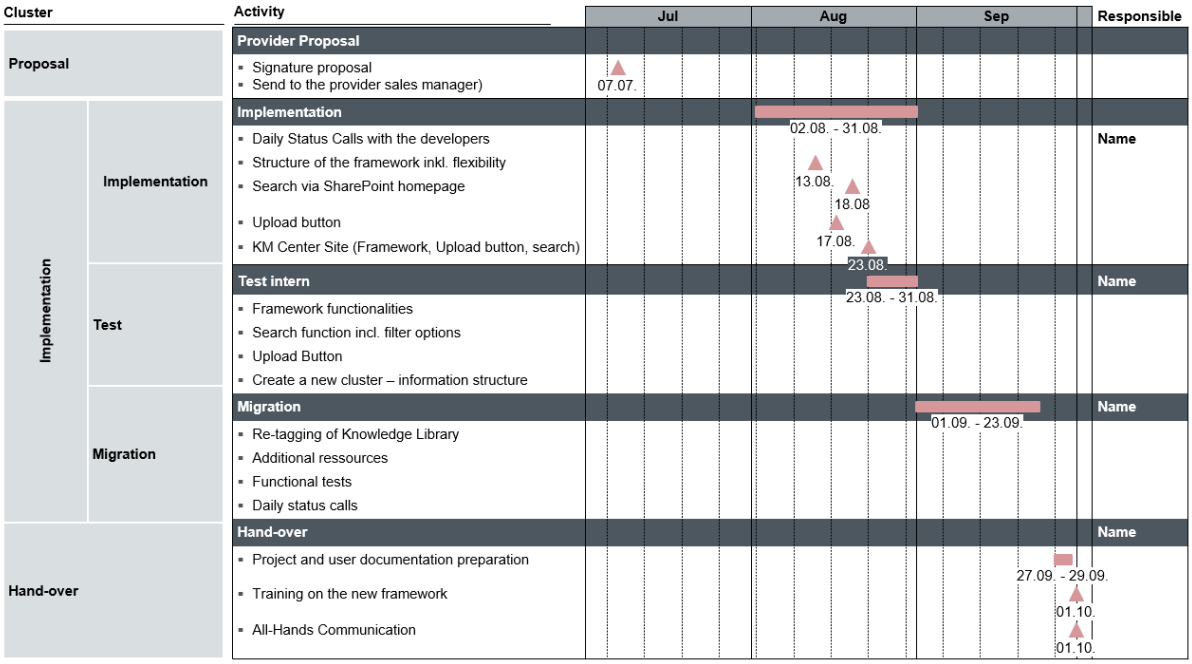


Figure 2: Roadmap for implementing knowledge framework

Figure 2 shows all the milestones of the implementation phase of the knowledge framework that serve as exemplary guidelines and consists of three main clusters: proposal, implementation and hand-over.

Proposal – to ensure the successful start of implementation, the deadline of provider proposal signature should be tracked.

Implementation – this cluster gives an overview of the activities such as the functionalities of the framework that must be implemented by the developer to ensure the following testing and adjustments, if there are issues. Daily status calls are mandatory for all implementation projects to ensure the progress of developers and to answer their potential questions. All functions and the whole structure of the framework should be tested in order to avoid unexpected bugs and issues. If the consulting company has any old software, the migration of files from the old one to the new one should be taken into account and included on the roadmap.

Hand-over – in this cluster, documentation of the project and user documentation should be created. The project can be closed as soon as the training in the new solution and communcation to the whole company has been given.

3.6 Stage 2 – User stories

Create a JIRA space for the product owner (someone who has a target picture of how the knowledge framework should look like and what functions it should have) and for developers. Any user stories that describe the functions of the knowledge framework, the progress of work budget and the time scope, should all be tracked. An exemplary JIRA space can be seen in Figure 3.

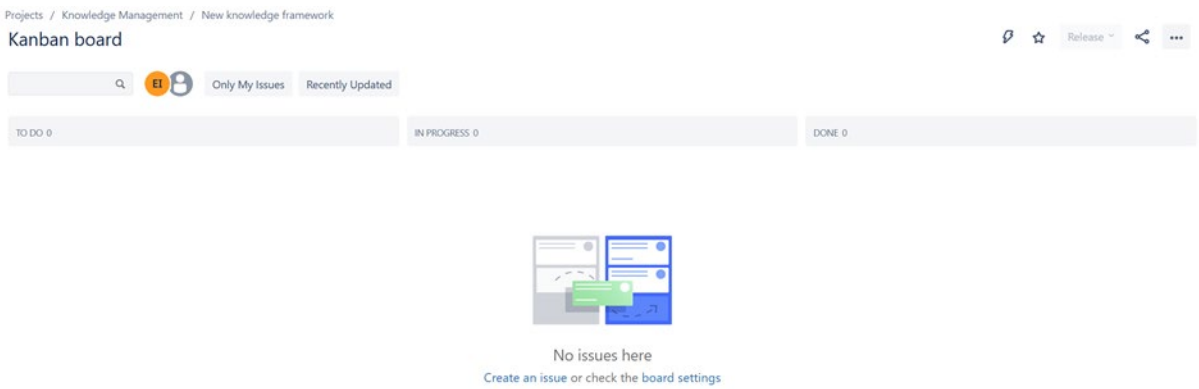


Figure 3: Exemplary JIRA board to track user stories

3.7 Stage 3 Kick-off with vendor and alignment on the expectation level and deliverables

This step can be run in parallel to steps 1 and 2 to reduce time and stay in scope. Research and analysis of a potential provider should be undertaken; select one who fulfils your expectation and who does not go over the budget. Additionally, align on the created user stories to ensure that developers understand the product and its functionalities.

3.8 Stage 4 Final quality assurance and acceptance

Ensure the quality of the developed knowledge framework, test all its functionalities, then the project can be officially closed.

4. Conclusion

The purpose of the paper was to provide a methodical approach for the successful conceptualisation and implementation of a knowledge framework. The research showed that knowledge is an essential part of management consultancy and has a direct impact on the success of the consulting firms. Therefore, it is even more important for companies to create a structured knowledge repository, where the project knowhow and overall knowledge is neatly stored. The challenge in creating such a system is the usability of the product. To achieve the best possible usability of the developed product, a multidimensional approach should be applied. In the first phase, the knowledge requirements must be determined. Since each seniority level at the consulting company has different requirements, employees from the different seniority levels should participate in the workshops to assess them. The next step is to define the information architecture of the knowledge framework, which is considered to be the base of the design. A user-friendly design ensures the successful usability of the product. After acceptance of the final design, the last step is to ensure the quality of the implementation, where the right vendor should be selected. Finally, to make the new product or the new knowledge framework visible across the whole company, a training series should be planned with all employees. The developed methodological approach for the creation of a knowledge framework was developed and successfully implemented at the Germany based consulting company and supported by the board of directors and all employees.

References

Apostolou, D. and Mentzas, G., 1999. Managing corporate knowledge: a comparative analysis of experiences in consulting firms. Part 1. *Knowledge and Process Management*, 6(3), pp.129-1238

Birkinshaw, J., Nobel, R. and Ridderstråle, J., 2002. Knowledge as a contingency variable: Do the characteristics of knowledge predict organization structure? *Organization Science*, 13(3), pp.274–289

Davenport, T.H. and Prusak, L., 1998. *Working knowledge how organizations manage what they know.* Boston: Harvard Business School Press, pp.43-165

Dunford, R., 2000. Key challenges in the search for the effective management of knowledge in management consulting firms. *Journal of Knowledge Management*, 4 (4), pp.295-302

Fincham, R., 1999. The consultant–client relationship: Critical perspectives on the management of organizational change. *Journal of Management Studies*, 36(3), pp.335- 351

Frame, D.J., 1995. *Managing projects in organizations. How to make the best use of time techniques and people.* San Francisco: Jossey-Bass Publishers, pp.95-111

Haas, M. and Hansen, M. T., 2005. When using knowledge can hurt performance: The value of organizational capabilities in a management consulting company. *Strategic Management Journal*, 26 (1), pp.1-24.

Hansen, Morten T., Nohria, N. and Tierney, T., 1999. What's your strategy for managing knowledge? *Harvard Business Review*. 77(2), March-April pp.106-116

Janicot C. and Mignon S., 2012. Knowledge codification in audit and consulting firms: a conceptual and empirical approach. *Knowledge Management Research & Practice,* 10(1), pp.4-15.

Lee, S.M. and Hong, S., 2002. An enterprise-wide knowledge management system infrastructure. *Industrial Management & Data Systems*, 102(1), pp.17-25.

Lim, T.T., 2002. Organizational culture and knowledge management. *Journal of Information and Knowledge Management*, 1(1), pp.57-63.

Løwendahl, B. R., Revang, Ø. and Fosstenløkken, S. M., 2001. Knowledge and value creation in professional service firms: A framework for analysis. *Human Relations*, 54(7), pp.911- 931

Martiny, M., 1998. Knowledge management at HP consulting. *Organizational Dynamics*, 27(2), pp.71 – 77

Mas-Machuca, M. and Martínez Costa, C., 2012. Exploring critical success factors of knowledge management projects in the consultancy sector. *Total Quality Management & Business Excellence*, 23(11-12), pp.1297-1313

Mezher, T., Abdul-Malak, M.A., Ghosn, I., and Ajam, M., 2005. *Knowledge management in mechanical and industrial engineering consulting: A case study*. Journal of Management and Engineering, Vol. 21, No. 3, pp.138-147

Morris, T. and Empson, L., 1998. Organisation and expertise: An exploration of knowledge bases and the management of accounting and consulting firms. *Accounting, Organizations and Society*, 23 (5-6), pp.609-624

Munchus, G., 1989. On the seeking of a definition of management consulting. Managerial Auditing Journal. Vol. 4, No. 1, pp. 21-25

Pahl, G., Beitz, W., Feldhusen, J. and Grote, K.-H. 2006. Pahl/Beitz Konstruktionslehre: Grundlagen erfolgreicher Produktentwicklung. Methoden und Anwendung. Springer, Berlin, pp.211–229

Powell, T. H. and Ambrosini, V., 2012. A pluralistic approach to knowledge management practices: Evidence from consultancy companies. *Long Range Planning*, 45(2), pp.209- 226

Ruuska, I. and Teigland, R., 2009. Ensuring project success through collective competence and creative conflict in public–private partnerships – a case study of Bygga Villa, a Swedish triple helix e-government initiative. *International Journal of Project Management*, 27, pp.323–334.

Sarvary, M., 1999. Knowledge management and competition in the consulting industry. *California Management Review*, 41(2), pp.95-107

Wagner, H. and Rolf, D., 1992. *Beratung von organisationen: Philosophien-konzepte-entwicklungen*. Wiesbaden: Gabler.

Werr, A. and Stjernberg, T., 2003. Exploring management consulting firms as knowledge systems. *Organization Studies*, 24(6), pp.881–908

Wojda, F. and Schwendenwein, G., 2000. Wissensmanagement bei planung und beratung. In: H. Krallmann and N. Gronau eds. *Wettbewerbsvorteile durch wissensmanagement – Methodik und anwendungen des knowledge management*. Stuttgart: Schäffer-Poeschel, pp.307-348

Digitizing the Austrian Universities' ICR for an Effective Higher Education Governance

Dominik Reisner
Austrian Federal Ministry of Education, Science and Research, Vienna, Austria
Dominik.reisner@bmbwf.gv.at

Abstract: The Intellectual Capital Reports (ICR) of the Austrian Universities are a major source of data needed for the evidence-based governance of the higher education sector in Austria. However, the current information gathering processes within the Science Ministry were very time consuming and labor-intensive due to the following reasons: Out of the three sections of the ICR universities could only deliver the indicator section via digital interface. The performance report as well as the performance agreement monitoring chapters, which consist largely of body of texts, had to be processed manually by gathering and compiling data out of separate pdf files for each university. This impedes the effectiveness of the use of the data contained in the ICR for governance purposes. Additionally, creating said elements at the universities largely happens by way of a collaborative effort. At some institutions, however, the processes for an effective collaboration require immense coordination efforts as these processes provide very little digital support. Consequently, the Science Ministry, under involvement of the universities, decided to create a tool, which enables the universities to compile the majority of the ICR in an online database achieving the following effects: The universities compile the ICR in a browser-based application in one of two ways: either they use the application's interface to compile the report elements collaboratively with clear process structures as well as comprehensive tasks and responsibilities. Alternatively, universities may copy texts from MS Word files if they have already established their own processes.The contents of the aforementioned sections are automatically entered into a search database that enables the Science Ministry to browse, compare and compile information either by keyword search or by exporting (sub)chapters. Search results may be grouped by single universities or groups of universities as well as the reporting year. Thus, accessibility of information contained in the ICRs is more easily accessible by providing tools for effective of data mining, thus conserving staff resources and therefore enhance the informed decision-making processes required for effective governance.

Keywords: Intellectual Capital, Higher education governance, digitization, search function

1. Introduction

The State is the major source of finance for the Austrian Public Universities. Accordingly, there is a high level of accountability. In its current role, the Federal Ministry of Education, Science and Research oversees the higher education sector and is responsible for its overall development. As the universities are autonomous entities, the government focuses on steering the sector through governance and policy measures. Effective governance requires not only data and information, but also a systematic approach of acquiring such and easy access to it. In times of tight staffing and an imminent demographic shift, that will drain great amounts of expertise from the administrative system having methods in place that help to affect a better system of information and knowledge management is of vital importance.

In order to increase usability of the Intellectual Capital Reports (ICR), the Science Ministry initiated a project to digitize the ICR and increase the use of the existing data for the purpose of governance.

2. Intellectual Capital Reports of Universities: Origins and Use

2.1 Background

In 2004, by enactment of the universities act, the 22 public universities became autonomous legal entities. This concluded a decades spanning shift in paradigm by applying the new public management principle to a major part of the Austrian higher education sector (Höllinger, 2004).

This new system required a radically different approach: While in the past even minor decision-making processes, which were mostly input- oriented to begin with, had to pass the competent ministry, the new arrangement left the Science Ministry out of the loop and therefore wanting for information. [Note: for political reasons, the competence for higher education switched to different ministries at multiple points in the past. For simplicities sake, the competent ministry of the day will be referred to as 'Science Ministry' to avoid confusion.]

This system change has been described as the most comprehensive, far-reaching higher education reform in Austria since 1849, especially because of the entrepreneurial model at its foundation (Fraenkel-Haeberle, 2014).

Leadership of universities was shared between professional managers and different government boards - University Council and Senate, respectively - and new governance principles and instruments had to be defined (Höllinger, 2004).

To compensate these changes and the loss of most direct oversight and decision-making competencies of the Science Ministry, the legislator decided to establish several new reporting instruments, among them the intellectual capital reports. Relating to this new tool parliament stated the intellectual capital report of the universities (ICR) should serve the universities as an instrument for the holistic presentation, assessment and communication of intangible assets, performance processes and their scope especially considering in regard to the political and the self-defined goals (Austrian Parliament, 2002).

Hence, starting from 2006, the public universities issued individual ICR to the public and the Science Ministry, the latter of which started to use the information from these reports to enhance its own decision making processes as well as using it as a source for several ministerial reporting obligations.

2.2 Periodicity, form and structure of the ICR

The specifics of how ICR has to be generated are defined within the Universities Act and the ICR ordinance (Wissensbilanz-Verordnung 2016) in their current form (BMBWF, 2016). Each public university has to issue an ICR annually, which contains the following sections/parts:

1. Performance Report – structured into ten chapters, this section focusses on a narrative, retrospective description of relevant areas of activity, like teaching, research and responsibilities towards society and the public, amongst others. A full report is required every three years. Universities may opt to restrict themselves to an executive summary in the years between.
2. Indicators – Overall, 24 indicators (plus 4 additional indicators for medical universities) have to be presented in several categories: human capital, relational capital, structural capital, core processes teaching and research, as well as output teaching and research. Indicators include classical higher education indicators like the number of 'exam-active' students as well as indicators concerning social policy like the gender pay gap of the academic staff.
3. Performance Agreement Monitoring – report on the implementation of goals and project over the performance agreement's period. [Note: Performance Agreements are the main governance tool for the public universities, allocating a global budget for a three-year period in return for a description of goals and projects the university pledges to achieve in that time.]

The ICR indicators have to be transmitted to the Ministry electronically for a data clearing process on March 15th every year (April 15th for indicators based on financial data) while the overall report has to be published in the university's gazette and transmitted to the ministry as a PDF file.

2.3 Purpose of ICR reporting and its use

Originally, the ICR was designed as a tool to cope with the changes brought on by implementing a new system of governance. By adapting intellectual capital as pioneered in Germany or at the IST Austria in Klosterneuburg, the legislator sought to create an innovative mechanism within the new public management framework (Habersam et al, 2018). In its current form, the ICR's purpose is a systematic display of the university's intellectual capital as well as the core processes qualitatively and quantitatively in an aggregated form. It serves as one of the bases for the performance agreements and as a standardized reporting tool (BMBWF, 2016).

The Science Ministry uses the contents of the ICR in different ways in order to effect governance decisions:

- • Reporting obligations – The Science Ministry is accountable to Parliament and the Austrian Court of Auditors. Furthermore, Austria has several international reporting obligations and strategies on higher education (i.e. the higher education mobility strategy, reporting obligations in the EU context or the OECD) (BMBWF; 2016). For that purpose, information is drawn from all three parts of ICR, some indicators serve as benchmarks.
- Competitive indicators – Some indicators from the ICR are used as a benchmark to distribute competitive funds alongside the performance agreements. (BMBWF, 2016)
- University report – Every three years the Science Minister must issue a report regarding the public universities to the National Council. The universities' ICR are one of the main sources of information for this report, as it needs to be based on the university's ICR.

- Preparing on-demand reports for the leadership of the Science Ministry – The day-to-day governance of the higher education sector necessitates informed decision-making processes. Requests for information on specific topics from the directors general, the secretary general or the office of the minister are very common. In many cases, information gathered from the ICR is used as a base for these reports.
- Systematic analysis of special areas for policy – governance efforts within the Science Ministry focus on several fields, such as teaching, research, and the vast field of social and general higher education policy. In many cases, the experts within the Science Ministry use the standardized information provided within the ICR to perform systematic analysis, which in turn greatly influences policymaking and governance. Examples include gender equality, intellectual property or development of main research.
- Summary of the Performance Agreement monitoring – each year, the results from Section/Part III of the ICR are summarized in a strategy document that gives an overview of the projects and goals that are being achieved and provides additional comments if the university's goal assessment aligns with the ministry's view. The results of this summary are annually discussed with the universities during the accompanying talks to the performance agreements.

As can be gathered from the points above, the ICR are a major repository of information on the public universities and offer a multitude of applications concerning governance. However, several challenges exist regarding the processing mechanisms of ICR data.

3. Challenges within the existing system

3.1 Setup

At the beginning of the digitization process, the legal framework stipulated a two-tier transmission system to the Science Ministry that involves the university's initiative: Part II, Indicators, is transferred through an online-based application that enables the Science Ministry to perform a data clearing process that consists of a plausibility check. Once the indicators have been cleared, the university rectorates finalize the ICR and pass it on to the university council for authorization. Once this is given the final ICRs are sent to the ministry by e-mail usually as a PDF file (Republik Österreich, 2002) (BMBWF; 2016).

This already highlights the core of the problem: while the indicators are transferred in a way that enables the Science Ministry to directly use and process the provided data, the majority of information contained within the ICR is not. Part I, Performance Report and Part III, Performance Agreement Monitoring, are transmitted as separate files that need to be processed with great effort.

3.2 Challenges

Several factors negatively affect an efficient use of the ICR's data.

Processing the information from Part I and Part III leads to a high workload by being very labor intense. Twenty-two separate documents have to be searched and compared manually to gather the necessary data. This is further hindered by the fact that not all universities provide the information in the same manner, even though the WBV stipulates the structure in detail. As the files are mostly transferred in PDF format this adds an additional layer of complexity.

The manual transference of data increases the chances for transmission errors. The corrections thusly necessitated also bind critical resources.

As there is no formal system for processing data from Part I and III of the ICR currently in place, (re)use of the existing data is being hindered. One could also argue that the ICR contains a 'treasure trove' of unused data. Some experts are even unaware of the existing information since the procurement of the data requires painstaking effort and personnel resources are very scarce.

4. Project Digital ICR

The challenges negatively affect the university governance as resources that could otherwise be devoted to actual analysis of the information and preparing necessary policy actions are used up inefficiently by the current obstacles. Therefore, a project was initiated to analyze possibilities for establishing a more efficient system.

4.1 Beginnings

The project originated in 2017 when ideas were first discussed within the Science Ministry whether or not the very time consuming process of creating the summaries for Part III should be digitalized. These efforts quickly expanded to Part I as well. An in-house project team was established, led by the head of unit responsible for the ICR and including several other departments heavily involved with the subject matter or related topics. Furthermore, staffers from the IT departments were included as consultants and (in the beginning) as possible programmers of the new system.

The first major question to answer was how expansive the digitalization effort should be. In the end, two variants surfaced as possible ways forward:

1. Standardize transmission through predesigned word processing forms that could be included into databases to implement a search engine.
2. Create an online editor to supplant existing ICR systems that the universities had established in the past that would automatically transfer the data to the ministry.

Variant 1 seemed like the safer choice, as the overall system would stay the same while the data could be processed automatically. On the downside, this system would perpetuate the fragmented solution across universities and lead to parallel processes as the universities would keep using their own system and fill in the information in the standardized form.

Variant 2 seemed to address many of these issues yet it would raise some of its own: establishing a single editorial system that would be able to take into account the requirements of all 22 universities would be hard to achieve. For example, some universities have very elaborate work flows and involve many people in the creation of the ICR while others rely on very small teams or even one- person responsible. Catering to all those requirements seemed like a daunting prospect.

These preliminary discussions took place until late 2017 when it was decided to involve the universities in the process early on.

In February 2018, the university ICR officers were invited to a discussion round to enable them to participate in the process on how to proceed.

The digitalization efforts roused the interest of the majority of ICR officers; however, they proposed different ways forward. In the end, the Science Ministry agreed to establish a working group consisting of ministry and university staff nominated by the universities' conference. This working group had an advisory function to discuss the possible implementation of a new system. The final decision rested with the Science Minister.

4.2 Project Goals

One of the first tasks of the working group was to determine and finalize the project goals. These were defined as follows:

- Long-term increase in usability and reduction of the workload for the Science Ministry and the universities
- Minimizing transmission errors
- Increased use of ICR data for governance processes
- Decrease of ad hoc ministry inquiries at universities.
- Enabling to draw a 'basic' ICR from the editor for subsequent use by the universities.

These goals served as a guideline for the remainder of the project along with two non-goals were: long-term increase of workload for the Science Ministry or the universities; creation of a 'surveillance tool' for the Science Ministry.

4.3 Determining the functional requirements

During the starting phase of the working group, the focus mainly lay on the scope of the planned tool and how it should be implemented. By June 2018, several requirements were set forth for the new tool:

- Standardized transmission of the performance report and the performance agreement monitoring.

- Creation of an online editor for the universities with a flexible role system that can be adapted to a university's needs.
- Possibility to export parts or some elements of the ICR as a Word file.
- Implementing a modern and intelligent search tool.
- Creation of an automated report for Part III according to standardized specifications.
- Ensuring the possibility to expand functionalities to other governance instruments like performance agreements.
- Software for consideration needed to be Open Source technology.

The original plan included the implementation of Part I as an APEX based solution. However, after finalizing the technical requirements and desired functionalities it became clear that the programming efforts had to be outsourced.

5. Implementing the Digital ICR

5.1 Search for a technical partner

Consulting the IT department's recommendations the project team scouted for potential IT partners to take over the programming of the new system. Using the Austrian Federal Procurement Agency's database a company was selected. Said business pitched two different approaches by two different sub-contractors to the project team in August 2018.

The first system was a TYPO3 based solution that included intuitive elements and a role based system. However, this concept did not include a search functionality nor did it fulfil the requirement of being an open source technology (Kappe, 2018).

The second system took a more innovative approach by including a more inclusive system based on Node JS and React JS / Create React Application that offered a search engine based on ElasticSearch (Functn/Techtalk 2018).

The project team quickly decided to continue pursuing the second option and expanded the working group by including representatives of the IT Company. From September to December 2018, the technical implementation was discussed in detail by taking the specified requirements, the universities' proposals for functionalities and the Science Ministry's demands to create the technical specifications that serve as the basis for programming work expected from the external IT-partner. Furthermore, a click dummy was created to visualize the functionalities for the decision makers within the Science Ministry.

In January 2019, the Science Minister authorized the project and the funding for it.

5.2 Technical implementation and specification

The actual programming work started by late January 2019 even though the external IT-partner started with some preparatory work before that. Technically, the backend application is based on Node.js 10.x, Postgres 10.x and on ElasticSearch 6.x (Peter et al, 2018)

The Frontend user interface is based on React JS / Create React App and Styled Components. Authentication will be operated through a Shibboleth Proxy layer (Peter et al, 2018).

Browser support will be provided for IE 11 and Evergreen Browser (Chrome, Firefox, and Safari). As it can be expected that work within the system would mostly be done on a desktop PC the system was not be optimized for responsive screens (Peter et al, 2018).

5.3 System Access

One of the first major discussions regarding the actual implementation of a new ICR system was how people working within the editor gain access to it. Discussion had made it clear that easy access through a single-sign-on (SSO) without password input would greatly enhance usability.

As all universities as well as the Science Ministry (at least partly) used authentication systems based on Shibboleth, the choice fell on said system to use it as gatekeeper for the ICR application.

As a first login step, users receive an invitation link by e-mail that leads the user to a landing page where he/she needs to choose his/her institution and will be automatically authenticated. The Shibboleth component processes the information from the identity provider and places http-header to mark the user as authenticated (Peter et al, 2018).

Overall, five different use cases were defined: Login ministry admin, university admin, chapter admin, performance agreement monitoring (PAM) admin and user, as well as maintenance role (Peter et al, 2018).

5.4 Roles

Defining the necessary role was one of the most time consuming aspects of the project. This is not altogether surprising as the question, which roles exist, and what they can and cannot do can make or break the most well designed process.

Roles within ICR system are assigned to the user. Several roles may be given to any specific user.
The Science Ministry roles are (Peter et al, 2018):

- Ministry admin: creates universities in the system, distributes university admins and ministry user roles, sets up chapter-structure and assigns chapters to university types.
- PAM admin: administrates all modules within Part III PAM including establishing periods, performance areas, create adapt, archive, approve and evaluate projects and goals.
- PAM user: sees and evaluates projects and goals and export date for analysis.
- Performance Report user: searches cleared ICR and export data.
- Ministry roles do not have access to the editor or any information in the system during the creation period. University data is only available to the Ministry roles after university clearance.
- University roles encompass (Peter et al, 2018):
- University admin: master admin on the university's side. Manages all users including PAM university admins, sets up additional (sub)chapters, exports the ICR, analyzes data and searches cleared ICR. This admin has all the rights of other university roles. Several university admins may exist, but one admin is compulsory.
- Chapter admin: This role administrates performance report chapters, marks chapters as 'ready for clearance' for the rectorate, creates subchapters as needed and has editorial rights as well as export rights for the chapter.
- Editors: have access to one or more chapters and can create and edit content within these chapters.
- PAM university admin: creates and edits projects and goals as defined in the performance agreements and clears them, exports the PAM, analyzes data and searches the cleared ICR as well as having the editorial rights for PAM.
- PAM editor: evaluates projects including 'traffic light status' enters the current goal value with an explanation and marks the project/goal as ready for clearance.
- Rectorate: has reading rights for editor and PAM. After all chapters in the editor and PAM are complete, the role clears the ICR for approval of the university council. In case of clearance denial, the role may add a comment to suggest changes.
- University council: has reading rights after clearance by the rectorate. Provides final authorization of the ICR after which the data is accessible to the ministry roles. In case of clearance denial, the role may add a comment to suggest changes.
- University read only: Reads all information (whether it is currently cleared or not) and analyzes cleared data.
- The list of roles is very extensive especially for the universities. However, the setup of the system ensures that a single user may perform all steps to create the ICR. This was necessary as some universities have a very minimalistic process structure in that regard.

5.5 Navigation

A central menu overview allows users to navigate the different modules and chapters. As the system is modular, these may be expanded by the ministry admin as necessary (Peter et al, 2018).

The current indicator application was not included for the time being due to time and budgetary constraints, a link to the indicators is provided within the navigation.

5.6 Editor

The editor is at the core of the new ICR system. It allows content to be created and edited by formatting texts, adding pictures and tables as well as creating 'info boxes' and placing footnotes. It also enables the university admin to set a character limit, as an 'internal disciplinary tool' to ensure concise texts (Peter et al, 2018).

In order to avoid loss of data an automated software versioning is in place that can be activated manually as well. Old versions may be restored by the user, which creates a new copy with the old information. For that reason even if the restoration happened by accident, the information would not be lost (Peter et al, 2018).

In order to enable an active process flow users may use the editor's comment function. This system creates a pop-up text field that initiates a comment thread to enable discussions and problem solutions. These threads may be deleted or archived and are inaccessible to the ministry users. (Peter et al, 2018)

Editing functions exist, but on a smaller scale compared to standard text processing applications like Microsoft Word. Similar restrictions apply to the creation of tables that is also limited in choices. This step was taken very consciously since fully re-creating sophisticated applications, as Microsoft Word is not feasible and beyond a reasonable cost-benefit ratio. The existing editing functions, while more minimalistic, serve the required purpose. The contents of all information contained in the performance report and the PAM may be exported, using the export function to ensure further editing.

5.7 PAM

This system allows the administration of all projects and goals contained in Part III of the ICR.

Each PAM period (which aligns with the three-year performance agreement period) needs to be initialized before any data can be provided. After that, projects and goals must be input into the system by the university PAM admin. Predesigned forms for projects and goals exist for that purpose. Once all information has been input the data is locked in and may only be changed by the PAM ministry admin after that (Peter et al, 2018).

The university admin enters the data for the project and goals of the current year and sets the traffic light status as well as gives a written explanation for the projects.

Once the university council clears the ICR, the information contained in the PAM becomes available to the PAM ministry editor. The latter evaluates the traffic light status and the explanations and is able to set their own traffic light status and reasoning. The PAM ministry admin clears, edits or returns single projects and goals to the ministry to clarify questionable content. A comment section enables direct contact with the universities for effective collaborative work (Peter et al, 2018).

A report giving an oversight on projects and goals structured by traffic light status or achieving the goal indicators can be generated from the system and exported as Word file for further processing.

The establishment of this system frees up human resources within the Science Ministry. In the past, just the copy and paste process consumed a lot of time that can be used more productively now.

5.8 Search Function

Making the data contained in the ICR searchable is one of the major goals of the overall project. As stated above, before implementing the new system, 22 separate PDF files had to be searched. A topical search over several years accordingly took up more time. Therefore, great care was taken in establishing the search function.

As the primary database technology used for the application, Postgres, is not the optimal solution for a full text search, the data contained within with the ICR is transferred to an ElasticSearch database. This system allows for different search mechanisms: full text search, filtering of parameters, ranked searches (frequency of word use as well as hierarchical positioning of the keyword) highlighting of keywords (Peter et al, 2018).

The search page includes a search field for specific keywords. Search results may be filtered by universities, groups of universities, reporting year and chapters. Users can apply several filters at once and choose between an exact word search and a fuzzy search. Filter settings can be saved for future use.

Search results contain a preview with highlighted keywords. Each result can be selected and deselected.

Selected results can be exported. The user can choose whether to export the whole chapter or only sections containing search results. Further processing of these texts is achieved by exporting them into a Microsoft Word document.

This feature will immensely reduce time spent on searching for relevant information from the ICR that can be better used for analyzing and preparing policy decisions.

5.9 Changes to the legal framework

Since form and structure of the ICR is defined through ordinance, any changes to the delivery methods must find reflection within the legal framework. Accordingly, a legal update of the ICR ordinance was put into force on November 1st, 2019. The Science Ministry took the opportunity to streamline the performance report (BMBWF, 2016).

6. Project Status and Upcoming Steps

The original project goals have been achieved: The universities deliver the performance report and the PAM via the web application since the reporting year 2020, when its use became compulsory after the test run for the reporting year 2019. The test run of the search function took place in 2021 since productive data was necessary to enable a complete system test.

Currently, the PAM functionalities are being revised to improve on optical aspects as well as the search functionality.

7. Lessons learnt during the project

Implementing a new digital tool is easier said than done. In the beginning, the scope of the project was not fully clear and expanded gradually.

The majority of the project team did not have an IT background, which led to different expectations of what can and cannot be done. The involvement of the IT-department was a critical factor for the success, as the feasibility of the project would have been assessed wrongly several times.

Determining the goals and non-goals of the project and the capabilities of such a system in advance and communicating those to all parties involved was immensely helpful and critical to success.

It cannot be stressed enough how vital the process for creating the requirement specification document was. Particularly challenging was a classical chicken/egg causality: the requirements for the application have to be described very accurately in order to receive the best possible outcome. However, the ignorance of possible tools available might keep IT amateurs from receiving the best technologies for their specific needs. Therefore, trust between any external IT-partners and the client is of critical importance as is an excellent communication basis.

A major obstacle in switching the former analogue reporting system to a digitized one was a certain level of mistrust and reluctance to change the existing processes from some stakeholders. While some university representatives involved in the development process wholeheartedly embraced the possibilities, others saw the project much more critically. A small number of process participants openly opposed the implementation citing the danger of increasing resources required to create the ICR with very little real benefit.

Most of these apprehensions could be alleviated over the course of several meetings. Regardless, any digitalization process should take great care to invest enough time into addressing critical opinions and to onboard dissenters.

8. Outlook

Fully digitalizing the ICR and therefore making essential data necessary for university governance more easily available has the potential of being a major game changer. By freeing up human resources currently bound by

administrative activities or error-prone copy/paste manoeuvres much more time can be invested into analyzing and preparing critical data.

Apart from the direct changes of ICR management, a rippling effect might be created. Especially the custom-made search function could be expanded to other highly relevant strategy documents.

As a next step, the indicators, which are currently administrated through a different platform, will be migrated into the system to streamline the digitalization efforts for the ICR and create a complete export version of the ICR.

In any case, implementing digitalization measures is part of the way to make knowledge management more effective. However, the best digital system does not change anything if people cannot be convinced of its benefit. Therefore, care should be taken to not only implement new systems but also educate the people on how to use them.

References

BMBWF, Begutachtungsentwurf zur Abänderung der Wissensbilanzverordnung [draft for public comments regarding the adaption of the intellectual capital report ordinance, title translated by the author, 2016, Wien, 2019

BMBWF, Hochschulmobilitätsstrategie (higher education mobility strategy, title translated by the author], Wien 2016

BMBWF; Wissensbilanzverordnung 2016 (intellectual capital report ordinance 2016, title translated by the author], Bundesgesetzblatt, Wien, 2016.

Fraenkel-Haeberle, C.: Die Universität im Mehrebenensystem. Modernisierungsansätze in Deutschland, Italien und Österreich (the university in a multi layer system: modernization efforts in Germany, Italy and Austria, title translated by the author], Tübingen: Mohr Siebeck, 2014.

Functn/Techtalk, BMBWF; Plattform Wissensbilanz Konzept (BMBWF, plattform ICR, concept, translated by the author), Wien 2018.

Habersam, M., Piber, M. and Skoog, M. "Ten years of using knowledge balance sheets in Austrian public universities: A retrospective and prospective view", Journal of Intellectual Capital, Vol. 19 (1), 34-52, 2018.

Höllinger, S.: Die Entwicklung von der staatlich gelenkten zur autonomen und europäischen Universität [The development from a state-controlled to an autonomous and European university; translated by the author]. In: Höllinger, S. & Titscher, S. (Eds.): Die Österreichische Universitätsreform. Zur Implementierung des Universitätsgesetzes 2002 [The Austrian university reform. On the implementation of the Universities Act 2002; translated by the author]. WUV Universitätsverlag, 51-69, Wien, 2004.

Kappe, M., Konzeptpräsentation Applikation Wissensbilanz/Leistungsbericht (concept presentation application ICR/performance report, title translated by the author), Dix Solutions, Wien, 2018.

Österreichisches Parlament Erläuterungen um Universitätsgesetz 2002 (recitals accompanying the universities act, title translated by the author], Gesetzesmaterialien, Wien, 2002.

Peter, Ch., Ehrenfellner P and Steizinger K., Lastenheft Digitale Wissensbilanz [Requirement Specification Digital ICR, translated by the Author], Tech Talk/Functn, Wien, 2018.

Republik Österreich, Universitätsgesetz 2002 [universities act 2002, translated by the author], Bundesgesetzblatt, Wien, 2002.

Smart Working Paradigms in a Hybrid Working era

Daniela Robu[1] and John B. Lazar[2]
[1]Alberta Health Services, Calgary, AB Canada
[2]John B. Lazar & Associates, Inc., Forest Park, IL USA
daniela.robu@ahs.ca
john@jblacoaching.com

Abstract: If we observe top companies in any industry, we notice they have one thing in common: innovation. Successful business leaders recognize when the same ideas and methods used before aren't working anymore. Smart, innovative approaches are needed for our hybrid working environment. The ABCD business model shows that present organizations spend the majority of their time on activities related to business administration (A) and doing repetitive work (D). The rest of the time is allocated to dealing with crises (C), and only nominally to improving the ways business is done (B). Digital transformation, competition, and the need for organizations to leverage technology and innovation in the future will 'force' organizations to maintain A, increase B, and (strategize how to) decrease C and D. Two initiatives will be unpacked and common elements will be identified as indicators in improving B. Five ways to change the game and become a human-focused organization that promotes innovation are proposed based on our learnings: *People*: 1. Encourage a growth mindset of continuous learning, creativity in how problems are solved, and flexibility how work gets done, 2. Encourage innovative thinking; create innovative groups, 3. Build skills, e.g., analytical thinking, innovation, creativity, and initiative, *Workplace*: 4. Design a psychologically safe culture, where people are included, can learn, have a sense of belonging, are appreciated, and valued for who they are and what they contribute and challenge. *Technology*: 5. Create an experimentation lab to TRY-TEST-ADAPT in rapid cycles to learn and fail/learn fast or advance the innovation. We are faced with multiple, messy issues that require out-of-the-box thinking and innovative solutions. Capturing lessons learned can build leading indicators that will help improve B. A simulation dashboard that quantifies the change is an innovation tool we plan to develop.

Keywords: digital transformation, ABCD model, digital competencies, innovation, human-focused

1. Introduction

Time to improve how we optimize work in a hybrid environment! According to Future of Jobs survey report (World Economic Forum, 2018) by the World Economic Forum, "Over the next 5 years, employers will be giving priority to those who are strong on analytical thinking and innovation, as well as creativity, originality and initiative." The vast flow, velocity, and variety of information requires digital transformation that further enables data-driven decision-making. A recent Global Innovation Survey by McKinsey (McKinsey and Company, 2022) highlights that "innovation is critical to growth, particularly as the speed of business cycles continues to increase." Organizations and leaders need to change the status quo and allow their employees to run experiments where they present innovative solutions to reduce costs, improve engagement and satisfaction (Aguirre and Baron, 2020). Challenging the status quo will trigger changes in decision-making culture, workplace design, processes, and approaches in building new skills.

"You can't manage what you don't measure", attributed to both W. Edwards Deming and Peter Drucker, explains why it is important to quantify the status quo. It will help determine which trigger activities enable organizations to shift from A (do the job), C (fight fires), D (repetitive work) to B (improve). In this paper, two case studies are discussed: *Case Study 1*, Case Investigation for COVID-19 cases, presents the interventions completed to decrease C (deal with high volume of assignments for workforce due to COVID-19 surge of cases) and D (repetitive, manual work for workforce placement). *Case Study 2*, Contract Procurement Supply Management: Contract Management Staff Orientation presents the interventions completed to decrease C (reduce re-work and errors) and D (manual update of content and tracking of employee knowledge checks and completion of training materials). Both case studies are examples of approaches to improve the ways business is done (increase B) in Alberta Health Services.

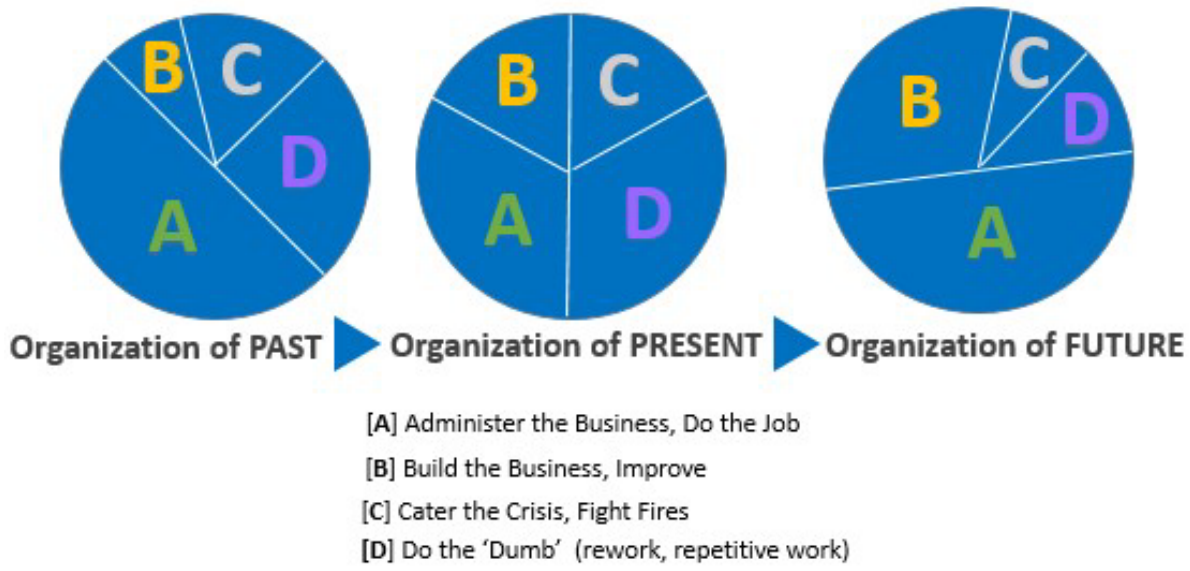


Figure 1. ABCD Model

Source: U of Alberta, U of Calgary, AHS (2019), adapted by authors

In addition to the technical upgrades needed to successfully complete these two projects, there also was performance support for the staff who would follow the new processes and use the new tools. From a systemic perspective, the blended solution design also included interventions that addressed human-centric needs of all involved staff. There were seven areas of note:

1. individual skills/competencies building in hybrid environment, including technical skills and soft skills (Edmondson, 2018);
2. process differences and aspects of communication and collaboration (Cross and Baron, 2021);
3. activities that happen when in the office (Davey, 2022);
4. culture, including psychological safety (Grant, 2021; Hancock et al., 2021; Ishak, 2017; and Klau, 2021)
5. management and addressing control issues for performance (Finn et al., 2021; Pistrui and Dimov, 2018; Ashford, 2021);
6. doing meaningful, purposeful work (Edelman, 2021; Imperative, 2022)
7. health and vitality (DDI, 2021).

Each one of these will be briefly discussed as appropriate for each of the case studies.

2. Methodology

The case study approach is useful when we need to understand a problem in depth and consider the approaches that need to be deployed in relation to the design, planning, analysis, interpretation and reporting of case studies. Case studies help in understanding and explaining connections and pathways resulting in changes proposed to create a new policy/process or update a current one; introduce service development. Another benefit of the case study is that it offers additional insights into the implementation gaps that exist and why one implementation strategy can be used over another.

There are three main types of case studies: intrinsic (typically undertaken to learn about a unique phenomenon), instrumental (uses a particular case to gain a broader appreciation of an issue), collective (involves studying multiple cases simultaneously or sequentially in an attempt to generate a still broader appreciation of a particular issue). In this paper, collective case study was used for Case Investigation: Automation of Workload Distribution (Case Study 1) and instrumental case study was used for Contract Monitoring Staff Orientation (Case Study 2). See Table 1.

Table 1: Case Study components: Data Collection, Data Analysis, Solution, Reporting

Description	**Case Study 1** Automation of Workload Distribution	**Case Study 2** Contract Monitoring Staff Orientation
Data Collection	*Quantitative*: Process workflows, data structure and sources, analysis of data quality *Qualitative*: Front line users storytelling, job shadowing, working group discussions, observations, results collected from testing prototypes	*Quantitative*: Process steps, content to be mapped, themes, curriculum *Qualitative*: Storytelling of process from current to future, work group discussions, results from testing Proof of Concept
Analysis of data	Comparison and analysis of data embedded in different models and workflows to inform best accuracy and repeatability	Review of orientation concept and creating a map structured by role and topics/theme assigning the corresponding metadata and related structure for the content hub
Solution	Decision matrix included comparison of four platform and their abilities related to web data visualization, server with Python interpreter and easy knowledge transfer of the solution	Review of existing online learning options and selection of the one that responds best to the end users/content management team and leaders
Reporting	Describe in detail the steps involved in selecting the automation flow and Machine Learning (ML) model, transparency in the steps involved, methods chosen and how interpretation and conclusions were reached. The transparency helps Sponsors and end users with trustworthiness of the report.	Provide learners and leaders with ability to track progress of learning and determine where content can be augmented or knowledge checks be adjusted to ensure accuracy and compliance with the Contract monitoring requirements.

3. Case Study 1. Case Investigation: Automation of Workload Distribution

Provincial Population and Public Health leaders were looking for a solution to be able to rapidly adjust the day-to-day workflow and be able to adapt in real time the assignment of staffing (increase B). Due to pandemic, the workload increased as workforce changed and the current processes could not scale.

Based on root cause analysis, the overall solution has three components: automation, prediction, simulation. This case study presents the automation component.

A cross-functional team (IT developers, analytics, business representatives, educators, instructional designers) was assigned to explore potential options, such as rule-based algorithms and/or Artificial Intelligence (AI) optimization algorithms/patterns to automate and optimize the manual processes that are time consuming and repetitive (C, D). The intended outcome of this work was to build an automation model that was flexible enough when 11 criteria and 81 variables were changing. Testing and using feedback loops to refine the model were essential in order to build trust in the Case Investigation team to adopt the model in their day-to-day work. If the model proved to reduce the gap, implementation would follow based on the stakeholders' approval. Options to assess efficiency, effectiveness, and benefits gained were explored once the automation model was approved and implemented. The project team conditions/parameters were:

Problem: Case Investigation activities are *complex* and include *multiple variables*: high volume of new hires (approximately 2,300 staff) that needed to be oriented and trained, weekly changes in workforce availability that require distribution per teams based on their qualifications, large volumes of both licensed and un licensed health professionals (averaging 100-150 at times) to be oriented in one week and experienced/inexperienced staff.

Gap: Processes that relate to workforce distribution are mainly *manual* and require increased number of hours to organize and schedule the Contact Investigators.

Goals: Increase efficiency and effectiveness in workload distribution processes (Decrease from 10h/day estimated manual work to 0h/day when automation is embedded in the process); create an automation model that can be replicated for other potential applications. However beneficial a new automated process can be and support decision-making and simplify the employee's process, the real test is how it interacts with the other aspects of the process, team and worker. Interdependencies play a critical role in affecting the outcomes. Leaders must plan a strategy that takes into account the interactions among all components of the business. They need to anticipate the complex interrelationships surrounding change. For example, feasibility (stability of the automation process), sequence (which parts of the process change first), location (online, on premise access

to the tools), staff competencies (new knowledge and skills), management of the solution, culture change (advance digital transformation), employee motivation are part of the matrix of change.

Outputs: In the Case Investigation: Automation of Workload Distribution project, the leaders carefully selected the interventions that could lead to a seamless implementation. *Feasibility* was addressed by comparing the manual results to the automated results, testing the solution for accuracy through repeated tests; *sequence* and *location* were addressed by shadowing the activities/tasks completed by the staff when handling data and transition points; *new staff competencies* were built through education, and simulation of steps; *culture change* was gradually introduced through team meetings, communication of the change and rationale, promoting the vision for creating internal efficiencies; motivating employees by acknowledging their effort and ability to learn new ways of doing work and adapting it in their day-to-day work. The implementation package included:

(1) Daily Automated Staff Assignment (DASA), automated process flow and assignment of staff - Online platform in SharePoint with tools integrated with Tableau (See Figure 2), (2) List of baseline parameters, (3) Service model that provides details regarding the type of changes that can be requested to be made to DASA, (4) Decision-making dashboards (Vizualization of staff assigned/not assigned, Staff Count/group/day), (5) audio visual education training materials located in an online library, (6) 493 staff trained in how to use DASA.

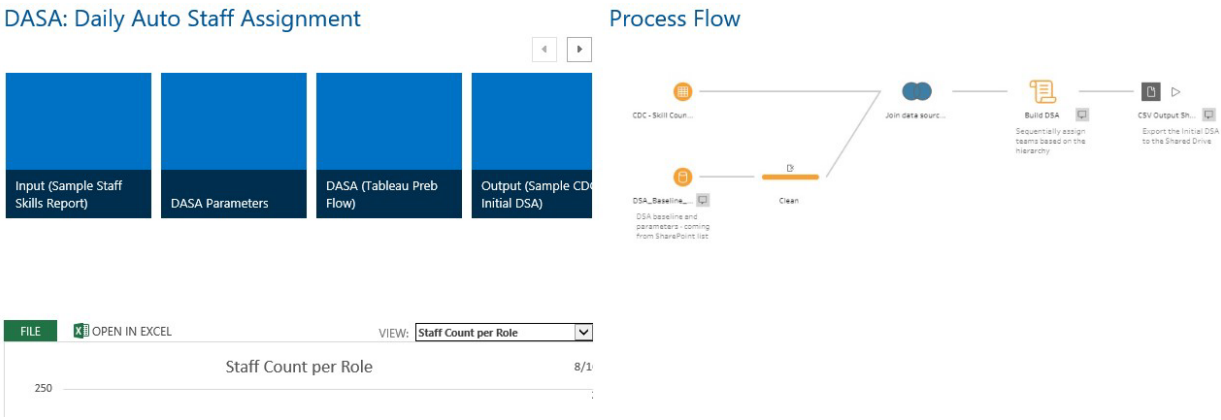


Figure 2: DASA Automation workflow

3.1.1 Outcomes:

- Automatically assigned an average of 1,200 staff. The impact after 6 weeks of using DASA decreased the initiation phase from 6-8 hours to 1-2 hours; decreased the review and adjust phase from 4 hours to 2 hours. The automation led to 8h/day time savings. The result of the automation intervention increased B, improved A, and decreased C, D.
- Staff were trained in digital competencies: information management, document management, data analysis, data interpretation using visualization tools.
- Staff satisfaction quotes: ”Infinitely better”, “This is quite amazing to see come together!”

When we map the case study to the ABCD model, gaps to be improved are identified and aligned with the interventions that trigger changes in C and D and increase in B. See Figure 3.

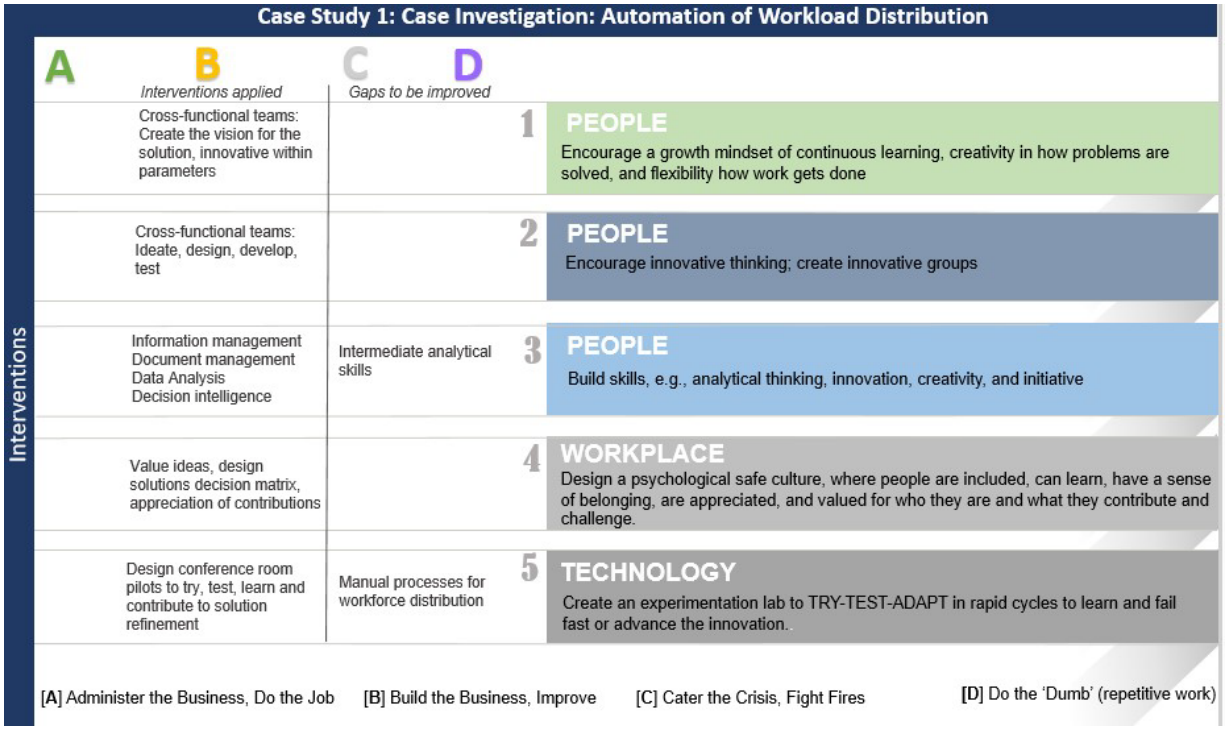


Figure 3: Case Investigation: Automation of Workload Distribution - Interventions to increase B

4. Case Study 2. Contract, Procurement and Supply Management (CPSM): Contract Monitoring Staff Orientation

Employees require constant upgrade of their skills (digital competencies, professional designation, etc.). Contract management staff, similar to the team in a surgical Operating Room, needs to have 100% compliance when they manage contracts and the fine details related to them. It requires skilling of the program's function and upskilling of concepts, operational requirements and processes, etc. CPSM, Risk & Internal Controls leaders assessed the need to develop performance support tools for the staff to obtain the required accuracy and consistency in their work output. A team with members representing the business and technology/analytics was structured and a project was scoped. The objective was to develop self-guided learning for staff with ability to complete knowledge checks and course correct, based on the responses received. The project parameters were:

4.1.1 Gaps: Identified gaps included:

- Time and resources required to manually: (1) Guide staff through orientation and walk them through materials; (2) Track learning progress of each staff member;
- Metrics to gauge learner's initial understanding of the materials and catch early on where re-training focus areas needed to be;
- Build competencies for staff

Goals: Increase efficiency of staff time used for learning; increase accuracy of deliverables required for the roles. When we relate to people and workplace interventions we have to be strategic in the learning process: Employees go through a learning journey from day one in a job. "Ebbinghaus' forgetting curve informs that people forget half of the information they learn just one hour after learning it, more than 70% after one day and 90% after 30 days. The challenge for learners is to find a way to focus on the bits of information that are most important to them and retain them in long-term memory". New ways to structure the learning process and receive only the relevant information to do the job have to be introduced in the business operations. For example, skills and competencies development built in such a way that learners follow learning paths as concise as possible; learning process created to allow learners to absorb new information at a comfortable pace; develop online quizzes and test to ensure progress tracking and repetition; provide rewards for the effort of learning; encourage continuous learning and create space for it.

Outputs: Contract Monitoring Orientation online platform created the safe space for employees to learn and test their knowledge: learning paths were created for two roles with curated resources for each; concise lessons were

prepared to help learner focus on what is important, promoting microlearning; short online knowledge tests were developed to trigger recall of information and retention.

A Self-guided Contract Management (CM) Learning Pathway (developed in SharePoint) that helps staff navigate through the CM Program's background documentation, business functions, frameworks, and processes. Staff can complete lessons that are associated with their role and monitor their learning progress. See Figure 4.

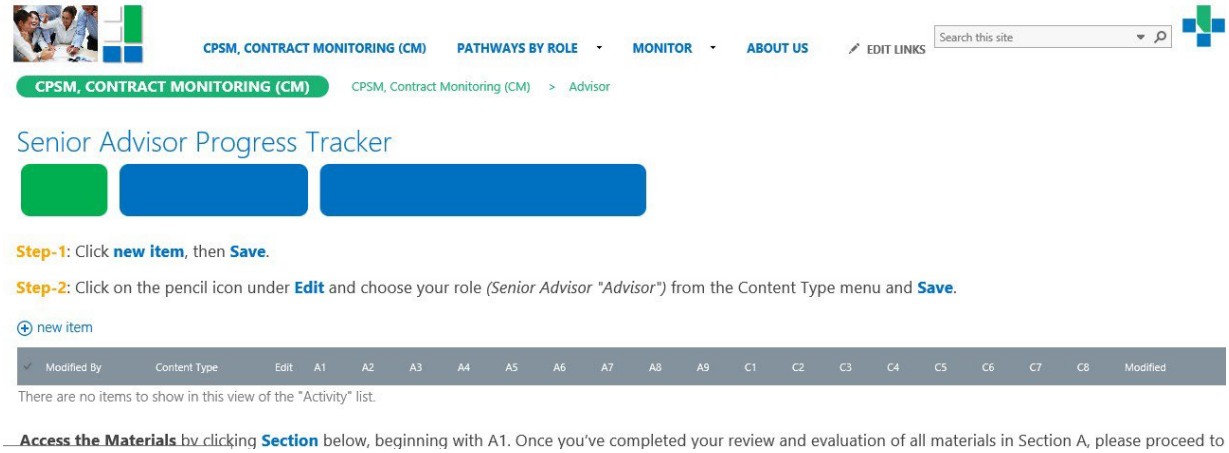


Figure 4: Self-guided Learning Pathway (example for Senior Advisor – 17 lessons)

4.1.2 Outcomes*:*

- The management of the Learning Pathway content is reduced once the library is set up with metadata for easy find/search and the version control is enabled for quick follow-up of updates
- Tracking of learner progress and quiz results is automatic; the supervisors can draw conclusions where they need to further clarify or add new content
- Staff can develop their own learning path as they complete the modules at their own pace
- New digital competency skills (online learning) are developed within the staff
- The Monitor component of the solution will assist leaders in developing metrics for learner's progress

When we map the case study to the ABCD model, gaps to be improved are identified and aligned with the interventions that trigger changes in C and D and increase in B. Figure 5.

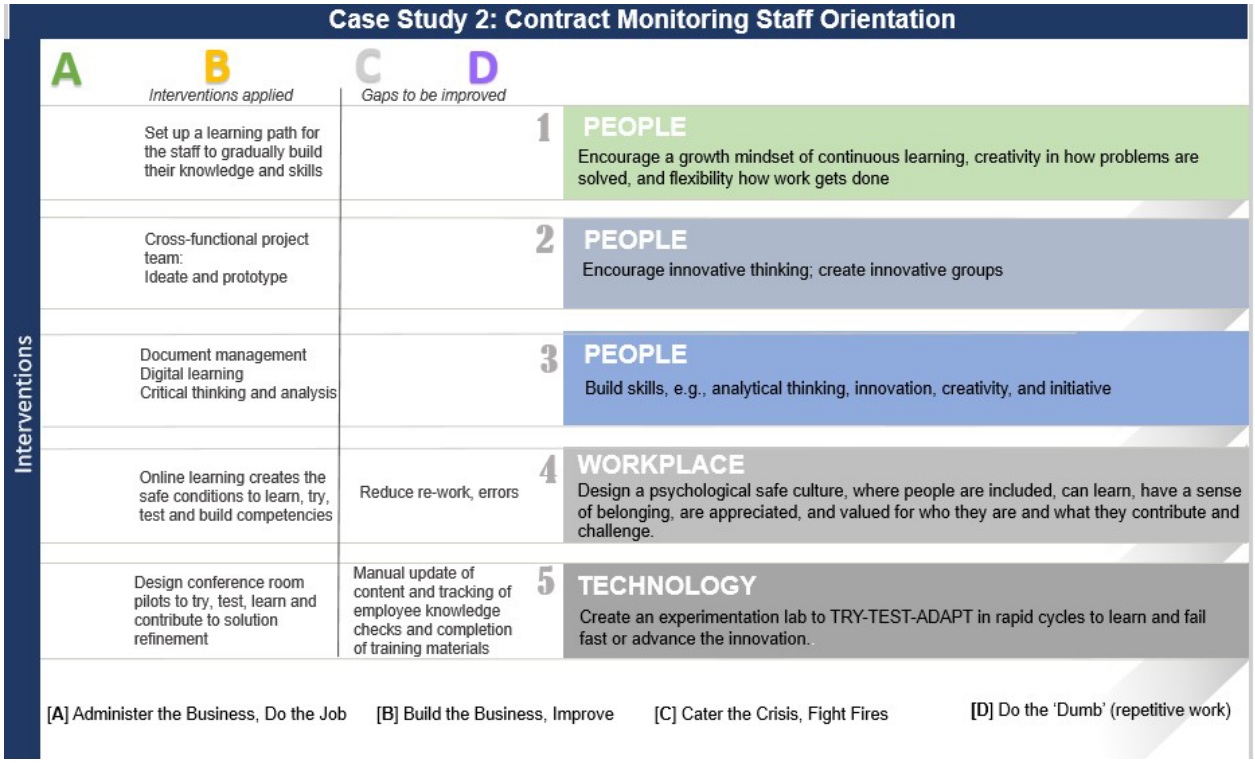


Figure 5: Contract Monitoring Staff Orientation – Interventions to increase B

5. Conclusions

> *"In the post-pandemic future of work, nine out of ten organizations will be combining remote and on-site working, according to a new McKinsey survey of 100 executives across industries and geographies. The survey confirms that productivity and customer satisfaction have increased during the pandemic."*

Leaders and teams need a new model in this hybrid world. How can this be achieved?

According to Forbes (Lital, 2021) the organizations need to: (1) Step up their digital game by embedding latest digital tools to create insights in the processes and measure progress; (2) Pay close attention to your employees' needs and requests as they are part of designing the hybrid work plan and their input is a necessity; (3) Keep work asynchronous, at least at first and analyze the value of meetings; (4) Hold everyone accountable by using two approaches, agile and sprint, which provide the teams a framework for staying on task and collaborating effectively in a hybrid world; (5) Don't forget that *balance* is needed. There needs to be a balance between people working collaboratively and on their own. Periodically, let individual brains marinate individual ideas before the team assembles again. Optimal collaboration requires at least some "alone time."

According to Case Study 1 and 2, and aligning with Forbes recommendation, the aim in the next 10 years is to fully leverage innovation and technology within the organization. Performance support tools, workplace conditions, and human-centric considerations need to be put in place. A set of three tools are introduced to respond to that: (1) Measure Progress Tool: ABCD Model to measure B from current to future when starting an initiative (Figure 6); (2) Change Management Tool: Initiative Intervention Map (Figure 7); (3) Change Management Tool: Human Centric intervention (Figure 8)

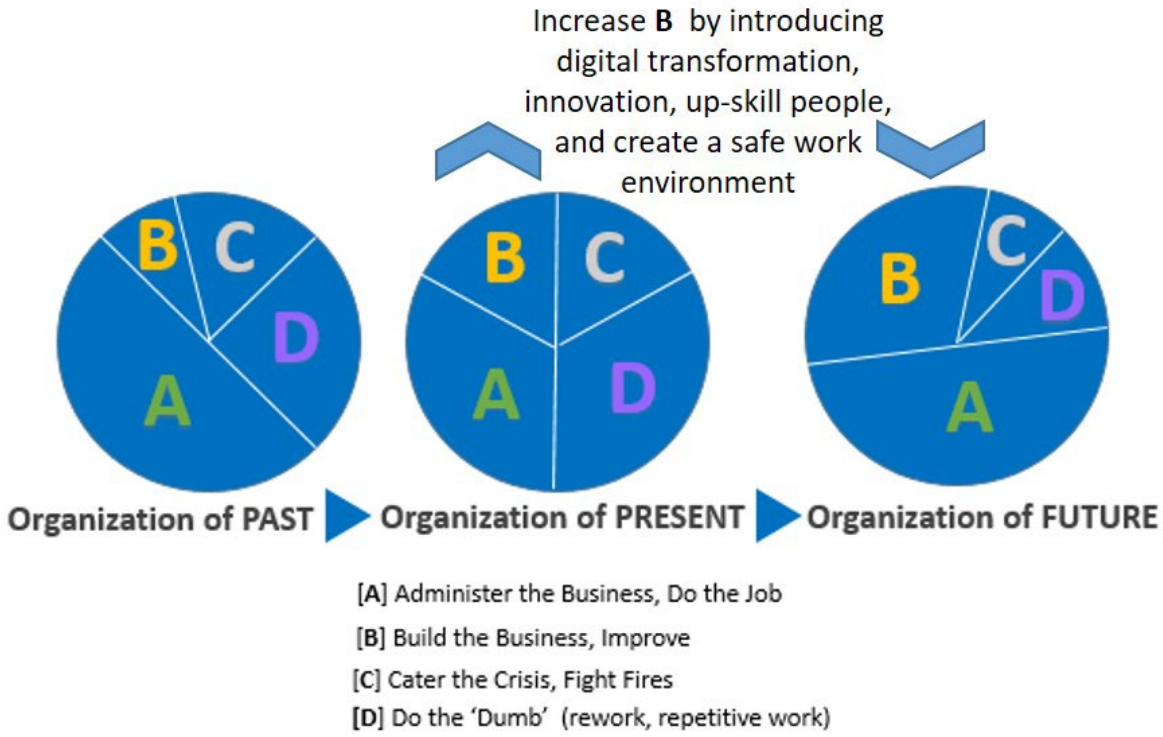


Figure 6: Measure Progress Tool: ABCD Model to measure B from current to future when starting an initiative

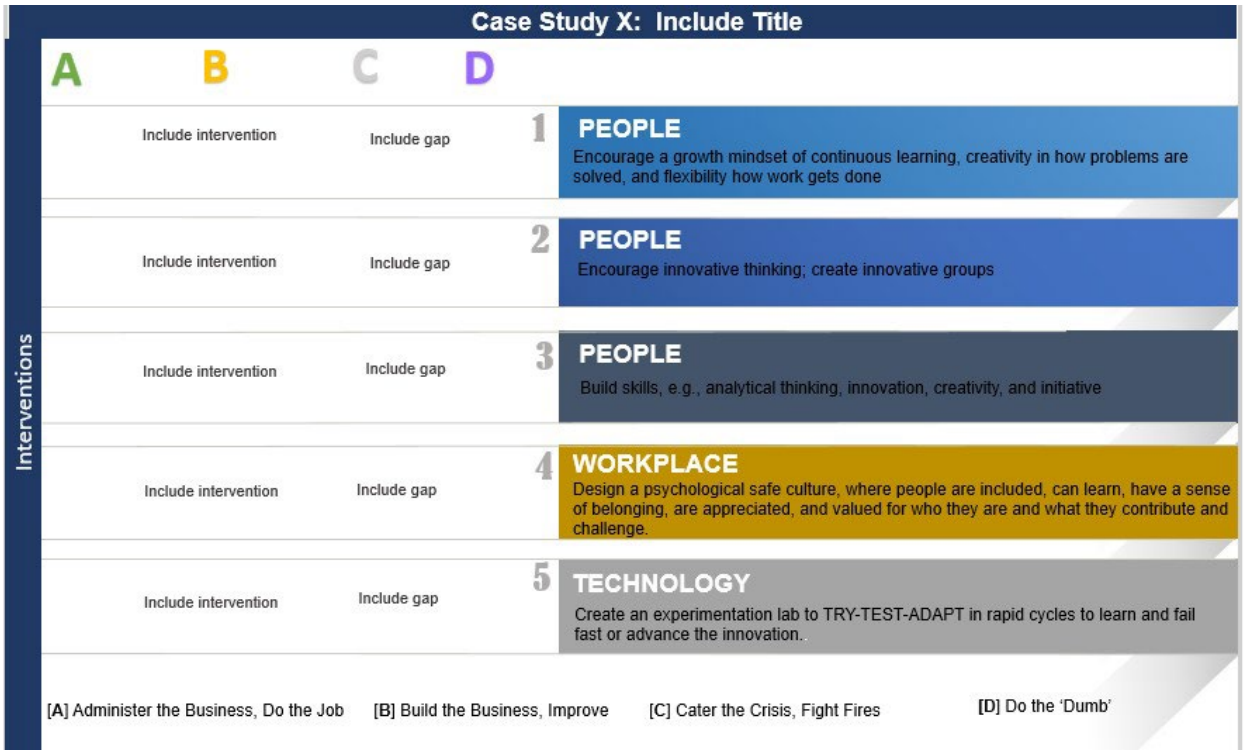


Figure 7: Change Management Tool: Initiative Intervention Map

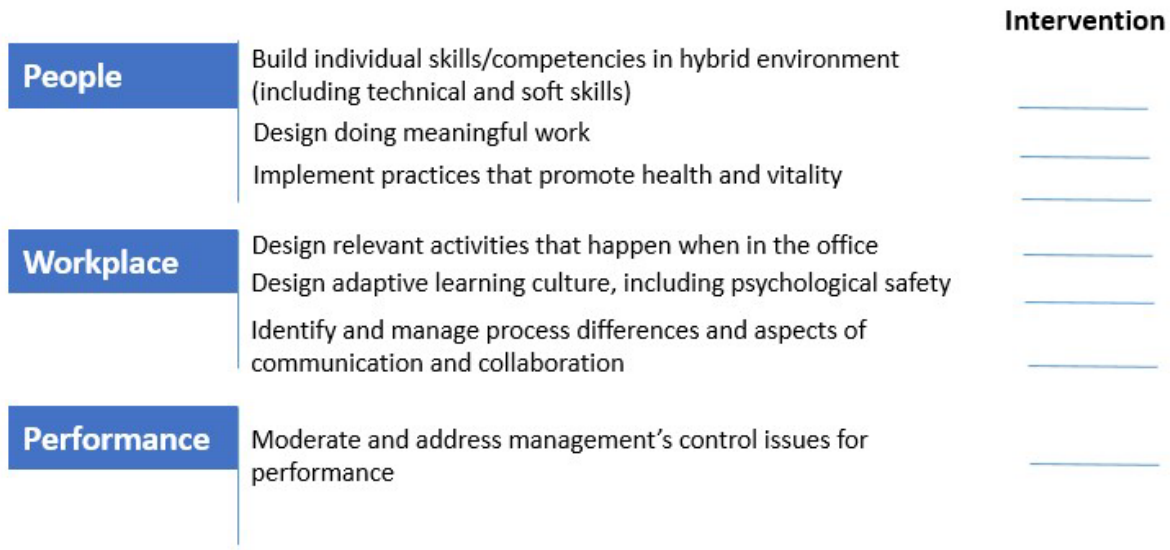


Figure 8: Change Management Tool: Human Centric intervention

These tools are to be tested and validated in the initiatives and projects ahead and assist in measuring how work changes over time.

References

Aguirre, D. and Baron, A. (2020) "Making Change Happen, and Making it Stick", Strategy + Business, [online], https://www.strategy-business.com/article/00057

Alberta Health Services, (2022) "About AHS", [online], https://www.albertahealthservices.ca/about/about.aspx

Alexander, A., Cracknell, R., De Smet, A., Langstaff, M., Mysore, M., and Ravid, D. (2021) "What Executives are Saying about the Future of Hybrid Work ", [online], What executives are saying about the future of hybrid work | McKinsey

Ashford, S.J. (2021) The Power of Flexing, HarperCollins. New York.

Brynjolfsson, E., Renshaw, A.A., and van Alstyne, M. (1997) "The Matrix of Change", MIT Sloan Management School

Cross, R. and Baron, P. (2021) "Optimizing Return-to-Office Strategies with Organizational Network Analysis", Strategy + Business, [online], https://sloanreview.mit.edu/article/optimizing-return-to-office-strategies-with-organizational-network-analysis

Crowe, S., Cresswell, K., Robertson, A., Avery, A., and Sheikh, A., (2011) "The Case Study Approach", BMC Medical Research Methodology, [online], The case study approach | BMC Medical Research Methodology | Full Text (biomedcentral.com)

Davey, L. (2022) "The Pros and Cons of Hybrid Teams", [online], https://www.lianedavey.com/the-pros-and-cons-of-hybrid-teams/

DDI. (2021, February) "Global Leadership Forecast 2021", [online], https://www.ddiworld.com/global-leadership-forecast-2021

Deer, M. (2022) "5 Tips for Knowledge Retention in a Digital World", [online], 5 Tips for Knowledge Retention in a Digital World - Training Industry

Edelman. (2021) "Edelman Trust Barometer 2021. Special Report: The Belief-Driven Employee", [online], https://www.edelman.com/trust/2021-trust-barometer

Edmondson, A.C. (2018) "The Fearless Organization: Creating Psychological Safety in a Workplace for Learning, Innovation, and Growth", Wiley, Hoboken, NJ.

Finn, P., Mysore, M., and Usher, O. (2021) "When Nothing is Normal: Managing in Extreme Uncertainty", McKinsey and Company, [online], https://www.mckinsey.com/business-functions/risk-and-resilience/our-insights/when-nothing-is-normal-managing-in-extreme-uncertainty

Grant, A. (2021) "Building a Culture of Learning at Work", Strategy + Business [online], https://www.strategy-business.com/article/Building-a-culture-of-learning-at-work

Hancock, B., Schaninger, B., and Weddle, B. (2021) "Culture in the Hybrid Workplace", McKinsey and Company [online], https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/culture-in-the-hybrid-workplace

Imperative. (2022) "The Imperative Workforce Purpose Index 2022" [online], https://uploads-ssl.webflow.com/5bae27a3939555a4ddb8d2ca/6233a375f23927913ba2ef1f_Imperative_Workforce%20Purpose%20Index%202022.pdf

Ishak, W. (2017) "Creating an Innovation Culture", McKinsey and Company [online], https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/creating-an-innovation-culture

Jacobs, R.W.J. (2021) "Leverage Change: 8 Ways to Achieve Faster, Easier, Better Results", Berrett-Koehler Publishers, Oakland, CA.

Klau, R. (2021) "Leading Change with a Culture of Experimentation", MIT SMR [online], https://sloanreview.mit.edu/article/leading-change-with-a-culture-of-experimentation/

Lazar, J.B., Greenblatt, E., and Robu, D. (2017) "Multiple Root Causes and Blended Solutions", Pre-conference workshop at ISPI EMEA Conference, Bologna, Italy.

Lital M., (2021), "How To Optimize Hybrid Work Models and Build High-Performing Teams", Forbes [online] How To Optimize For Hybrid Work Models And Build High-Performing Teams (forbes.com)

McKinsey & Company. (2022) "Growth & Innovation"[online], Growth & Innovation | Strategy & Corporate Finance | McKinsey & Company

Pistrui, J. and Dimov, D. (2018) "The Role of a Manager has to Change in 5 Key Ways", Harvard Business Review [online], https://hbr.org/2018/10/the-role-of-a-manager-has-to-change-in-5-key-ways

University of Alberta (Alberta School of Business), University of Calgary (Haskayne School of Business, Executive Education), and Alberta health Services (AHS). (2019) "AHS Achieves Results", Lecture – Executive Education Program

World Economic Forum. (2018) "The Future of Jobs Report", [online], WEF_Future_of_Jobs_2018.pdf (weforum.org)

Work in Progress Papers

Conceptualising the Role of the UAE Innovation Strategy in University-Industry knowledge Diffusion Process

Mousa Al-kfairy[1], Munir Majdalawieh[1] and Saed Alrabaee[2]
[1]Department of Information Systems, College of Technological Innovation, Zayed University, UAE
[2]Information System and Security, College of IT, United Arab Emirates University, Al Ain, UAE
mousa.al-kfairy@zu.ac.ae

Abstract: Universities are considered one of the primary sources of knowledge and an essential component of the triple helix theory. They fuel the industries with the required expertise and pool of resources to operate efficiently. Moreover, entrepreneurial universities successfully contributed to regional development and employment growth by supporting entrepreneurial activities and incubation programmes. Thus, university-industry collaboration is vital for enhancing knowledge-based industries' knowledge diffusion as well as the regional innovation atmospheres. On the other hand, countries and regional authorities strive to stimulate their regional development by encouraging innovation and entrepreneurship activities. For example, the UAE announced its 2015 innovation strategy that focused on seven industries: education, technology, renewable energy, transportation, education, health, water, and space. The strategy stressed the role of universities R & R&D, first-class research, and promoting incubation services as one of the country's main innovation enablers. Thus, universities, scholars and industry should concentrate on the identified sectors to achieve the strategic innovation goals. This work aims to conceptualise and test the relationship and collaboration between industry and universities in the UAE and the impact of the innovation strategy on this relationship. Therefore, we critically analyse literature on the university-industry relationship and connect it with the UAE innovation strategy that resulted in a conceptual university-industry relationship model where the innovation strategy and UAE government act as a moderator of this relationship. The initial results show that the conceptual model includes research and curriculum collaboration. Research collaboration includes joint research, research fund, commercialisation of the research output, while curriculum collaboration includes the programmes and courses updates and joint training programmes. The developed model is still in its early stage of development and requires further updates based on interviews with the HEIs researchers and the survey results.

Keywords: University-Industry, Knowledge Spillover, UAE Innovation Strategy, Innovation Management

1. Introduction

Governments and regional authorities strive to enhance regional innovation capabilities. Thus, many theories evolved to stimulate regional innovation and entrepreneurship. For example, business clusters and Science and Technology Parks (STPs) were identified as a key player in connecting main innovation players. Moreover, it has been proved that locating on-cluster will help firms produce more innovation and therefore has more employment and financial growth (Al-kfairy et al., 2017; 2018; 2019a, 2019b). One of the key components of regional innovation development (and STPs theory) is Higher Education Institution. The classical role of research institutes and universities has been changed since the theory of Silicon Valley. For example, Stanford University and Cambridge University have played a crucial role in regional economic development. They are a very integrated part of Silicon Valley and Cambridge business cluster (Moore et al., 2004) and the triple helix theory connecting industry, with HEI as well as the governments (Etzkowitz and Leydesdorff, 2000; Leydesdorff and Etzkowitz, 2003). The following summarises the role of HEI institutions in regional and innovation development.

First of all, universities should deliver the required knowledge into their surrounding regions. It is vital to building the right pool of skilled labour, which is considered a critical factor for any industry's success and growth, while labour shortage is a declining reason (Davis et al., 2006). Secondly, commercialisation/productization of research outputs/patents and make them available for the industry through what is called “universities spin-offs” or “knowledge spillover” (Smith and Bagchi-Sen, 2012). For example, Delgado et al. (2014) proved that patenting positively impacts overall regional economic development. Moreover, when companies start to license patents and products, this indicates a recognised product/company.

Research collaboration is another factor influencing the relationship between firms and universities, which is shaped by the type of targeted knowledge (“explorative” or “exploitive”). Explorative knowledge comes though research, which leads to more radical innovation (developing new idea), while exploitive knowledge is more

related to improve knowledge stock of firms. Firms may seek either type of knowledge through university-firm networking (Huggins et al., 2011).

Provide the needed training and consultation services for the start-ups and mature firms within the targeted industry. Moore et al. (2004) determined that many start-ups struggle to manage businesses, and many of the entrepreneurs have difficulties understanding business processes. Therefore, some universities have developed training programs which were very efficient in preparing the "new" business leaders. For example, Klofsten (2000) reported 80 new establishments all over Sweden, resulted from the development program designed at Linköping University. The programme was delivered at 7 different places in Sweden [see (Smith and Bagchi-Sen, 2012) for Oxford University entrepreneurial program, for recent reviews on the role of universities in business clusters see (Valero and Van Reenen, 2019) for general role of HEI on the overall economic development)].

Generally, universities are considered as one of the primary sources of knowledge benefiting firms. It is contribution to knowledge stocks is widely acknowledged. However, the amount of university impact depends on many factors. For example, close proximity is very important for regional firms benefiting from new universities. In contrast, old and prestigious universities may have a broader relationship exceeding the university's geographical boundaries (Huggins et al., 2012), which is emphasising the role of HEI as part of the triple helix theory.

The goal of this work in progress paper is to conceptualise the role of UAE national innovation strategy in shaping the collaboration between industry and academia in UAE. First, we will review the literature covering the HEI institution and industry collaboration, then, a summary of the UAE national innovation strategy will be presented, after that, the conceptual model of UAE HEI – industry collaboration will be discussed, final section concludes.

2. University – Industry Collaboration in UAE

The previous research on the U-I collaboration in UAE suggests a lack of cooperation between both parties. For example, Rowland-Jones (2016) concluded that among 25 UAE universities surveyed, only 10% of them are engaged in industry-funded research caused by a lack of cooperation between the triple-helix actors (Salem, 2017). This low collaboration between universities and local industries resulted in a low employment rate in the private sector, where Emarati fills only 5% of the private vacancies. However, 65% of the vacancies offered in the UAE are from private companies, increasing the dependency on expats (Xanthidis et al., 2020). Therefore, scholars identified several barriers preventing effective collaboration. Those barriers include relational and trust barriers, funding barriers, the usability of the results barriers, intellectual property (IP) policies, shared governance and scientific knowledge (Salem, 2017). As a result, universities tried to enhance the amount of collaboration by implementing Technology Transfer Offices (TTOs), innovation centres, collaboration labs and updating their curriculum to match with the industrial needs, increase university spin-offs and commercialisation of students' products (Iqbal et al., 2018).

Reviewing the literature analysing the University-Industry (U-I) collaboration in UAE reveals that few scholars tackle this research area and there is a lack of understanding the factors that may contribute into enhancing such a relation.

3. Review of UAE Innovation Strategy

UAE innovation strategy published in 2015 has defined three innovation pillars: innovation-enabling environment, innovation champions and priority sectors. The strategy has identified seven priority sectors: education, water, health, space, transportation, and renewable and clean energy. In order to stimulate the priority industries, the strategy stressed that they need to create the right innovative environment by updating the rules and regulations, especially the registration of the patent policies and procedures, encouraging high-quality education and incubators programmes, enhancing the current technology infrastructure and provide funding and incentives for innovative companies and personnel. The strategy stressed the need to promote social innovation, develop specialised zones for innovation sectors, and award innovative companies and institutions.

4. The Conceptual Role of Innovation Strategy in HEI- Industry Relationship in UAE

Figure 1 shows the conceptual model for the relationship between the HEI and Industry in UAE where the innovation strategy act as a moderator between the two main parties.

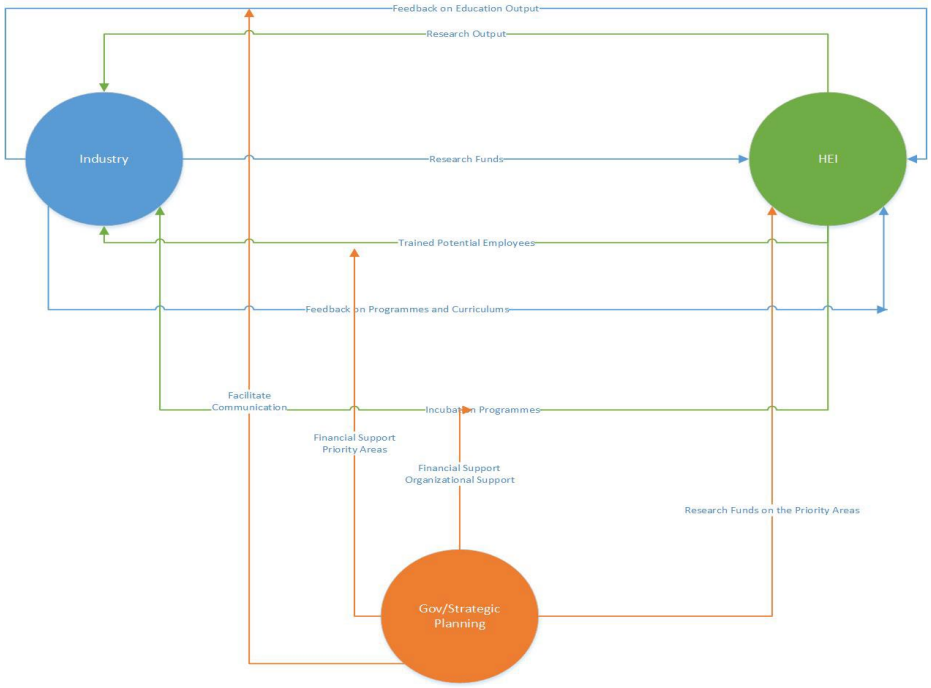


Figure 1: HEI- Industry Relationship (Innovation Strategy as a moderator)

The figure shows that there is a direct connection between industry and HEI. For example, industry is supposed to provide research funds, feedback on education output and programmes and curricula provided by the HEI, on the other hand, the HEI is assumed to collaborate on research output, well-trained employees and incubation programmes to help start-up companies. Based on the above model, we assume that the national innovation strategy impacts the incubation programmes provided by the HEI, training of the students on the right strategic sectors and the feedback on the educational programmes by concentrating more on the innovation sectors.

5. Conclusion

The work in progress paper presented here shows that there is a lack of understanding on how the U-I collaboration is shaped in UAE. However, our hypothesis is that this collaboration has been enhanced and further developed since the introduction of the innovation strategy. Thus, we built the conceptual model presented in Figure 1 to test the role of the innovation strategy in stimulating this collaboration. Next, we will collect data through surveys and interviews to validate the conceptual model and understand the drivers of the U-I collaboration in UAE. This work is still in progress and will go through a number of development phases.

References

Al-Kfairy, M., Khaddaj, S. and Mellor, R.B. (2017) 'Variables affecting high-tech cluster innovation: a statistical approach'. In 7th International Conference on Law, Business, Marketing and Corporate Social Responsibilities.[online] London: HEAIG. Available at: http://heaig. org/images/proceedings_pdf H (Vol. 12175121).

Al-Kfairy, M., Khaddaj, S. and Mellor, R. (2018) September. 'A longitudinal study of corporate benefits accrued by firms inhabiting a mature science park'. In European Conference on Knowledge Management (pp. 43-XV). Academic Conferences International Limited.

Al-Kfairy, M., Khaddaj, S. and Mellor, R.B. (2019a) 'Computer modelling and identification of factors important for the success of business clusters', International Journal of Knowledge-Based Development, Vol.10 No.4, pp.384-405.

Al-kfairy, M., Khaddaj, S. and Mellor, R.B. (2019b) 'Computer modelling reveals the optimal development for the organisational structure of business clusters', International Journal of Knowledge-Based Development, Vol.10 No.3, pp.249-275.

Davis, C.H., Arthurs, D., Cassidy, E., Wolfe, D. (2006) 'What indicators for cluster policies in the 21st century'. Proceedings of the Blue Sky .

Delgado, M., Porter, M.E., Stern, S. (2014) 'Clusters, convergence, and economic performance', Research Policy Vol.43, pp.1785-1799.

Huggins, R., Johnston, A. and Stride, C. (2012) 'Knowledge networks and universities: Locational and organisational aspects of knowledge transfer interactions'. Entrepreneurship & Regional Development, Vol.24 No.7-8, pp.475-502.

Huggins, R., Prokop, D., Johnston, A., Steffenson, R. and Clifton, N. (2011) 'Small firm-university knowledge networks: evidence from the UK and the US'. In Triple Helix IX Conference. Stanford University, California, pp. 11-14.

Iqbal, F., Hung, P.C., Wahid, F. and Mohammed, S.M.Q.A. (2018) 'A glance at research-driven university's technology transfer office in the UAE'. International Journal of Technology Management, Vpl.78 No.1-2, pp.70-87.

Klofsten, M. (2000) 'Training Entrepreneurship at Universities: A Swedish Case', Journal of European Industrial Training, Vol.24 No.6, pp. 337-44.

Leydesdorff, L., Etzkowitz, H. (2003) 'Can 'the public be considered as a fourth helix in university-industry-government relations? Report on the Fourth Triple Helix Conference, 2002', Science and Public Policy Vol.30, pp.55-61.

Moore, G., Davis, Kevin (2004) 'Learning the Silicon Valley Way', in Bresnaha, T., Gambardella, A. (Eds.), Building High-Tech Clusters: Silicon Valley and Beyond. Cambridge University Press, pp. 1-1-7.

Rowland-Jones, R. (2016) 'A triple helix approach to supporting Emitarisation, promoting research by moving from didactic to dialectic learning in the UAE', Procedia-Social and Behavioral Sciences Vol219, pp.381-386.

Salem, F. (2017) 'Triple Helix Model's (THM) impact on enhancing creativity and skills within UAE public and private sectors'.

Smith, H.L., Bagchi-Sen, S. (2012) 'The research university, entrepreneurship and regional development: Research propositions and current evidence', Entrepreneurship & Regional Development Vol.24, pp.383-404.

Valero, A. and Van Reenen, J. (2019) 'The economic impact of universities: Evidence from across the globe', Economics of Education Review, Vol.68, pp. 53-67.

Xanthidis, D., Manolas, C., Xanthidou, O.K. and Paul, S. (2020), March 'Triple Helix in Higher Education in the UAE: Current Standing and Research Directions', In 2020 IEEE International Systems Conference (SysCon) (pp. 1-6). IEEE.

The Effects of Knowledge Sharing on IT Risk management Performance

Neda Azizi[1], Bahareh Ghodoosi[2], Claire Davison[1], Omid Haass[3] and Shahrzad Saremi[1]
[1]Torrens University Australia, Melbourne, Australia
[2]School of Information and Communications Technology Griffith University Brisbane, Australia
[3]School of Property, Construction and Project Management, RMIT University, Melbourne, Australia
neda.azizi@torrens.edu.au; claire.davison@torrens.edu.au
shazi.saremi@torrens.edu.au.
bahareh.ghodoosi@griffithuni.edu.au
omid.haass@rmit.edu.au.

Abstract: The paper aims to develop a model for comprehensive implementation of IT risk management (ITRM) from risk-related knowledge of involved stakeholders. The literature review indicated a need to gain a greater understanding of the effectiveness ITRM process. This qualitative study adopts a subjectivist epistemology, complemented with an interpretive paradigm and inductive reasoning. The findings provide new insights in relation to ITRM implementation by considering knowledge sharing. The outcomes of this research are expected to benefit practitioners and researchers through exploring key factors that can facilitate stakeholders to share their knowledge from an IT project to another.

Keywords Knowledge Sharing, Risk Management, IS Implementation, Qualitative Research

1. Introduction

The effectiveness of ITRM is particularly important for organization (Ngwenyama et al. 2021). Organizations have increasingly adopted ITRM; however, there are many difficulties involved in implementing ITRM effectively (Azizi et al. 2019).

Ngwenyama et al. (2021) pointed out that the effectiveness of ITRM process implementation is commonly recognized as an organizational learning process, because organizations implementing ITRM not only need to acquire IT risk-related knowledge or experiences, but also require employees to internalize these lessons. During the learning process, one important knowledge issue refers to the gap between the acquisition of tacit IT risk-related knowledge and the use of the knowledge within an organization to mitigate IT risks.

According to Moser & Deichmann (2021), employees may repeat mistakes and perform rework in implementing processes because of their inability to apply and tailor the obtained knowledge. Despite the significance of the ITRM knowledge gap, however, few studies have investigated the measures that organizations can adopt to resolve it (Pearce 2019). In the context of the effectiveness of ITRM process implementation, KS helps organizations target and absorb tacit IT risk-related knowledge, and deploy this knowledge in their processes, routines, and operations (Pearce 2019).

This study will propose a conceptual framework that attempts to link KS, the effectiveness of ITRM implementation. This perspective regards humans as active agents and their behaviour as generally indeterminate. A series of four case studies will be designed around 20 semi-structured in-depth interviews to investigate how and why IT managers and their IT teams implemented ITRM. The theory generated from the empirical findings will suggest that the intentions and actions of IT department's members, the processes they enact, as well as the organisational context into which they are implemented, critically influence ITRM implementation.

2. Literature Review

2.1 IT Risk Management (ITRM)

The ITRM process consists from is a structured, systematic and reoccurring process which can facilitate organisations for handling information on uncertainties in results of technological, cognitive and sociological aspects of information technology and thereby informs decision-making (Jean-Jules & Vicente 2021; Ngwenyama et al. 2021). Jean-Jules & Vicente (2021) pointed out that the evolution of ITRM to the holistic view

of effective ITRM requires the destruction of barriers between organizational silos and the exchange and application of knowledge from different ITRM areas. The main difference between ITRM and effective ITRM is in the enterprise strategic view of risk analysis for the whole organization as opposed to RM's "silo view".

Naeve et al. (2008) pointed out that organizations that lack effective learning processes will experience the knowledge gap, influencing their abilities to acquire and utilize IT risk-related knowledge, thus hindering the effectiveness of ITRM, i.e. achieving and sustaining the ITRM. Despite the significance of the ITRM knowledge gap, however, few studies have investigated the measures that organizations can adopt to resolve it. In this research, we develop a research focusing on organizations learning processes to fill the knowledge gap and eventually achieve the effectiveness of ITRM process. It is argued that without more emphasis on the dynamic nature of the implementation process, an incomplete understanding of the problem will result.

2.2 The Concept of Knowledge Sharing (KS)

KS defines as "the act of placing knowledge possessed by an individual at the disposition of others within the organization" (Suppiah & Singh Sandhu, 2011), it has identified as a key factor in innovation by directly influencing product innovation, radical innovation (Alavi, et al., 2006; Azizi et al. 2019) and innovation capability. KS has been recognised a major challenge in the field of knowledge management (Nonaka & Takeuchi, 1995). The main problem of KS resides in the transfer of knowledge from one department to another.

The researcher such as Kucharska (2021) investigated effective factors on KS can be divided into three main groups: individual, organizational, and technological. At an individual level, effective factors on KS are mostly associated to elements such as lack of trust, and lack of communication skills, at an organisational level, these factors can be considered as lack of organisational culture (OC), lack of resources, at a technology level, these factors seem to correlate with factors such as lack of training, lack of alignment IT systems and processes KS and so on.

According to De Moraes et al., (2022), it is impossible that an organisation manages its risks effectively without managing its knowledge. A project failure can be the result of lack of knowledge between the project team, lack of KS during project progress, capturing the appropriate knowledge at an inappropriate time of the project (Haass & Azizi, 2020; Özkan et al. 2021). Actually, without KS as a facilitator to communicate risks among people of a project team, RM might suffer from ineffectiveness and inefficiencies. Hence, most authors recognized how well integrated KS and ERM are vital to improve IT projects executions.

2.3 Factors Influencing the Effectiveness of RM

This category of success factors of ITRM is related to the people who are involved (their interpretations), influence on, or are influenced (their needs and motivation) by the RM. Thus, success factors in this categorisation is based on interpretation and values and beliefs of organisations' members. Considering participation, social network, communication, knowledge sharing, trust between individual and experience levels can be identified as key success factors (Haass & Azizi, 2019; Öbrand et al. 2019).

The most frequent subcategory of success factors in this group is culture including the dimensions of the organisations in which RM is performed such as values and believes, motivating to encourage more effective collaboration, and flexibility (Sha et al., 2020). Azizi & Rowlands (2020) pointed out the importance of OC in which values and expectations for sharing of experiences to mitigate risks, need to be developed widely and effectively throughout the organisation. However, OC plays a key role in the RM framework. There are needs to have a constant and continuous communication on values and on processes that can enhance sharing of experiences and early identification of risks (Azizi & Rowlands, 2019).

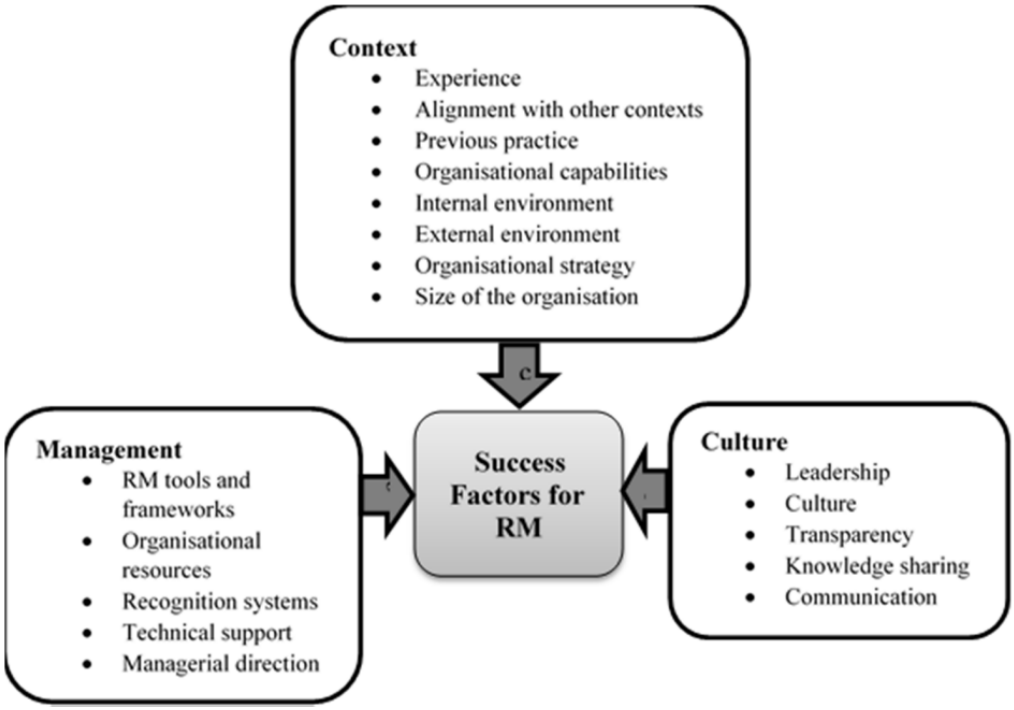


Figure 1: Categories and Subcategories of Success Factors for RM Success

3. A Conceptual Model of a Successful Implementation of ITRM

This research will develop a model for assistance in understanding implementation of ITRM, and considers a number of different aspects of context that are likely to be involved in the implementation. From the socio-technical perspective, it seems reasonable to explore the concept of ITRM schemes requires some understanding of IT people per se and perhaps some interpretation of the assumed link between human and non-human resources.

This research presents the factors that are posited to be linked to the implementation process and their conceptual and/or empirical support in the literature. These success factors were initially categorised in 3 categories. Figure 1 illustrates the categories and subcategories of factors. The problem of how these factors intertwine over time and influence an implementation outcome – the process – remains unknown.

Based on the findings of literature review and in line with our research a conceptual model will be constructed by grouping the various contextual issues into three distinct, but interrelated categories. However, what is missing from this model is a description of the dynamics of how these factors interact over time. This study will argue that researchers have not adequately examined the implementation issues involved in individual own perceptions and a specific type of IT artefact (ITRM); that is, the dynamic set of contextual elements interacting with one another over time leading to a successful implementation.

4. Research Method

This research proposes a two-stage research design (see Figure 1). In Step 1, we have identified from prior literature, a relationship between KS and ITRM success. We interpreted the three success factors to link them to KS and cultural values underlying ITRM as shown in Figure 1. At this step, it is argued that a KS culture is indeed needed and must be integrated effectively with IT-RM to ensure correct execution. In Step 2, this research will employ a qualitative study within a paradigm helping the researcher to explore data from selected documents. The statistical population of the research is the employees present in a scientific research organization. This study adopts a subjectivist epistemology, complemented with an interpretive paradigm and inductive reasoning.

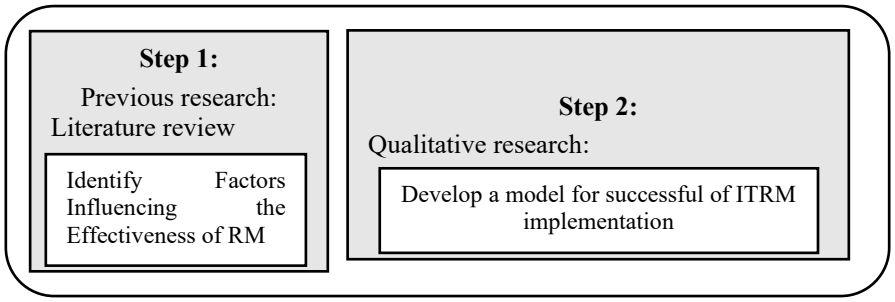


Figure 2: Research Method

5. Conclusion and Overview of Next Phase of Research

The KM and ITRM concepts increase the employees' and working teams' productivity, communications, cooperation and assistances among people, encourages team collaboration, reduces the ratio of errors, enhances employees' participation and engagement in organizational issues. ITRM significantly helps IT managers achieve this objective by encouraging people to do beyond what is determined as their job description.

This paper is a research-in-progress focusing on understanding the relationships between KM and ITRM as well as proposing an appropriate method to analyze the collected data. Our exploratory research will develop a success model and address a lack of a theoretical research to steer empirical studies that can contribute to the domain of management field. This research includes a two-step research design that was introduced in Figure 2.

References

Alavi, M., Kayworth, T.R. and Leidner, D.E. (2006), "An empirical examination of the influence of organizational culture on knowledge management practices", Journal of Management Information Systems, Vol. 22 No. 3, pp. 191-224.

Azizi, N., Miah, S. J., & Masmali, F. H. (2019). Development of an Innovative Framework for IT Risk Management. In 2019 IEEE Asia-Pacific Conference on Computer Science and Data Engineering (CSDE) (pp. 1-4). IEEE.

Azizi, N., & Rowlands, B. (2020). Developing an IT Risk Management Culture Framework. In ICT for an Inclusive World (pp. 483-491). Springer, Cham.

Azizi, N., & Rowlands, B. (2019). Developing the concept of Individual IT Culture and its Impact on IT Risk Management Implementation. In 30th Australasian Conference on Information Systems, Perth.

Azizi, N., Rowlands, B., & Miah, S. J. (2019). IT Risk Management Implementation as Socio-Technical Change: A Process Approach. In 30th Australasian Conference on Information Systems (pp. 505-515). ACIS.

De Moraes Cordeiro, M., Oliveira, M., & Sanchez-Segura, M. I. (2022). The influence of the knowledge management processes on results in basic education schools. Journal of Knowledge Management.

Haass, O., & Azizi, N. (2020). Challenges and solutions across project life cycle: a knowledge sharing perspective. International Journal of Project Organisation and Management, 12(4), 346-379.

Haass, O., & Azizi, N. (2019). Knowledge sharing practice in project-oriented organisations: a practical framework based on project life cycle and project management body of knowledge. International Journal of Project Organisation and Management, 11(2), 171-197.

Jean-Jules, J., & Vicente, R. (2021). Rethinking the implementation of enterprise risk management as a socio-technical challenge. Journal of Risk Research, 24(2), 247-266.

Kucharska, W. (2021). Do mistakes acceptance foster innovation? Polish and US cross-country study of tacit knowledge sharing in IT. Journal of Knowledge Management.

Moser, C., & Deichmann, D. (2021). Knowledge sharing in two cultures: the moderating effect of national culture on perceived knowledge quality in online communities. European Journal of Information Systems, 30(6), 623-641.

Naeve, A., Sicilia, M. A., & Lytras, M. D. (2008). Learning Processes and processing learning: from organizational needs to learning designs. Journal of Knowledge Management.

Ngwenyama, O., Henriksen, H. Z., & Hardt, D. (2021). Public management challenges in the digital risk society: A critical analysis of the public debate on implementation of the Danish NemID. European Journal of Information Systems, 1-19.

Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford university press.

Öbrand, L., Augustsson, N. P., Mathiassen, L., & Holmström, J. (2019). The interstitiality of IT risk: An inquiry into information systems development practices. Information Systems Journal, 29(1), 97-118.

Özkan, E., Azizi, N., & Haass, O. (2021). Leveraging Smart Contract in Project Procurement through DLT to Gain Sustainable Competitive Advantages. Sustainability, 13(23), 13380.

Pearce, G. (2019). The Sheer Gravity of Underestimating Culture as an IT Governance Risk. ISACA Journal, 3, 1-8.

Sha, X., Chen, J. E., & Teoh, S. Y. (2020). The dynamics of IT-business strategic alignment: evidence from healthcare information systems implementation. Information Technology & People, 33(5), 1465-1488.

Suppiah, V., & Singh Sandhu, M. (2011). Organisational culture's influence on tacit knowledge-sharing behaviour. Journal of knowledge management, 15(3), 462-477.

Key Types of Crowdsourcing in Science: Systematic Literature Review

Regina Lenart-Gansiniec
Jagiellonian University in Krakow, Krakow, Poland
regina.lenart-gansiniec@uj.edu.pl

Abstract: Recent changes in information systems technology, combined with the postulates of open access to information, are causing the processes of knowledge production and dissemination to change. The necessity of the democratization of science, scientific openness, social orientation of science and the involvement of stakeholders from outside the scientific community in conducting research becomes a necessity for researchers. This is also in line with the guidelines of the European Commission's Community Research and Development Information Service, according to which academics are expected to change the ways of creating knowledge, be oriented towards solving social problems or transgress traditional disciplinary boundaries. Crowdsourcing in science is a collaborative online process through which scientists involve a group of self-selected individuals of varying, diverse knowledge and skills, via an open call to the Internet and/or online platforms, to undertake a specified research task or set of tasks. While research efforts to date have focused on the benefits of crowdsourcing in science, its typology has yet to mature. Typologies are important in describing complex, multidisciplinary organizational forms such as crowdsourcing in science. The main purpose of this article is to identify and provide a typology of crowdsourcing in science. Based on the thematic analysis of publications collected in a systematic manner and focused group interviews, 12 types of crowdsourcing in science are identified. The proposed crowdsourcing in science typology matrix may be a starting point for future research and decision-making by practitioners regarding the choice of a specific type of crowdsourcing in science.

Keywords: crowdsourcing in science, typology, academics, academic crowdsourcing, thematic analysis

1. Introduction

Crowdsourcing in science is part of the knowledge economy. Crowdsourcing in science is a collaborative online process through which scientists involve a group of self-selected individuals of varying, diverse knowledge and skills, via an open call to the Internet and/or online platforms, to undertake a specified research task or set of tasks. The basis of crowdsourcing in science is not only collaboration with a large number of people, but also the access to external knowledge, engagement in knowledge creation, and knowledge sharing between scientist and crowd.

Previous publications in the field of crowdsourcing in science concerned the identification of its significance for science, society (Law et al. 2017), the functionality of crowdsourcing platforms (Schlagwein & Daneshgar 2014), as well as the threats, limitations and barriers of crowdsourcing in science, ways of motivating the virtual community, characteristics of the virtual community participating in research projects (Franzoni & Sauermann 2014). The main purpose of this article is to identify and provide a typology of crowdsourcing in science. We define typologies as organized systems of types that break down overarching concepts into component dimensions and types. On the other hand, type as an analytic category that may be (but is not necessarily) situated in and defined by a typology. We also provide an extensive literature review aimed at determining the attributes of individual types of crowdsourcing in science in business disciplines. This is important because previous research on crowdsourcing in science was conducted from the perspective of biology, medicine, physics, geography, anthropology, scientific information and engineering (Lukyanenko et al. 2019). To identify types and develop the crowdsourcing in science typology, we relied on Kluge's (2000) guidelines on empirically grounded typology construction in social research.

2. Methodology

Our research aims at identifying and providing a typology of crowdsourcing in science. We provide a comprehensive overview and determination of the attributes of the types of crowdsourcing in science in business disciplines. We followed the typology guidelines (Kluge 2000), which include the following steps: (1) developing the relevant analysing dimensions, (2) extracting and grouping types, (3) exploring crowdsourcing "ideal types", and (4) representing typology.

First, we conducted a systematic review of the literature to rigorously identify the typology of crowdsourcing in science. Its choice is supported by the fact that it is a helpful method to assess the state of knowledge and it

provides reliable results, from which conclusions can be drawn and decisions made as to further research directions. The literature on the subject was selected on the basis of foreign scientific databases, such as Scopus and Web of Science.

Only English-language articles published in the years 2006-2022 (until 1 February 2022) were analysed, where the starting date is related to the first publication devoted to crowdsourcing. Due to the fact that researchers use different terminology when referring to crowdsourcing in science (Tauginienė et al. 2020), the following filtering criteria included in titles, abstracts or keywords of the publication, synonymous equivalents and related terms in relation to crowdsourcing in science, were applied: "crowdsourced science", "crowdsourcing science", "crowd science", "crowd research", "scientific crowdsourcing", "science 2.0", "crowdsourcing in the science", "crowdsourcing for research", "crowdsourcing for science", "academic crowdsourcing". We included articles in the analysis that contained: the definition of crowdsourcing in science, various dimensions or features, and a description of types or uses. We then performed backwards iteration (Webster & Watson 2002) to collect a relatively complete set of relevant literature. In this way, we selected 56 publications in total. Dimensions that were identified through a systematic literature review were subject to their content analysis.

Focus group interviews were conducted in May-June 2021. In line with the recommendations, we interviewed people who were most helpful in achieving the research goal. Particular attention was paid to heterogeneity. It took into account the balance of gender, age, position, field and discipline represented. In total, nine focus group discussions with 36 researchers were conducted, including: 25 women, 11 men (8 assistants, 10 assistant professors, 10 university professors, 10 titular professors) in the following fields: social sciences, medical sciences and health sciences, humanities, agricultural sciences, natural sciences, engineering and technical sciences.

In step 2, for extraction and grouping of types, we distinguished the "ideal types" (Doty & Glick 1994) from the many different crowdsourcing activities or initiatives that we identified through the literature review and focus research. For extraction and grouping of types, we used the most commonly used dimensions of crowdsourcing, by Estelle-Arolas and Gonzalez-Ladron-de-Guevara (2012), such as: crowd (who does what and what receives in return), initiator (who and what receives in return from the crowd) and the process (type of process, type of call, and medium used). In Stage 3, exploration of crowdsourcing "ideal types", we have described the emerging "ideal types" or key categories and highlighted their particularities. Finally, we presented the crowdsourcing in science typology using a typology matrix in which we took into account the dimensions of crowdsourcing in science like crowd (nature of crowd collaboration) and process (task characteristics).

3. Results

3.1 Step 1. Development of the relevant analysing dimensions

Crowdsourcing in science is a heterogeneous concept (Karachiwalla & Pinkow 2021), which determines the various perceptions of its dimensions. Despite the growing interest of researchers in the issues of crowdsourcing in science, there is only one attempt in the literature to distinguish the dimensions of crowdsourcing in science, while other researchers used the dimensions assigned to crowdsourcing. With regard to crowdsourcing in science, Keating and Furberg (2013) distinguished the following five dimensions: research goal (formulating a goal before starting a crowdsourcing initiative), crowd (the specificity of a virtual community participating in a crowdsourcing initiative and defining the task that will be given to this community), engagement mechanism (designing engagement mechanisms, strengthening the motivation of members of the virtual community to join and perform the task), platforms (a platform supporting crowdsourcing activities and providing a forum for communication and exchange of values with members of the virtual community). However, as Keating and Furberg (2013) themselves claim, their dimension proposal is based on the success factors of a crowdsourcing in science initiative and recommendations for using crowdsourcing methods to support research. Additionally, the above proposal of the components of crowdsourcing in science was not appreciated by other researchers. In order to capture and identify the dimensions of crowdsourcing in science, we analysed the publications obtained as part of a systematic literature review, and for this purpose we conducted a thematic analysis. This allowed for identifying the following three dimensions of crowdsourcing in science along with their *differentia specifica*: crowd, initiator, and process.

3.2 Step 2. Extraction and grouping of types

In the second, we noticed that other researchers often used related concepts, which makes it difficult to distinguish different types of crowdsourcing in science. The above is not made easier by the polymorphic nature of crowdsourcing (Kietzmann 2016). Moreover, individual types of crowdsourcing in science rarely exist in pure form and overlap with the benefits and tasks that are transferred by the initiator to members of the virtual community (Uhlmann et al., 2019). Our thematic analysis of systematically collected literature identified 49 different types of crowdsourcing in science grouped according to four criteria: types of assets, types of tasks, types of results and the degree of inclusiveness. Using the identified types on the basis of a literature review and focus research, we proceeded to distinguish "ideal types".

3.3 Step 3. Exploration of crowdsourcing "ideal types"

In the third stage, the twelve "ideal types" distinguished were analysed taking into account the results obtained from the scientific literature review, grey literature, results of focus research and crowdsourcing initiatives dedicated to researchers. Additionally, in order to establish the final typology, three stages of the scientific research process (conceptual, empirical, and documentation stage), the support aspect of the research process (Keatinga & Furberg 2013) and three dimensions of crowdsourcing in science (crowd, initiator, and process) were taken into account. The first criterion focuses on this conceptual stage, which includes conceptualization, explication, and operationalization. This stage includes the following types of crowdsourcing in science: crowd ideation, crowd assembling resources, crowd literature review, crowd research question, crowd creation.

3.4 Step 4: Typology representation

To determine the typology representation, we took into account the dimensions of crowdsourcing in science. After Estelle-Arolas and Gonzalez-Ladrdon-de-Guevara (2012), the identified types of crowdsourcing in science differ in the degree of difficulty of tasks directed to the crowd and the degree of crowd involvement and cooperation. Crowd tasks range from simple to complex and creative (Durward et al. 2020). With regard to simple tasks, these are usually works that do not require close cooperation of many people, but the involvement of individuals, which does not involve a huge amount of work and time on the part of crowd members. Simple tasks require little cognitive load from the crowd. The crowd may be involved in complex tasks where there is a need for knowledge-based activities.

4. Discussion and Conclusion

Our research broadens the knowledge of the types of crowdsourcing in science. We extend the existing findings (Uhlmann et al. 2019) and contribute to the crowdsourcing in science theory by providing a typology. Literature on type of crowdsourcing in science is scattered and the number of crowdsourcing in science initiatives that appear means that not all of them are covered by naming conventions. Our literature analysis showed 49 different types of crowdsourcing in science grouped according to four criteria: types of assets, types of tasks, types of results and the degree of inclusiveness. On the other hand, focus research allowed us to organize the identified types within the framework of the literature review. This allowed for the emergence of three additional, complementary types of crowdsourcing in science: monitoring, sharing content and communicating with other researchers. We eliminated the types not indicated by our interlocutors. Ultimately, we identified twelve types of crowdsourcing in science: crowd ideation, crowd assembling resources, crowd literature review, crowd research question, crowd creation, crowd science, crowd data collection, crowd data analysis, crowd review, crowd writing, crowd decision, and crowd networking.

Our findings provide some practical tips on the type of crowdsourcing in science. Firstly, the proposed crowdsourcing in science typology matrix may be a starting point for future research in the field of making decisions by practitioners regarding the choice of a specific type of crowdsourcing in science. It can also facilitate the analysis of crowdsourcing in science profiles, providing scientists with a more robust protocol to evaluate, compare and report their types. Secondly, irrespective of the type, initiators of crowdsourcing in science should clearly define the nature of crowd collaboration and task characteristics. It is indicated that crowdsourcing in science initiators can direct simple or creative tasks to the crowd, while the nature of collaboration with the crowd may be integrative or selective.

This study has several limitations. To identify the type of crowdsourcing in science, we conducted a literature review on crowdsourcing in science based on two electronic databases, Scopus and Web of Science. We included full-text English-language peer-reviewed publications in our review, which may have resulted in some articles being omitted. To prevent the risk of missing publications, we additionally conducted focus group interviews.

Another limitation of the study is related to the fact that crowdsourcing in science involves new initiatives that are evolving rapidly, which means that some types may have been omitted and not included in our proposal. Therefore, future research may focus on identifying new crowdsourcing in science initiatives such as open science, crowd research, and responsible research and innovation. The current research can also be expanded to include crowd motivation mechanisms, which may contribute to the provision of new types of crowdsourcing in science.

Acknowledgments

This project was financed from the funds provided by the National Science Centre, Poland awarded on the basis of decision number DEC-2019/35/B/HS4/01446.

References

Doty, Harold, D. and & Glick, William, H. (1994) "Typologies As A Unique Form Of Theory Building: Toward Improved Understanding And Modeling", Academy of Management Review, Vol. 19, No. 2, pp. 230-251.

Durward, David., Blohm, Ivo, & Leimeister, Jan Marco (2020) "The Nature Of Crowd Work And Its Effects On Individuals' Work Perception", Journal of Management Information Systems, Vol. 37, No. 1, pp. 66-95.

Estellés-Arolas, Enrique and González-Ladrón-de-Guevara, Fernando (2012). "Towards An Integrated Crowdsourcing Definition", Journal of Information Science, Vol. 38, No. 2, pp. 189-200.

Franzoni, Chiara and Sauermann, Henry (2014) "Crowd science: The Organization of Scientific Research in Open Collaborative Projects", Research Policy, Vol. 43, No. 1, pp. 1-20.

Karachiwalla, Rea and Pinkow, Felix (2021) "Understanding Crowdsourcing Projects: A Review On The Key Design Elements of A Crowdsourcing Initiative", Creativity and Innovation Management, Vol. 30, No. 3, pp. 563-584.

Keating, M., Rhodes, B. and Richards, A. (2013) Crowdsourcing: A Flexible Method For Innovation, Data Collection, And Analysis In Social Science Research, In: Social Media, Sociality, and Survey Research, Craig A. Hill, Elizabeth Dean, and Joe Murphy (ed.), John Wiley & Sons, New Jersey.

Kidwell, Mallory C., Lai, Calvin K.. McCarthy, Randy J., Riegelman, Amy, Silberzahn, Raphael (2019) "Scientific utopia III: Crowdsourcing science", Perspectives on Psychological Science, Vol. 14, No. (5), pp. 711-733.

Kietzmann, Jan H. (2017). "Crowdsourcing: A revised definition and introduction to new research", Business Horizons, Vol. 60, No. 2, pp.151-153.

Uhlmann, Eric Luis, Ebersole, Charles R., Chartier, Christopher R., Errington, Timothy M.,

Kluge, Sussan (2000) "Empirically grounded construction of types and typologies in qualitative social research", Forum: Qualitative social research, Vol. 1, No. 1.

Law, E., Gajos, K. Z., Wiggins, A., Gray, M. L. and Williams, A. (2017) "Crowdsourcing as a Tool for Research: Implications of Uncertainty'", Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing, Portland, Oregon, USA.

Lukyanenko, Roman, Parsons, Jeffrey, Wiersma, Yolanda F. and Maddah, Mahed (2019) "Expecting the unexpected: effects of data collection design choices on the quality of crowdsourced user-generated content", MIS Quarterly, Vol. 43, No. 2, pp. 623–648.

Schlagwein, D., and Farhad, D. (2014) "User Requirements of a Crowdsourcing Platform for researchers: Findings from a Series of Focus Groups", PACIS.

Tauginienė, Loreta, Butkevičienė, Eglė., Vohland, Katrin, Heinisch, Barbara, Daskolia, Maria, Suškevičs, Monika, Portela, Manuel, Balázs, Bálint and Prūse, Baiba (2020) "Citizen science in the social sciences and humanities: the power of interdisciplinarity", Palgrave Communications, Vol. 6, No. 1, pp. 1-7.

Webster, Jane and Watson, Richard (2002) "Analyzing the Past to Prepare for the Future: Writing a Literature Review", MIS Quarterly, Vol. 26, No. 2, pp. 13-23.

Disruption, Disruptors and Disruptiveness of Scholarly Communication: An Actor-Network Theory Approach

Alina Praun[1], Anna Cunningham[1] and Martina Pieperhoff[2]
[1]Disruption and Societal Change Center (TUDiSC), Technische Universität Dresden, Germany
[2]Faculty of Business and Economics, Technische Universität Dresden, Germany
alina.praun@tu-dresden.de
anna.cunningham@mailbox.tu-dresden.de
martina.pieperhoff@tu-dresden.de

Abstract: The rise of Open Access, the increasing pace of scientific work, the serial crisis and the need for interdisciplinary research are just some examples of the current disruptions of traditional scholarly communication. As publishing is a significant practice for distributing scientific knowledge and therefor for academic knowledge management, an understanding of the current disruptions in the field is necessary for the future development and maintenance of the system. The paper presents a conceptualization of disruptions drawing from Latour's Actor-Network-Theory with reference to current understandings of disruption. The aim of the research is the identification and mapping of current disruptions, their disruptors and the disruptiveness in scholarly communication in the field of economic and social sciences by analyzing scientific editorials. Therefore, a short overview about previous analyses of scientific editorials is presented. For the sampling of editorials, a systematic literature search was conducted using Web of Science, followed by an application and comparison of Text Mining operations using R. Afterwards an in-depth investigation of the disruptors as source of disruption and disruptiveness as potential of disruption will be following using qualitative content analysis. The insights of this research will be helpful for anticipating and overcoming the current disruptions as well as for identifying and dealing with future disruptions in the field.

Keywords: scholarly communication, actor-network theory, text mining, disruption

1. Introduction

Publication of research is a crucial process for knowledge dissemination and exchange in the global research community and therefore for academic knowledge management. Through developments like Open Science and Access or the serial crisis scholarly communication had and has to constantly modify its business model (Marple, 2018), leading to changes e.g. for authors, reviewers and editors. Therefore, it is evident, that scholarly communication is confronted with "large-scale disruptions" (Barbour, 2019, p. 151).

The aim of the work-in-progress is to investigate, by analyzing scientific editorials, which disruptions can be identified in the scholarly communication of economics and social sciences, what their origins are, and what potential of disruption they provide. For doing so, a conceptualization of disruptions is provided drawing from Latour's Actor-Network-Theory (ANT).

In the ANT, a network consists of a web of relations among different actors, whereby an actor is everything that acts or gets activity by others (Callon and Latour, 1981). Following Latour (1996), ANT uses properties of nets and adds an actor undertaking some work, leading to a redefinition of spatial metaphors (far – close, local – global, inside – outside, small – large), which are substituted by the metaphor of connections that exist or not. Regarding disruptions, two common approaches are referred to: Disruptive innovations describe a specific type of innovation entering a market, thereby causing leading companies to fail as they are not predictable by standard management methods (Christensen, 2001). Societal disruptions are events that affect society as a whole (Camillus et al., 2020) by changing the way society lives together, disturbing the function of everyday processes, thereby negatively impacting infrastructure and markets (Schrijvers, Prins and Passchier, 2021).

Following neutral terms of ANT (Latour, 2005) disruption refers to a radical disturbance or irritation, which necessitates an adaptation in reactive adjustment or transformation processes to maintain the actor-network. A disruptor refers to the actor(s) causing the disruption by possessing a specific potential of disruption, called disruptiveness.

2. Scientific editorials as database

For answering the research question, scientific editorials are used as an expression of expert views about the current developments and changes in scholarly communication. Considering the small amount of research using

scientific editorials as data basis (del Árbol, 2005), it can be assumed that they are underrepresented in research. Although, most research is limited to scientific articles, some researchers have made use of editorial analysis, since editorials have DOIs and are citable sources (Waaijer, van Bochove and van Eck, 2011). Heterogenous methods can be identified in relation to editorials in research, which range from bibliometric mapping (Waaijer, van Bochove and van Eck, 2011) over sensitivity analysis combined with clustering (Waaijer, 2013) to interpretive analysis (Miller et al. 2006).

3. Method

This work adopts a mixed-method approach, which combines quantitative text mining (TM) with in-depth qualitative content analysis of editorials. The research process is shown in Figure 1.

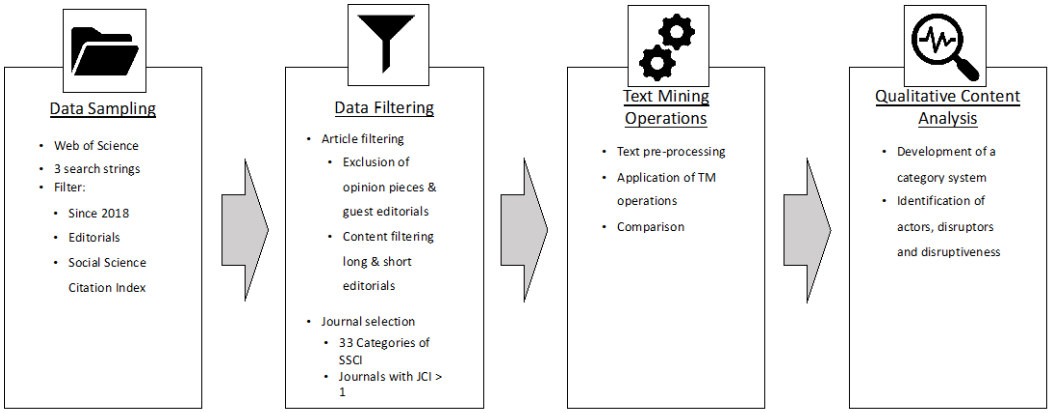


Figure 1: Research Process

3.1 Sampling strategy

For sampling editorials in the field of economics and social sciences, a systematic literature search was conducted in Web of Science using the Social Science Citation Index (SSCI) and combining three search strings. A field narrowing seems reasonable due to different disciplinary publication practices. For article selection, the results were filtered regarding their document type to exclude guest editorials and opinion paper. Additionally, the shortest and longest editorials were content reviewed to reduce dimensionality. On Journal Level 33 categories of the SSCI were included. A further selection based on the Journal Citation Index > 1 was conducted to only include Journals with an at least average impact in their field. Resulting in a final sample of 367 editorials.

3.2 Text mining operations

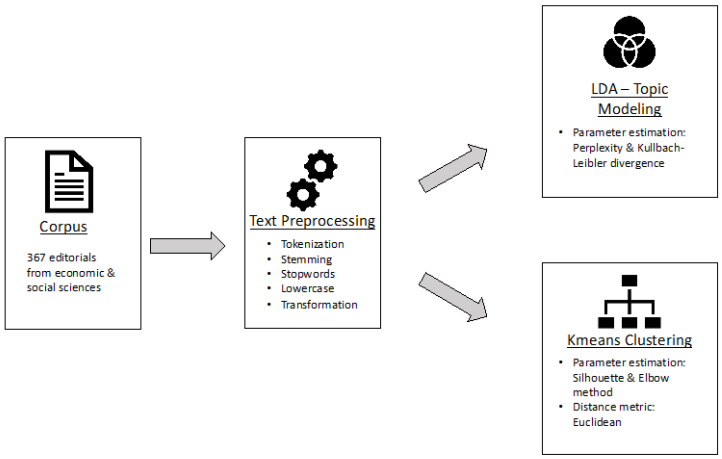


Figure 2: Text Mining Process

The purpose of TM is to extract information or patterns from a big amount of unstructured textual data (Grimmer and Stewart, 2013). Two unsupervised methods are used and compared, and their applicability to scientific editorials is examined. The TM process is visualized in Figure 2 and was conducted using the Quanteda

(Benoit et al., 2018) and topicmodels package for R. In text preprocessing, the data is prepared to reduce the dimensionality and transformed into a document term matrix. For topic modeling the Latent Dirichlet Allocation (LDA) a probabilistic topic model that sees documents as a mixture of topics is used (Blei, Ng and Jordan, 2003). A topic is thereby modeled by the co-occurrence of words (Grimmer and Stewart, 2013). Perplexity and Kullbach-Leibler divergence were calculated to estimate the number of topics, resulting in an optimum between 20 and 21.

For Clustering, the K-means algorithm was used, resulting in a single-membership approach. A Cluster is generated by identifying document subsets that minimizes the squared Euclidean distance within them (Grimmer and Stewart, 2013). The silhouette and elbow methods were used to determine the optimal number of centroids, leading to the optimum of 2. Prospectively, TM results will be compared and validated by a qualitative content analysis.

4. Preliminary results

In this work-in-progress the results of K-means Clustering and LDA topic model with a k of 20 are presented.

4.1 K-means clustering

The K-means clustering results can be seen in Figure 3, which shows that the clusters are not distinct but cluster 1 is in cluster 2. Also, increasing the number of k does not lead to distinct clusters. Therefore, the paper focuses on topic modeling results.

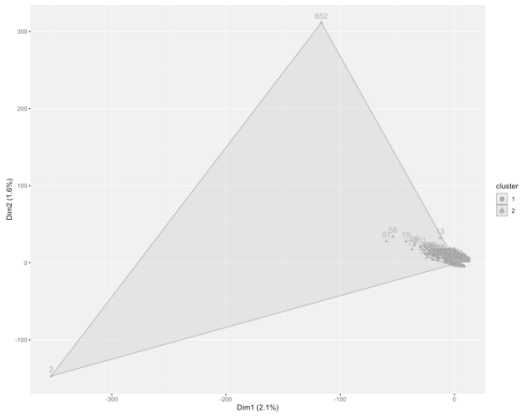


Figure 3: K-means cluster plot (k=2)

4.2 LDA topic modeling

Based on the top words per LDA topic, visualized in Figure 4, a cautious description of the editorials is possible. Broadly three groups can be identified:

The first category refers to general publication issues, concerning all scientific disciplines. Publication formats like theoretical contributions (T11), research studies (T14) and methodological issues (T16) are part of editorials. In the context of the ongoing debate on quality assurance in science, the review process (T18) as well as publishing ethics (T19) are addressed. Furthermore, new questions arising in science like Open Science and Access (T8) and data research and transparency (T15).

The second group of topics includes discipline-specific questions of particular research fields e.g., educational research (T7) or spatial economics (T12). These topics are probably currently discussed objectives in the respective discipline.

The third group of topics covers societal issues and developments that enter scientific or disciplinary debates. The rise of communication technology and media (T13) affects the scientific publication system as well as the Covid-19-pandemic (T2). Women and gender issues (T17) or politics and state security (T10) are also addressed.

Furthermore, the topics seem to have different temporal dimensions: Some topics concern events with transformational character and other can be brought in association with ongoing debates or processes like the gender balance.

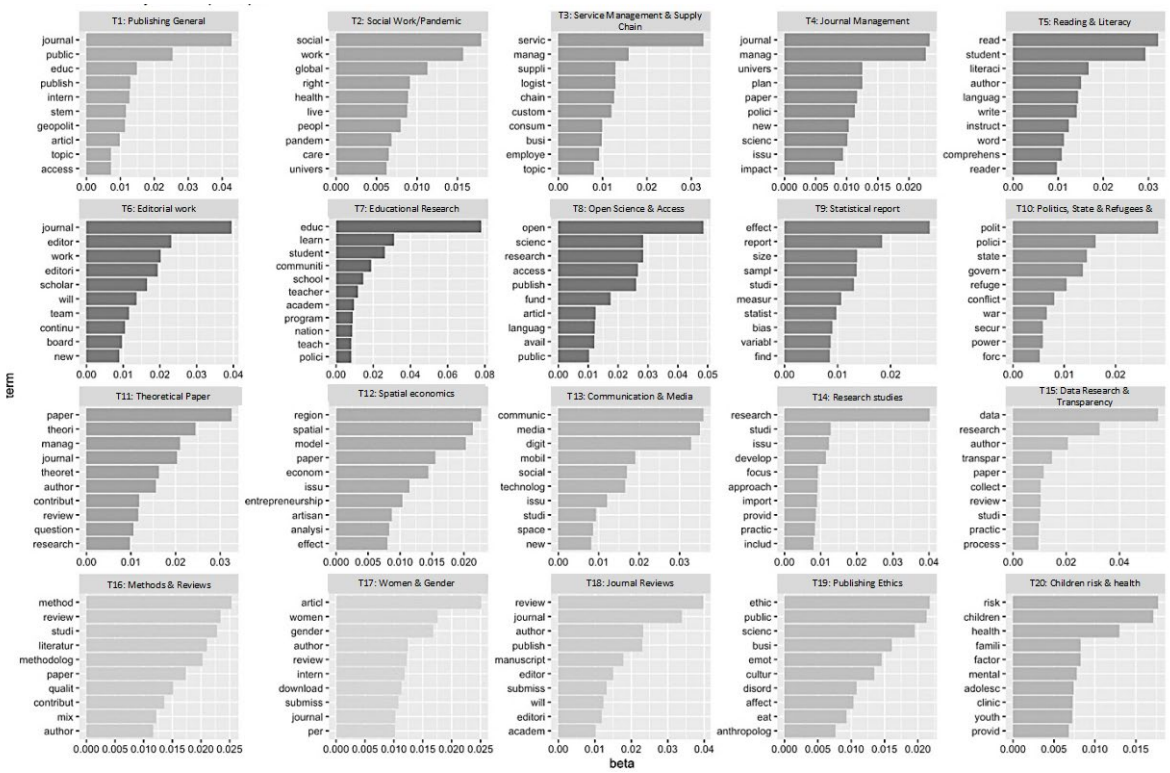


Figure 4: Probability of Top Terms per LDA-Topic

5. Discussion and implications

The analysis of editorials provides insights into future research developments. Relating the results with disruptions, some general publishing themes are referred as disruptions in the literature like Open Access and Science (Barbour, 2019), which changes the model of access and business (Allahar, 2017), the pandemic that accelerates scientific pace (Preiser and Preiser, 2020), or the rise of data science (Lagoze et al., 2015). The disruptions described in the literature could be shown to occur as statistical topics in the editorials, but no information can be provided yet about the editors' perceptions and attitudes. Also, the disruptive character still has to be made explicit and topics have . to be further validated. With an in-depth analysis, it will be explicated which disruptions are apparent and by whom and how disruptions are triggered. Methodologically, TM and the use of editorials is a novel approach to gain insights into the scientific system. Additionally, it allows the analysis of a large amount of data, which, after validation, has an impact on the informative value of the results. Nevertheless, it could also be shown that not all TM applications are equally suitable.

Acknowledgement

“Disrupt!Research” is part of the Excellence measure "Disruption and Societal Change" at TU Dresden (TUDiSC) and is funded by the Federal Ministry of Education and Research (BMBF) and the Freestate of Saxony within the Excellence Stategy of the German Federal and State Governments.

References

Allahar, H. (2017) “Academic Publishing, Internet Technology, and Disruptive Innovation,” *Technology Innovation Management Review*, 7(11), pp. 47–56. doi:10.22215/timreview/1120.

del Árbol, E.V. (2005) “A genre-based study of biomedicaleditorials and letters to the editor: a contrastive analysis,” *Íbérica*, 10, pp. 145–160. Available at: http://www.aelfe.org/documents/09-Ib10-Vazquez.pdf.

Barbour, V. (2019) “The future of academic publishing: disruption, opportunity and a new ecosystem,” *Medical Journal of Australia*, 211(4), pp. 151-152.e1. doi:10.5694/mja2.50265.

Benoit, K. *et al.* (2018) “quanteda: An R package for the quantitative analysis of textual data,” *Journal of Open Source Software*, 3(30), p. 774. doi:10.21105/joss.00774.

Blei, D.M., Ng, A.Y. and Jordan, M.I. (2003) “Latent Dirichlet Allocation,” *Journal of Machine Learning Research*, 3, pp. 993–1022. Available at: https://www.jmlr.org/papers/volume3/blei03a/blei03a.pdf?ref=https://githubhelp.com.

Callon, M. and Latour, B. (1981) "Unscrewing the big Leviathan: how actors macro-structure reality and how sociologists help them to do so," in Knorr, K. and Cicourel, A. (eds) *Advances in Social Theory and Methodology*. London: Routledge, pp. 277–303. doi:10.4324/9781315763880.

Camillus, J.C. *et al.* (2020) "Strategies for transcending the chaos of societal disruptions," *Vilakshan - XIMB Journal of Management*, 17(1/2), pp. 5–14. doi:10.1108/xjm-07-2020-0052.

Christensen, C.M. (2001) *The Innovator's Dilemma*. 1st edition. Boston: HighBridge.

Grimmer, J. and Stewart, B.M. (2013) "Text as data: The promise and pitfalls of automatic content analysis methods for political texts," *Political Analysis*, 21(3), pp. 267–297. doi:10.1093/pan/mps028.

Lagoze, C. *et al.* (2015) "Should I Stay or Should I Go? Alternative Infrastructures in Scholarly Publishing," *International Journal of Communication*, 9, pp. 1052–1071. Available at: https://ijoc.org/index.php/ijoc/article/view/2929/1354.

Latour, B. (1996) "On actor-network theory: A few clarifications," *Soziale Welt*, 47(4), pp. 369–381. Available at: http://www.jstor.org/stable/40878163.

Latour, B. (2005) *Reassembling the social an introduction to actor-network-theory*. 1. publ., *Clarendon lectures in management studies*. 1. publ. Oxford: Oxford University Press. Available at: https://ebookcentral.proquest.com/lib/slub/detail.action?docID=422646.

Marple, H. (2018) "Parasite, Pirate and Robin Hood: Sci-Hub is Disrupting the World of Academic Publishing," *The iJournal*, 3(2). Available at: https://theijournal.ca/index.php/ijournal/article/view/29480.

Preiser, W. and Preiser, R. (2020) "Academic publishing in pandemic times," *South African Journal of Science*. Academy of Science of South Africa, pp. 6–7. doi:10.17159/sajs.2020/8803.

Schrijvers, E., Prins, C. and Passchier, R. (2021) *Preparing for Digital Disruption*. Cham: Springer. doi:10.1007/978-3-030-77838-5.

Waaijer, C.J.F. (2013) "Careers in science: Policy issues according to Nature and Science editorials," *Scientometrics*, 96(2), pp. 485–495. doi:10.1007/s11192-013-0958-z.

Waaijer, C.J.F., van Bochove, C.A. and van Eck, N.J. (2011) "On the map: Nature and Science editorials," *Scientometrics*. Kluwer Academic Publishers, pp. 99–112. doi:10.1007/s11192-010-0205-9.

How to Facilitate Knowledge Ambidexterity with the Use of Enterprise Social Media

Gerald Stei[1], Levente Szász[1] and Alexander Rossmann[2]
[1]Babes-Bolyai University, Cluj-Napoca, Romania
[2]Reutlingen University, Reutlingen, Germany
Gerald.Stei@econ.ubbcluj.ro
Levente.Szasz@econ.ubbcluj.ro
Alexander.Rossmann@reutlingen-university.de

Abstract: Organizations that operate under uncertainty need to cultivate their ability to manage their primary resource, knowledge, accordingly. Under such conditions, organizations are required to harvest knowledge from two sources: to explore knowledge that is to be found outside the organization as well as exploit knowledge that is contained within. In a knowledge management context these exploitation and exploration activities have been conceptualized as knowledge ambidexterity. While ambidexterity has been studied extensively in contexts as manufacturing or IT, the notion of knowledge ambidexterity remains scarce in current knowledge management research. This study illustrates knowledge ambidexterity and elaborates its positive impact on organizational performance. Our study furthermore answers the question of how the use of enterprise social media (ESM) can facilitate the performance effects of knowledge ambidexterity. Drawing on the theory of communication visibility, we argue that ESM (e.g., Microsoft Teams, Slack, etc.) allow employees to communicate unhindered while making these communications visible. This allows for capturing tacit knowledge within these communications - this form of knowledge is generally hard to codify and can be a source of competitive edge. With respect to knowledge ambidexterity, ESM use can capture tacit knowledge aspects originating from inside and outside the organization, which fosters the development of a competitive advantage and, thus, supports its positive effect on organizational performance. This paper contributes to IT-enabled ambidexterity research in two aspects: (1) It sheds light on knowledge ambidexterity and, thereby, addresses a major practical challenge for knowledge-intensive organizations, and (2) it elaborates on the effects that ESM use can have on the relationship between knowledge ambidexterity and organizational performance. This work-in-progress paper offers a better understanding of the phenomenon of ambidexterity in a knowledge context, while providing insights on the facilitating role of ESM. Our research serves as a foundation for future empirical examinations of the concept of knowledge ambidexterity.

Keywords: Knowledge Ambidexterity, Knowledge Management, Enterprise Social Media

1. Introduction

A considerable part of modern organizations faces increasingly uncertain conditions. Under such environmental conditions, organizational learning plays a crucial role for the prosperity of organizations: they need to conduct continuous learning activities to sense an seize opportunities in their environment (Zhou et al. 2019). Prior research has stated that under uncertainty organizations need to specifically pursue two sometimes conflicting learning activities at once: exploit existing knowledge and explore new knowledge (Geerts et al. 2010, North and Kumta 2018). These observations led to the shaping of the concept of ambidexterity. While all organizations need to cope with the tension these conflicting learning activities pose on them, they become increasingly important with rising degrees of knowledge-intensity (Junni et al. 2013) and provide a major challenge for knowledge-intensive organizations. However, only a few conceptualizations of the knowledge ambidexterity are available. The question arises of how organizational knowledge ambidexterity activities can be supported (e.g., Veeravalli and Vijayalakshmi 2019). One important aspect refers to the use of IT platforms. Prior research has coined the term IT-enabled knowledge ambidexterity and found a positive impact of IT infrastructure on organizational (innovation) performance (Benitez et al. 2018). However, there are some open questions about the role of specific IT platforms for knowledge management in the context of knowledge ambidexterity.

Given the relevance of knowledge as an organizational resource, it seems clear that organizations need to pursue appropriate knowledge management activities. Traditionally, organizations have been relying on knowledge management systems to manage organizational knowledge. However, recently one category of communication platform has gained increased relevance in the context of knowledge management, the so-called enterprise social media (ESM) (Veeravalli and Vijayalakshmi 2019). These platforms promise a variety of advantages over traditional knowledge management systems and, for this study, seem worth a closer look. To the best of our knowledge, no study has examined the role of ESM in the context of knowledge ambidexterity. Therefore, we

aim to gain a better understanding of how ESM can support knowledge ambidexterity activities. This study answers the following question: *What role does ESM use play in facilitating knowledge ambidexterity?*

To shed light on this topic, a causal research design seems appropriate. First, we develop a research model. Second, we plan to test our model against empirical data to determine if our hypotheses hold true. This work-in-progress paper describes the first step. It briefly describes the central concepts (ambidexterity as well as ESM use). It furthermore describes the research model development. Finally, concluding remarks are provided.

2. Knowledge Ambidexterity

With respect to organizational learning, March (1991, p. 71) described two central mechanisms: "the relation between the exploration of new possibilities and the exploitation of old certainties". This led to the coining of the concept of ambidexterity: The pursuing of both, sometimes conflicting activities does provide a challenge to organizations. Ambidexterity in general can be understood as the organizational capability to simultaneously pursue fundamentally different actions (Tushman and O'Reilly 1996). In addition to organizational learning, this organizational capability has been examined in a variety of contexts: technological innovation, organizational adaptation, strategic management, and organization design (Raisch and Birkinshaw 2008). Prior research have linked ambidexterity with increased organizational performance (e.g., O'Reilly and Tushman 2013, Kafetzopoulos 2021).

In an IT-context, the concept of ambidexterity has been examined as well. Lee et al. 2015 have examined the impact of IT ambidexterity on organizational agility. IT ambidexterity can be understood as "the ability of firms to simultaneously explore new IT resources and practices (IT exploration) as well as exploit their current IT resources and practices (IT exploitation) (Lee et al. 2015, p. 398). However, examinations of organizational IT platforms for knowledge management an ambidexterity context remain scarce.

Recently, ambidexterity has been coined specifically in a knowledge context, i.e., knowledge ambidexterity (e.g., Vrontis et al. 2017). Knowledge ambidexterity represents a "firm's ability to use a well-balanced combination of exploration and exploitation of organizational knowledge for operational purposes" (Benitez et al. 2018, p. 9).

With respect to knowledge management, ambidexterity refers to knowledge exploitation and exploration activities as well. As both activities can be described as conflicting and they mean a certain tension for the organization (Im and Rai 2008). O'Reilly and Tushman (2013) describe three approaches that organizations can follow to cope with this tension: (1) sequential ambidexterity (sequential adaptation of structures and processes to meet environmental conditions), (2) structural ambidexterity (separate organizational units to carry out exploration and exploitation activities simultaneously), and (3) contextual ambidexterity (individuals' decisions on how to split their time between exploration and exploitation activities). There is an ongoing debate about whether exploitation and exploration activities need to be balanced (balanced approach) or maximized individually (combined approach) (Junni et al. 2013).

3. Enterprise Social Media Use

ESM can be characterized as IT platforms that are used for knowledge management within enterprises (Sun et al. 2019). ESM can be used in two ways: (1) For external communication with parties like customers, suppliers, or the public in general and (2) for the communication among employees. For this study we focus on the second mode, the internal communication. Following Leonardi et al. (2013, p. 2), we define ESM as "Web-based platforms that allow workers to (1) communicate messages with specific coworkers or broadcast messages to everyone in the organization; (2) explicitly indicate or implicitly reveal particular coworkers as communication partners; (3) post, edit, and sort text and files linked to themselves or others; and (4) view the messages, connections, text, and files communicated, posted, edited and sorted by anyone else in the organization at any time of their choosing". ESM offer employees communication functions as chatting, videoconferencing, (micro-)blogging, or virtual project rooms. They allow for the creation of user generated content and allow for a seamless information sharing across geographical and hierarchical distances (Laitinen and Sivunen 2021). Well-established ESM are Slack or Microsoft Teams.

With respect to knowledge management, the use of ESM promises a variety of advantages over traditional knowledge management systems (Mukkamala and Razmerita 2014). While the later typically require users to codify their knowledge and store this knowledge for later use, ESM capture knowledge that is contained within

the conversations of employees. By storing employee conversations and making them accessible to further employees, they allow for a dissemination of knowledge within the organization.

To understand the nature of communication in ESM, we draw on the theory of communication visibility from Leonardi (2014). This theory argues that it is the visibility of employee communication to third parties that creates positive effects for the organizations. In particular, the communication visibility leads to an improvement of metaknowledge: Who knows who and who knows what. This metaknowledge can help create more innovative products, which may increase competitiveness as well as performance.

4. Development of a Research Model

An ambidextrous organization is capable of leveraging existing competencies within as well as exploring new opportunities in the environment. The use of these capabilities can be expected to enhance organizational competitiveness and, finally, its performance (Vrontis et al. 2017). This positive impact has been shown by a number of studies (O'Reilly and Tushman 2013). We hypothesize that knowledge ambidexterity impacts positively on organizational performance (H_1).

ESM allow for an easy communication and collaboration among employees. We draw on the theory of communication visibility by Leonardi (2014) and argue that ESM use makes employee conversations about exploration and exploitation activities visible. It helps spreading this knowledge across organizations and enables a free information flow between employees. With respect to knowledge management, ESM can capture tacit knowledge – a major challenge for traditional knowledge management systems. This tacit knowledge has been described as a major asset for organizations as it is typically hard to grasp and cannot be easily imitated by competitors. It can be understood as a central component for gaining a competitive edge over rivals (Eisenhardt and Santos 2000). We expect ESM use to positively moderate the relationship between knowledge ambidexterity and organizational performance (H_2).

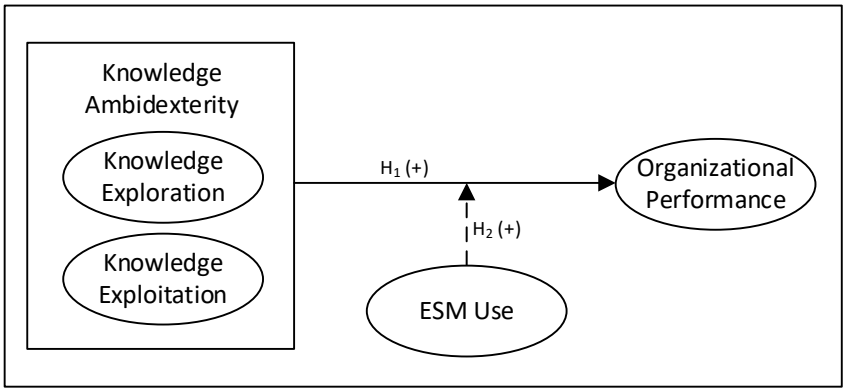


Figure 1: Research model

Figure 1 depicts our research model. Knowledge ambidexterity is our exogenous variable, conceptualized as a higher-order variable that comprises two lower-order variables: Knowledge exploration and knowledge exploitation. We link knowledge ambidexterity to organizational performance. ESM use serves as a moderating variable. We expect that with higher degrees of ESM use, the positive effect of knowledge ambidexterity on organizational performance will rise.

5. Concluding Remarks

This work in progress contributes to research on IT-enabled knowledge ambidexterity by examining the moderating role of ESM use. We explain how ESM can support the positive effects of knowledge ambidexterity on organizational performance. We explain this effect with the capturing of tacit knowledge. This is a theoretical contribution to the research stream of knowledge ambidexterity.

This work in progress study can serve as foundation for further examinations. In particular, empirical examinations are required to determine if our considerations hold true against real world data. We plan to conduct quantitative studies to examine the concept of organizational ambidexterity. Data from different organization may lead to fruitful insights to advance knowledge in this field.

One open question refers to the measurement model of knowledge ambidexterity. Ambidexterity has typically been measured with items in the exploration and exploitation dimensions. However, there is some doubts about how the interaction of these dimensions should be operated. One shortcoming of traditional ambidexterity measures is that they typically regard exploitation and exploration as two independent variables. We argue that this does not represent the tension that ambidextrous organizations need to cope with. Other papers have proposed different mathematical operations to capture the interaction between both ambidexterity dimensions. However, it remains unclear whether these measurement models capture the nature of ambidexterity. As the next step we plan to analyze different measurement models for ambidexterity and, if needed, will engage in the development of a new knowledge ambidexterity measurement model.

A fruitful way for further research could be in the question of what further constructs mediate the relationship between knowledge ambidexterity and organizational performance. Dynamic capabilities may play a major role in this regard. Future studies could examine different constructs in detail. One organizational variable that seems worth considering is organizational agility. Prior research has reported positive effect of ambidexterity on organizational agility (Lee et al. 2015).

Our research also reveals some insights relevant for practitioners. This study can help to understand the positive performance-related effects of ESM use. While ESM use generally has soared during the Covid-19 pandemic, organizations still need to understand how to leverage their positive effects. This study, therefore, can help organizations determine what organizational effects ESM use has and how the potential of these platforms can be leveraged.

References

Benitez, Jose; Castillo, Ana; Llorens, Javier; Braojos, Jessica (2018): IT-enabled knowledge ambidexterity and innovation performance in small U.S. firms: The moderator role of social media capability. In *Information & Management* 55 (1), pp. 1–44.

Eisenhardt, Kathleen M.; Santos, Filipe M. (2000): Knowledge-Based View: A New Theory of Strategy? In *Handbook of Strategy and Management*, pp. 1–55.

Geerts, Annelies; Blindenbach-Driessen, Floortje; Gemmel, Paul (2010): Achieving a Balance Between Exploration and Exploitation in Service Firms: A Longitudinal Study. In *Academy of Management Proceedings* 2010 (1), pp. 1–6.

Im, Ghiyoung; Rai, Arun (2008): Knowledge Sharing Ambidexterity in Long-Term Interorganizational Relationships. In *Management Science* 54 (7), pp. 1281–1296.

Junni, Paulina; Sarala, Riikka M.; Taras, Vas; Tarba, Shlomo Y. (2013): Organizational ambidexterity and performance: A meta-analysis. In *Academy of Management Perspectives* 27 (4), pp. 299–312.

Kafetzopoulos, Dimitrios (2021): Organizational ambidexterity: antecedents, performance and environmental uncertainty. In *Business Process Management Journal* 27 (3), pp. 922–940.

Laitinen, Kaisa; Sivunen, Anu (2021): Enablers of and constraints on employees' information sharing on enterprise social media. In *ITP* 34 (2), pp. 642–665.

Lee, One-Ki; Sambamurthy, Vallabh; Lim, Kai H.; Wei, Kwok Kee (2015): How Does IT Ambidexterity Impact Organizational Agility? In *Information Systems Research* 26 (2), pp. 398–417.

Leonardi, Paul M. (2014): Social Media, Knowledge Sharing, and Innovation: Toward a Theory of Communication Visibility. In *Information Systems Research (ISR)* 25 (4), pp. 1–40.

Leonardi, Paul M.; Huysman, Marleen; Steinfield, Charles W. (2013): Enterprise Social Media: Definition, History, and Prospects for the Study of Social Technologies in Organizations. In *Journal of Computer-Mediated Communication (JCMC)* 19, pp. 1–19.

March, James G. (1991): Exploration and Exploitation in Organizational Learning. In *Organization Science* 2 (1), pp. 71–87.

Mukkamala, Alivelu Manga; Razmerita, Liana (2014): Which Factors Influence the Adoption of Social Software? An Exploratory Study of Indian Information Technology Consultancy Firms. In *Journal of Global Information Technology Management* 17 (3), pp. 188–212.

North, Klaus; Kumta, Gita (2018): Knowledge Management. Cham: Springer International Publishing.

O'Reilly, Charles A.; Tushman, Michael L. (2013): Organizational Ambidexterity: Past, Present, and Future. In *Academy of Management Perspectives* 27 (4), pp. 324–338.

Raisch, Sebastian; Birkinshaw, Julian (2008): Organizational Ambidexterity: Antecedents, Outcomes, and Moderators. In *Journal of Management* 34 (3), pp. 375–409.

Sun, Yuan; Zhou, Xinjie; Jeyaraj, Anand; Shang, Rong-An; Hu, Feng (2019): The Impact of Enterprise Social Media Platforms on Knowledge Sharing. In *Journal of Enterprise Information Management* 32 (2), pp. 233–250.

Tushman, Michael L.; O'Reilly, Charles A. (1996): Ambidextrous Organizations. In *California Management Review* 38 (4), pp. 8–30.

Veeravalli, Suchitra; Vijayalakshmi, V. (2019): A Morphological Review of Enterprise Social Media Literature. In *Journal of Organizational Computing and Electronic Commerce* 29 (2), pp. 139–162.

Vrontis, Demetris; Thrassou, Alkis; Santoro, Gabriele; Papa, Armando (2017): Ambidexterity, external knowledge and performance in knowledge-intensive firms. In *The Journal of Technology Transfer* 42 (2), pp. 374–388.

Zhou, Jing; Mavondo, Felix T.; Saunders, Stephen Graham (2019): The Relationship between Marketing Agility and Financial Performance under different Levels of Market Turbulence. In *Industrial Marketing Management* 83, pp. 31–41.

The Ethics of Classifying the World: From Library Catalogues to AI

Clare Thornley[1], Marta Bustillo[2] and Christoph Schmidt Supprian[3]
[1]Clarity Research, Ireland.
[2]University College Dublin, Ireland.
[3]Trinity College Dublin, Ireland.
cthornley@clarityresearch.eu
marta.bustillo@ucd.ie
schmidc@tcd.ie

Abstract: This paper reports on an initial exploration of knowledge classification ethics: What are the important ethical issues in how we classify knowledge and what kind of cognitive, cultural and social impacts may they have? An important part of Knowledge Management is the classification and organisation of knowledge to make it findable and reveal connections in related subjects. Discussion on the ethical aspects of this issue have recently been brought to the fore in both Library and Information Studies (LIS), in terms of objections to Library classification terms, and also in AI which can classify data using data sets which themselves reflect existing injustices and bias. The ethical implications of both types of knowledge classification can be better understood when the classification ethics debate in LIS and AI are used to inform each other. Findings include that AI provides clarity on measuring adverse outcomes whilst LIS provides nuance on the potential cultural and psychological harm of inappropriate terminology and inaccurate positioning within 'worlds of knowledge'.

Keywords: Artificial Intelligence, ethics; Library and Information Studies, classification systems, terminology

1. Introduction

The inspiration for this paper is many years of discussion and teaching on the topic of cultural bias in Library Classification systems, such as the Dewey Decimal System and the Library of Congress Subject Headings. Recently this debate has extended to concerns about bias in Artificial Intelligence (AI) systems and the ethical impacts of how we classify knowledge has received wider attention. Classification is a core part of KM (Alavi and Leidner, 2001) and thus ethical issues in classification influence KM. Classification is the act of identifying the subject of information items and then assigning them to class (category) of similar items. This then places the item within a structured (usually hierarchical) system. This immediately raises questions of how 'representative' the subject headings and their structure are of the knowledge 'in the world' and who or what may be missed out, misrepresented or marginalised. A system or a data set are biased if they are not an accurate representation (sample) of what (population) they are supposed to represent. Representation is , by its nature, incomplete and imperfect but it is deemed biased if it is systematically inaccurate, particularly when it generally disfavours certain groups. Are these systems 'biased' in terms of favouring certain subjects and people and inaccurately representing others? Is the system therefore 'unfair'? The definition of bias and , in more depth 'fairness' , is discussed in some depth in AI (Mehrabi *et al.*, 2022) We argue that understanding this issue requires both an historical and future focused perspective. It needs to combine a practical focus on negative impact with respect for the seemingly more subtle harm of mis-labelling groups of people or historical events. The current debate on bias in AI does not , as yet, acknowledge and learn from previous related work in the Library and Information Studies field and *vice versa*. The potential of AI to frame problems in ways which can marginalise currently does not include cultural /spiritual harm but rather focuses on function/resources whilst the debate in Library Classification rarely offers direct evidence of material harm. Both literatures often fail to engage with the structural inequalities which created the bias they decry. The aim of this paper is to make some initial observations on how the two areas of debate and research could inform each other and improve understanding of this increasingly vital topic.

The structure of the paper is as follows. Firstly, we define the key concept of classification and its role in representing and ordering the world with a focus on the library perspective. We then describe its connection to Artificial Intelligence which is also used to categorise the world. Finally we analyse the major themes in the literature concerning bias and ethic and conclude with suggestions for further research.

1.1 What is classification?

Classification is both a thing , a classification system e.g. the Dewey Decimal System, and an activity (someone or some algorithm places items in certain categories within the system), and a set of rules or guidelines which guide either people or algorithms on the logic and methods of deciding what goes where. It also is by its nature

historical , it organised items that are published or available, but its focus is future orientated, people look for information to inform future actions.

'While cataloguing provides information on the physical and topical nature of the book (or other item), classification, through assignment of a call number (consisting of class designation and author representation), locates the item in its library setting and, ideally, in the realm of knowledge. Arranging similar things in some order according to some principle unites and controls information from various sources.'('library classification | library science |', 2013)

The question of bias in classification systems is complex. As classification systems are created and used by humans they cannot be completely 'objective 'but it is possible to make them more fit for purpose and to minimise the harm caused by inaccuracies and omissions. Classification is one method of organising ,structuring and describing the world. As such, like any method of describing , it both reflects a particular human perspective on the world and can also reinforce or undermine particular perspectives. Its purpose is mainly to enable information to be found and understood. Thus it has very real impact on research and society as it can control who finds what information and thus have a corresponding effect on their actions. Recently , for example , there has been growing awareness that the male body has been used as a model in car safety tests with the spurious assumption that this would be equally valid for women (Criado Perez, 2019). In that case a category is mis-labelled 'human' whereas in fact its content is only 'men' , this failure of accuracy causes harm.

A topic which is much discussed in the Library and Information literature is the more subtle effect of bias through its claims to represent the world and 'framing' subjects or problems in certain ways. If it excludes certain groups of people or areas of knowledge , or puts them in very small categories, or puts them in categories which are felt as inappropriate or just false (e.g. placing ethnic groups under 'history') by the people concerned it can cause harm (Moulaison Sandy and Bossaller, 2017). There is also an interest in anthropology and philosophy in terms of how the structure of language reflects the lives of the people who speak it. The title of Lakoff's book on the theory of language (Lakoff, 1987) 'Women Fire and Dangerous things' is a reference to the Aboriginal Australian Dyirbal language, in which (as interpreted by Western anthropologists) the "feminine" category includes nouns for women, water, fire, violence, and certain animals. Hence the creation and use of classification systems , both in terms of their structure and how they 'label' categories, can both reflect, influence and reinforce how we perceive ourselves and others. When this is combined with the unequal power structures and relationship between different groups of people it has the potential to further 'other' and marginalise those who are already socially and politically excluded.

1.2 What is AI?

AI has no universally agreed definition and many attempts note that we do not fully understand intelligence in humans so defining it accurately for machines is problematic. A useful definition, by the EU High-Level Expert Group on Artificial Intelligence, is given below (2018).

'Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals.
AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications).'

AI is concerned with classification in that one of its uses is to place data items into categories based on their characteristics and then also to 'make decisions' about what should be done with the data subjects based on an algorithm. Unlike library classification AI is often 'bottom up' classification without necessarily a pre-existing set of categories. Large data sets are analysed to 'detect' useful patterns which can 'be found' in the data. These can then be used to inform or predict future events e.g.

Which candidates should we shortlist for interview?
What kind of youth is most likely to pull a concealed weapon?

The issue of bias in AI is usually one of the data sets which are used to 'train' the system The data set may not be representative of the actual population it will inform decisions about. Data sets can also reflect accurate but unjust distribution of characteristics (e.g. more white men are senior managers, more young black men tend to

get arrested for violent crime). A problem with AI is that it often uses **descriptive** analysis to provide **normative** analysis. In these examples , for instance , it cannot judge that this distribution of outcomes is influenced by the sexist and racist assumptions (whether conscious or not) of the decision makers involved. So women are classified as 'type of person that **should not** get senior level job' because they have been 'accurately' classified as type of person who **at present does not** tend to get a senior level job.

Both AI and Library Classification systems can have a spurious aura of natural objectivity. AI can also amplify and extend its false assumptions and/or deductions in ways which are not transparent (Ali *et al.*, 2019). Additionally, as AI use spreads, it increasingly has many users who are not experts in the relevant technology and mathematics, which can make it harder to spot bias (Srinivasan and Chander, 2021).

2. Methods

2.1 Data collection

An initial literature review covering ethics and bias in Library and Information Studies and then in AI in Google Scholar was carried out. This research is in its initial stages and a more comprehensive literature review is planned. This review was supplemented through discussions with colleagues and students.

2.2 Data Analysis

The most relevant papers were selected (7) based on the abstract. The full papers were then read to pull out the main ethical themes (7) raised and whether they included a guide to practice.

3. Results

3.1 Library Classification

A review of the works on library classification schemes is heavily dominated by Northern American publications covering issues of the classification terms of the indigenous peoples with some recent discussion on trying to change the LCSH 'illegal alien' to 'undocumented immigrant' (Ford, 2020).

3.2 AI

The work on AI does not tend to cover issues of history or incongruous naming as much as classification schemes. Bias is more often discussed from a statistical perspective and normally combined with clear evidence of material negative impact on particular groups. Guidance on mitigating measures to reduce the impact of bias is more frequently included and the potential of AI to be less biased than humans (e.g. in recruitment) is sometimes mentioned.

3.3 Summary Table of themes

Source	Omission	Naming incongruent with self-assigned name	Lack of detail	Consigning to history	Inaccurate	Othering/ Defining as non-x	Material Negative impact	Review & Guidance
AI and Data								
(Ali, 2019)					Y	Y	Y	Y
(Criado Perez, 2019)	Y		Y		Y	Y	Y	Y
(Srinivasan,et al. 2021)					Y		Y	Y
Library Classification Schemes								
(Marshall, 1977)	Y	Y				Y		
(Ford, 2020)		Y						Y
(Lee et al, 2021)		Y	Y	Y	Y			
(Moulaison et al, 2017)		Y	Y	Y	Y	Y		Y

4. Discussion and Conclusions

This initial work demonstrates the potential of exploring further the relationships and mutual learning opportunities between research on the ethics of library classification and AI ethics. There are shared perspectives , in terms of concerns for the representation of traditionally disadvantaged groups, but differences in terms of the complexity of discussion regarding the nature of bias and its impact. Future work will include a more systematic literature review which will include professional guidance or standards provided for librarians or AI professionals. Our findings show that a more nuanced understanding of the nature of harm caused by classification and the role of structural power inequalities could be developed through further integration and analysis of the two literatures. It would combine cultural and spiritual marginalisation with improving understanding of material harm. This analysis should not serve as a potential distraction from efforts to correct structural inequalities but rather as a useful contribution by revealing the power of knowledge representations to both reflect and shape perceptions and experiences. A more thorough understanding of the actual nature of representation and classification, and the ethical issues it can raise will assist in making more informed and relevant decisions about how to reduce harm.

Acknowledgements

The authors would like to thank the Information and Library Management MSc students at Dublin Business School who have contributed to many interesting discussions on this topic.

References

Alavi, M. and Leidner, D. E. (2001) 'Review: Knowledge Management And Knowledge Management Systems: Conceptual Foundations And Research Issues', *Management MIS Quarterly*, 25(1), pp. 107–136.

Ali, M. *et al.* (2019) 'Discrimination through optimization: How Facebook's ad delivery can lead to biased outcomes', *Proceedings of the ACM on Human-Computer Interaction*, 3(CSCW).

Criado Perez, C. (2019) *Invisible women : data bias in a world designed for men*. New York: Abrams.

Ford, A. (2020) 'Conscientious Cataloging | American Libraries Magazine', *American Libraries*.

High-Level Expert Group on Artificial Intelligence (2018) *A definition of AI: main capabilities and scientific disciplines*.

Lakoff, G. (1987) *Women, Fire, and Dangerous Things: What Categories Reveal about the Mind*, *Language*. Chicago: The Univ. of Chicago Press.

Lee, T., Dupont, S. and Bullard, J. (2021) 'Comparing the Cataloguing of Indigenous Scholarships: First Steps and Finding', *KO KNOWLEDGE ORGANIZATION*, 48(4), pp. 298–306.

'library classification | library science |' (2013) *Britannica*.

Marshall, J. K. (1977) *On equal terms : a thesaurus for nonsexist indexing and cataloging*. New York: Neal-Schuman.

Mehrabi, N. *et al.* (2022) 'A Survey on Bias and Fairness in Machine Learning', *ACM Computing Surveys (CSUR)*, 54(6).

Moulaison Sandy, H. and Bossaller, J. (2017) 'Providing Cognitively Just Subject Access to Indigenous Knowledge through Knowledge Organization Systems', *Cataloging & Classification Quarterly*, 55(3), pp. 129–152.

Srinivasan, R. and Chander, A. (2021) 'Biases in AI systems', *Communications of the ACM*, 64(8), pp. 44–49.

Late Submissions

Preparing Students for a Digital Work-Life Using Student-Centred Methods: A Case Study from Music Production

Hanne Haave, Ole Jørgen Ranglund, Tone Vold and Carl-Henrik Wahl
The Inland Norway University of Applied Sciences, Rena, Norway
Hanne.haave@inn.no
Ole.ranglund@inn.no
Tone.vold@inn.no
Carl-henrik.wahl@inn.no

Abstract: Students are expected to be digital, using digital tools for staying updated on their study programmes, time schedules, and how to find and hand in assignments. The tools that the students need in their future jobs are not necessarily taught, as these tools may be specific to each company. However, in the study programme of Music Production, the use of equipment and digital software is a part of the education. This paper showcases how the students are exposed to tools and work forms that they will use in the music production business. Introductions are provided, and the students can then practice using the tools. The most intensive training is provided in five to six intensive sessions during a study year. These sessions are called "camps". These camps have a duration of approximately 12 hours each, with the students divided into groups, the purpose of which is to develop and produce song texts and melodies, which at the end of the camp are presented in a plenary session. These intensive learning activities include the extensive use of tools for producing the songs, as well as collaborative work forms, as the students need to work together and learn together in groups. The qualitative investigations from these intensive song writing camps show how the students benefit from the group work, situated learning and collaboration, and present their view on the usefulness of these camps.

Keywords: situated learning, work-life preparation, collaborative work, cooperation, communication

1. Introduction

Within Higher Music Education (HME), there has been a turn to a more student-centred perspective (Ski-Berg, 2022). The employability of the students being educated has had an increasing focus, not only in performing arts, but also within music production. Being interesting for the work market after they have finished their education is attractive for most educational programmes.

In this paper, we will showcase a pedagogical "take" that will support the employability of the students in the Bachelor Programme in Music Production at the Inland Norway University of Applied Sciences. Here, through collaborative methods (Christophersen, 2016), the students were exposed to technology, work forms and structures that they recognize in their future work-life.

2. The "camps":

The students take part in a total of six "camps" during the first year of their Bachelor Programme. The "camp" is an intensive work session, which starts at 10 am and ends at approximately at 10:30 pm. Prior to the first camp, they are introduced to a digital programme for music production (GarageBand). Prior to other camps, they are exposed to other types of digital programmes to use as tools (Rhyme.zone, Masterwriter and Splice are all websites where the students can find different aids). The students are also instructed on how to organize as a group. For each camp, the theme is slightly different. For example, in camp 4 they are instructed to create a song that can be played on a Norwegian radio channel, while for camp 6 they are asked to develop songs for four different artists at Sony Music. At the end of the camps, the students are asked to reflect upon their experiences.

This intensive way of teaching to master tools, cooperation, collaboration, and to also make music, is intended to provide the students with a situated learning opportunity. Results from previous camps have resulted in published music; hence, the camps provide an arena for the students. But what do the students think of this way of working?

We have therefore formulated the following research question:

How do the students experience the songwriter - camps?

In the following, we will present a theory that will enlighten our study. We will also present the method of inquiry and the results from our investigations, and lastly, we conclude and point forward to future research.

3. Theoretical foundation

Student-centred learning approaches were advocated by Carl Rogers (Rogers and Freiberg, 1994). To help support this, one may facilitate for student activity and for students to be active knowledge-creators. They should be encouraged to build on their own previous experiences, reflecting and also actively investigating their environments for acquiring knowledge. It is important to develop the students' intellect (Kember, 1997; Tangney, 2014), and it is also about supporting the students and empowering them (Mezirow, 2010).

Since the students are primarily exposed to the camps in order to learn how to develop songs under time pressure, this is a way of "learning by doing" (Dewey, 1938). By experiencing how to develop music, using the tools and receiving guidance from their lecturers, they learn about music production and development. Because there are six camps during one year of lecturing, the students also have the opportunity to reflect and develop as singers/songwriters. Similar to what Kolb (2014) explains, the experiential learning cycle can be repeated, and they can improve based on their experiences and reflections. Reflections can be undertaken prior to, during- and after the camps, and since the students are encouraged to reflect upon their learning outcome, how they work in the groups regarding cooperation and collaboration can be related to any prior experiences (Schön, 1987).

As music production has gradually become more and more digitalized, to learn about digital work-forms is also necessary. Utilizing tools for not only developing music (GarageBand, Splice, etc.), they can use tools for co-writing, such as Google Docs. The lyrics are then available for all the group members. This may come in handy when they are to co-work with other songwriters not co-located with themselves. This resembles work from a distance, which during COVID-19 gained a renewed focus (Wang *et al.*, 2021). The enabling of work from a distance allows songwriters to cooperate and collaborate across borders.

Working in a group also allows for learning from each other. The students can share knowledge and improve as a group, and may also learn from their lecturers/mentors. This collaborative learning may resemble the SECI model from Knowledge Management (Nonaka, 1994; Nonaka and Takeuchi, 1995). By socializing and discussing, both among each other and with mentors, they can externalize tacit knowledge, which by combining with existing knowledge with each student, becomes these students' internalized knowledge. So, by learning and being taught different digital tools, different ways of thinking regarding developing music and how to cooperate and collaborate, the students can develop as songwriters.

This will also provide the students with a situated learning opportunity. Lave and Wenger (1991) refer to learning in Communities of Practices and situated learning. Hence, learning from- and with fellow students in a work-like setting, cooperating and collaborating as they would in work-life, may be a part of the preparations for the future work-life.

The communication often aligns with Habermas (1985) and his principles of good communication, such as that the participants in a case should all take part in the dialogue, that all the participants have the same possibilities regarding presenting and "criticizing" within the dialogue setting, and that the participants should have the ability and will to understand each other. Furthermore, it is important that any discrepancies in the power structure between the parties are neutralized in order to maintain a consensus. Flyvbjerg (2012) points out that an infinite amount of time can be a factor to help support this. The participants also need to display their goals and intentions, and not think too "strategically" regarding their own gain.

To a certain degree, the "rules of the game" are established according to these principles, which open for a dialogue and participation, as one is now an equal partner in the communication, and all input and argumentation should be paid attention to. This prepares the ground, even for the less experienced, to take part in a new arena.

In the next section, we will explain our method of inquiry to investigate how the students experienced the "camps".

4. Method of inquiry

This study is a qualitative case study following three songwriter camps during the spring semester of 2022. Our aim was to investigate how the songwriter camps were organized, as well as the teaching methods, and making enquiries about the students' experiences regarding student centredness. Due to this purpose, we chose to combine observation with formal and informal interviews, both individually and in groups (Dalen, 2011). We were three researchers taking part in the data collection. In addition, one of the three teachers in charge of the songwriter camps has contributed to this paper. We conducted an open observation during the camps, being in the role of present observers (Creswell, 2007). In addition to observation, we were doing both formal and informal interviews with teachers and students, e.g., sitting in at the introduction from the start, following the students doing studio practice during the day, and listening in at the presentations of music in the evening. This provided us with an insight into the processes of the songwriter camps, as well as the meanings, feelings and reflections of the various participants, which can be called thick descriptions (Geertz, 1973). During and after observations, we took field notes. In addition, three students were interviewed individually. Two group interviews were conducted by two of the researchers using a semi-structured interview-guide (see Table 1), and the conversations were recorded and transcribed verbatim.

Table 1: Overview of data collection, timetable and informants

Songwriter camp	**Observation by researchers in classroom and studio (field notes)**	**Informal group conver-sations with students (field notes)**	**Informal conver-sations with teachers (field notes)**	**Individual interviews students (rec)**	**Group interview students (rec)**	**Group interview teachers (rec)**
18thFeb 2022	Researcher 1	x	Teachers1 and 2	Informants A and B		
4thMarch 2022	Researcher 2	x	Teachers1 and 3			
6th April 2022	Researchers1 and 3	x	Teachers1 and 2	Informant C	Four informants	Teachers 1 and 2

We have analysed the data by first going through the transcripts to identify themes and issues relevant to the research questions. The material was coded by marking sentences with a central meaning, thereby developing descriptive codes close to the experience. The findings are presented and discussed against the theories presented above.

5. Results and discussion

In this part, we will present the central findings from our material, and seek to answer the research question: *How did the students experience the songwriter camps?*

5.1 How did they experience working in groups?

"Great teamwork" (C)

Each session starts with an introduction, in which the teachers establish the groups of students who are to work together during the camp. They then also receive the day's assignment, with each student assigned a role with a certain responsibility within the group's work. This can be vocals, being a headliner, producer or being responsible for "good vibes" in the studio. The students go to the studios to solve the task of the day, as the work is well organized, structured and very intensive at the same time. The teachers take on the role as mentors, as they walk around and visit the different studios, and offer help, provide feedback, advice and the facilitation of the process of songwriting. As this is a very creative process, the feedback from the teachers/mentors is highly valued, and is important for the learning process.

The informants consider the work in teams like this to be very beneficial to them when it comes to learning from other students. This is conveyed in both informal conversations and formal interviews:

I enjoy working in a group, because if you have an idea that you find is a good one, and then the others come in and don't know about that idea. If I had been alone, I maybe would have used an idea that was very bad. (C)

This implies that they are learning from each other, much like what you would expect, e.g., in Communities of Practice (Lave and Wenger, 1991). This also resembles a real-life setting, and allows the students to learn in a work-like environment, which enables the explorative opportunities of student-centred learning (Rogers and Freiberg, 1994; Kember, 1997; Mezirow, 2010). Also, the learning from mentors allowing the students to integrate learning absorbing tacit knowledge is similar to what is described in the SECI model with socialization (with mentors and fellow students), externalization by discussing and communicating, the combining of new knowledge with previous knowledge, and lastly, internalizing it so that it becomes the students' own knowledge to utilize now and later.

5.2 Communication and cooperation in teams

According to our informants, the communication in the groups usually works very well. This is a prerequisite for maintaining a good relationship and keeping the songwriter process going. This has developed from the first camp, when it was somewhat different, and it took some time to get to know each other: *"From the start, the mood was different from what is it now. You didn't know the people, and everyone was a bit quieter, actually."* (C)

Although the members in the groups change from camp to camp, the informants find that the communication is very good. They speak very freely in the groups:

"We sometimes almost talk too freely." (C)

"It's very instructive. Because you learn from the others, and they maybe know things that I don't know." (C)

The instructed communication allows for students to elaborate their ideas and build on previous experiences (Habermas, 1984; Flyvbjerg, 2012).

5.3 Establishing a safe learning space provides better results

The open and free communication is also a prerequisite for good cooperation:

"I have never worked in this way before, with other people. So, before I went to study, I have just been sitting in my room alone and producing music". ..

"The results become better when working in teams. "(C)

The "safe space" allows for support for acquiring new knowledge (Rogers and Freiberg, 1994), which also helps to empower the students (Mezirow, 2010).

5.4 Developing digital skills

The songwriter camps are structured and organized, as each student knows what role to take in the studio production. The learning teams are organized like a real-life studio team, so that all can have a near real-life experience: *"I have learned more about the use of the technics and the digital programmes and stuff." (C)* This statement confirms the experienced learning outcome from the work, much like what is described by Dewey (1938) and Kolb (2014).

This contributes to establishing a space for learning that feels safe, and a culture in which you can ask questions and be open, instead of acting strategically. The feeling of safety is also important, because some of the programmes (e.g. Google Docs) are used in cooperation with others, which requires a safe learning space in the student teams. Naturally, this takes some time to establish, as far as getting to know the others:

"We get ideas from each other... and if someone is stuck on a baseline, then the others can say: Why don't you rather do it like this? Then you get done faster." (C) This statement points towards the knowledge sharing described by Nonaka (1994) and Nonaka and Takeuchi (1995).

We found that what is positive about writing together is that ideas can be developed and cultivated in cooperation with others, and this is more easily accomplished when you feel safe about your group members. Statements like: "*I find that most of what we have been through has been very good" (C)* show that the collaboration and cooperation in groups have been perceived as positive.

Although we asked about how reflection would support their learning outcome, the students did not have a clear idea about reflection as a tool for learning. We found that they reflected well upon being asked, and were to hand in reflection notes, but we did not find any distinctive awareness about reflection supporting learning outcomes. Here, the faculty staff should be advised to work more on supporting reflection for learning purposes. Schön (1987), Dewey (1938), Kolb (2014) and Rogers and Freiberg (1994) promote reflection to support a deeper learning process.

6. Conclusion

The students are very positive about the "camps", and feel that they learn a lot from both each other and their mentors, from learning about and how to use the different tools, and from collaborating and cooperating. The way they communicate among each other provides a safe arena for cooperation and collaboration, and allows knowledge sharing among group members. They seem to experience a real-life situation during the camps, not only by utilizing the tools of the trade, but also by developing music for real artists. Even if they are able to reflect upon their learning and written reflection notes, they do not seem to connect reflection to enhanced learning outcomes. This show that the "camps" are arenas for student-centred learning in most of the aspects of the term.

6.1 Further research

As researchers, we see a plethora of potential for further investigations into what the camps represent as a tool for learning and support for real-life learning opportunities. In this paper, we have investigated how the students perceived the camps, without going more in-depth into the various features of the "camps". We suggest investigating the role of the mentors, and how they prepare and work during the camps. We also propose to conduct further research into how to utilize *reflection* as a learning tool. Yet another suggestion would be to follow these students in their further education and career, in order to establish how much from their education they use in their future work-life as songwriters.

References

Christophersen, C. (2016) '"Perspectives on the Dynamics of Power Within Collaborative Learning in Higher Music Education."', In Helena Gaunt and Heidi Westerlund (Eds.), *Collaborative Learning in Higher Music Education*. New York, USA: Routledge, pp. 77–85.

Creswell, J. W. (2007) *Qualitative inquiry & research design: choosing among five approaches*. 2nd ed. Thousand Oaks, Calif: Sage.

Dalen, M. (2011) 'Intervju som forskningsmetode [Interview as a research method]', *Oslo: Universitetsforlaget*.

Dewey, J. (1938) *Experience & education*. New York: Kappa Delta Pi/Touchstone.

Flyvbjerg, B. (2012) 'Making social science matter', *Social Science and Policy Challenges: Democracy, Values, and Capacities, Paris: UNESCO Publishing*, pp. 25–56.

Habermas, J. (1984) *The theory of communicative action: 1: Reason and the rationalization of society*. Edited by J. Habermas. London: Heinemann.

Habermas, J. (1985) *The theory of communicative action: Volume 1: Reason and the rationalization of society*. Beacon Press.

Kember, D. (1997) 'A reconceptualisation of the research into university academics' conceptions of teaching', *Learning and instruction*, 7(3), pp. 255–275. doi: 10.1016/S0959-4752(96)00028-X.

Kolb, D. A. (2014) *Experiential learning: Experience as the source of learning and development*. FT Press.

Lave, J. and Wenger, E. (1991) *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

Mezirow, J. (2010) 'Transformative learning in practice: Insights from community, workplace, and higher education'. Edited by E. W. (Edward W. Taylor). San Francisco: Jossey-Bass.

Nonaka, I. (1994) 'A dynamic theory of organizational knowledge creation', *Organization Science*, 5(1), pp. 14–37.

Nonaka, I. and Takeuchi, H. (1995) *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford University Press.

Rogers, C. R. and Freiberg, H. J. (1994) *Freedom to learn*. 3rd ed. Edited by H. J. Freiberg. New York: Charles E. Merrill.

Schön, D. A. (1987) *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions.* Jossey-Bass.

Ski-Berg, V. (2022) '"Blazing the trail or exposing the gaps?" Discourses on student-centredness in genre independent and classical music performance study programmes in Norway and the Netherlands', *Music Education Research*, pp. 1–11.

Tangney, S. (2014) 'Student-centred learning: A humanist perspective', *Teaching in Higher Education*, 19(3), pp. 266–275.
Wang, B. *et al.* (2021) 'Achieving effective remote working during the COVID-19 pandemic: A work design perspective', *Applied Psychology*, 70(1), pp. 16–59.

The Application of PLS-SEM in Knowledge Management Processes in Higher Education Institutions

Emanuela Riccio[1], Roberto Cerchione[2] and Piera Centobelli[3]
[1]University of Naples Parthenope, Naples, Italy
[2]University of Naples Parthenope, Naples, Italy
[3]University of Naples Federico II, Naples, Italy
emanuela.riccio@unibg.it
roberto.cerchione@parthenope.it
piera.centobelli@unina.it

Abstract: This paper aims to investigate knowledge management (KM) processes in higher education institutions and shed light on the factors that influence the dynamics behind these processes. We focused on understanding how the perceptions about the involvement in KM activities can influence two of the knowledge management skills defined in the literature: absorptive capacity and desorptive capacity. Our work is based on the Theory of Planned Behaviour because it has the power to analyse and explain, through its constructs (attitude, subjective norm, perceived behavioural control), the attitudes of individuals and their perceptions about the implementation of a particular behaviour. The methodology adopted for the empirical investigation is PLS-SEM (Partial Least Squares -Structural Equation Model). The necessary data was collected through a questionnaire sent by email to the potential academics interviewed. The results suggest that the factor impacting the relationship between KM and absorptive and desorptive capacity processes is the behavioural control perceived by academics. In addition, they demonstrate that the organizational climate within the university is an essential predictor of the behavioural intention of academics. The limitations, including the limited number of respondents and suggestions for future developments, are the conduction of a multi-group analysis and building a second-order PLS (Partial least square) model.

Keywords: Absorptive Capacity (ACAP), Desorptive Capacity (DCAP), Higher Education Institutions (HEI), Knowledge Management (KM), Structural Equation Model (SEM), Theory of Planned Behaviour (TPB).

1. Introduction

This paper aims to investigate knowledge management (KM) processes in higher education institutions and shed light on the factors that influence the dynamics behind these processes. We focused on understanding how the perceptions of these individuals about their involvement in KM activities can influence two of the knowledge management skills defined in the literature: absorptive capacity and desorptive capacity. We asked the following research question: "What factors influence the relationship between knowledge management processes and absorptive capacity and desorptive capacity in the university context?". The purpose of the investigation carried out is to answer this question. We based our research on the Theory of Planned Behaviour (TPB). We have chosen this theory to analyse and explain, through its constructs, the attitudes of academics and their perceptions about implementing a particular behaviour. The methodology adopted for the empirical investigation conducted in the Higher Education field is the PLS-SEM, frequently used by scholars, in various areas, to model structural equations in applied research projects. Among the many advantages of this methodology is the requirement for small sample size and no assumptions about the distribution of variables.

SmartPLS 3 was used to implement the PLS algorithm, user-friendly software. The latent variables were first identified with the respective indicators found in the managerial literature to create the path model. Subsequently, the hypotheses existing between them were defined. The necessary data was collected through a questionnaire sent by email to the potential academics interviewed. The report has been carefully analysed to evaluate the goodness and reliability of the structural and measurement model. Finally, bootstrapping was started using SmartPLS3, a resampling method, to verify the significance of the internal and external model and establish, in conclusion, which model hypotheses are supported. Lastly, the relationships between the significant latent variables were identified, and, therefore, the supported model hypotheses were discussed. The results suggest that the factor impacting the relationship between KM and absorptive and desorptive capacity processes is the behavioural control perceived by academics. In addition, they demonstrate that the organisational climate within the university is an essential predictor of the behavioural intention of academics, represented by the three constructs of the TPB. Our paper also features identification of the research limitations, including the limited number of respondents, and suggestions for future developments, including conducting a multi-group analysis and building a second-order PLS model. After this introduction, the second paragraph focuses on knowledge management and the SECI model. The third paragraph presents the methodology adopted for the

empirical investigation to understand how individuals' perceptions impact is the implementation of a specific knowledge-sharing behaviour on the organization's ability to absorb and transfer knowledge to the external environment. The fourth paragraph describes the birth of the ACAP and DCAP models from Knowledge Management Capacity. The fifth paragraph illustrates the Theory of Planned Behaviour. This theory analyses and explains the attitudes that academics assumed and their perceptions about implementing a specific behaviour. The sixth paragraph illustrates the Organizational climate variable. The seventh paragraph tests the model presented and explains the algorithm's start. Finally, the results obtained, and the research limits are analysed and discussed in the last paragraph.

2. Theoretical background

2.1 Knowledge Management

The term Knowledge Management was coined in 1986 by Karl Wiig, then president of the Knowledge Research Institute, during a conference organized by the International Workers' Organization of the United Nations. Among the most cited definitions of KM, there is one enunciated by Davenport and Prusak (1998). They define KM as the capture, distribution, and efficient use of knowledge. According to Duhon (1998), KM is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all the company's information resources. The resources it refers to include databases, documents, policies, procedures, skills, and experience. These definitions share knowledge management vision from an organizational and business perspective. Yew Wong and Aspinwall (2004) define KM as the systematic management of knowledge-related activities and processes that create value for the organization. Organizations adopt knowledge management systems for many reasons: to stimulate innovations, to improve their adaptability and agility, to build the organization's institutional memory, to strengthen the sense of community, and to improve the internal and external effectiveness of the organization. In general, knowledge management also leads to improved decision-making.

2.2 Knowledge management in Higher Education

Higher education institutions (HEI) are knowledge-intensive organisations and play a central role in creating and disseminating knowledge through research activities. In addition, they play a fundamental role in transferring knowledge through teaching, collaboration with other public and private organizations, sharing research results, and developing the territory by favouring and promoting the training of start-up and university spin-offs. Knowledge management in higher education institutions is increasingly being discussed. Nowadays, methodically, organizations have understood that practical knowledge, rapid acquisition, and use represent the only source of sustainable competitive advantage (Mahdi et al., 2019). If we consider the university as an enterprise and apply the concept developed by Nonaka and Takeuchi (1995), the knowledge management of university research groups is the ability to create new knowledge, spread it within the group and incorporate it into all developed research processes. Nowadays, society faces severe sustainability issues that require new knowledge, new strategies for knowledge management, and the acquisition of skills (Halberstadt et al., 2019). However, the production and transmission of knowledge are considered traditional objectives of higher education institutions.

2.3 SECI model

The contribution of Japanese professors Nonaka and Takeuchi to the managerial literature in knowledge management represents an authoritative point of reference. They distinguish tacit knowledge from explicit knowledge. Explicit knowledge refers to knowledge transmissible into a formal and systematic language. It can be expressed in words and numbers and shared in data, formulas, and manuals (Nonaka, 1994). Tacit knowledge is personal and challenging to access, formalize and communicate. It is deeply rooted in an individual's actions, experiences, ideas, values and emotions (Nonaka and Konno, 1998). In the model proposed by Nonaka and Konno (1998), the continuous interaction between tacit knowledge and explicit knowledge determines the development of new knowledge. Starting from the assumption that knowledge comes out of the continuous conversion between tacit and explicit knowledge, Nonaka and Takeuchi elaborate on the SECI model, which called for the inclusion of four modes of conversion of knowledge Socialization, Externalization, Combination, Internalization. The creation, acquisition, sedimentation, use and application of knowledge to business processes, typical of an organization, involve individuals strongly influenced by social and organizational dynamics. Knowledge management, therefore, concerns not only economic and technological aspects but also psychological and organizational aspects. According to Nonaka and Takeuchi, the creation of knowledge is to be understood as a dissemination process in which the knowledge created by individuals is systematized within the

organization's knowledge network. The SECI model is of fundamental importance in HEI as it is necessary to identify the mechanisms of exchanging information and knowledge between academics. Socialization is the process of converting tacit knowledge into another tacit knowledge. Externalization is the conversion of tacit knowledge into explicit knowledge. It is linked to the conceptualization and formalization of the contents of knowledge. Combination is the process of converting explicit knowledge into another explicit knowledge. Internalization is the process of converting explicit knowledge into tacit knowledge. Written documentation helps individuals internalize and, in addition, facilitates the transfer of explicit knowledge to other individuals, allowing them to live the experiences of others indirectly. Internalization is closely related to "learning by doing" (Nonaka and Takeuchi 1995).

3. Methodology

Partial Least Squares is a soft-modelling approach used to model structural equations in applied research projects. In the last two decades, it has found application in various fields of research such as marketing (Hajipour and Ghollamzadeh, 2010; Julien and Ramangalahy, 2008), information systems (Miranda and Saunders, 2003; Yoo and Alavi, 2001), strategic management (Tsang, 2002) and knowledge management (Lee et al., 2016). From the systematic review prepared by Cepeda-Carrion et al. (2018), many researchers in the field of Knowledge Management have used PLS-SEM, mainly for the benefit of the small sample. To pursue the objective of bringing to light the causal link between the propensity of academics to assume a behaviour of sharing their knowledge and the ability of the university to absorb and transfer knowledge to the external environment, a PLS model has been built that includes the following six latent variables, taken up and adapted from the existing managerial literature on KM and from the theory of planned behaviour (Ajzen, 1991). The variables are organizational climate, absorptive capacity, desorptive capacity, attitude, subjective norm, perceived behavioural control.

4. Knowledge Management Capacity

Knowledge management capacity refers to an organization's ability to manage its knowledge base over time. Argote et al. (2003) and Nonaka (1994) have distinguished the exploration or creation of knowledge from the exploitation or application of knowledge. Andersen and Drejer (2008) highlighted the critical role of combining internal and external knowledge in innovation processes. In light of this distinction, the authors Lichtenthaler and Lichtenthaler (2009) propose six knowledge management capacities: inventive capacity, is the ability to generate new knowledge within the organization; absorptive capacity is the ability to acquire new knowledge from the outside; transformative capacity is the ability of the organization to retain knowledge over time; connective capacity is the ability to take care of inter-organizational relationships and preserve their benefits in terms of exchanged knowledge; innovative capacity is the ability to match inventions to the internal context; desorptive is the capacity to transfer knowledge to the outside world.

4.1 ACAP Model

The ability to recognize the value of new external information, assimilate and apply it for commercial purposes is defined by Cohen and Levinthal (1990) with the term absorptive capacity (ACAP). The resulting model consists of three phases and originates at the individual level: the individual, based on previous knowledge, acquires new knowledge from the outside; the acquired knowledge is brought within the organization and, finally, is exploited to generate beneficial results (Marabelli and Newell, 2014). ACAP is defined as routines and processes through which organizations acquire, assimilate, transform and use knowledge to generate a dynamic organizational capacity (Zahra and George, 2002). Acquisition refers to the organization's ability to identify and acquire knowledge from the external environment. Assimilation refers to the organisation's routines and processes that allow the interpretation and understanding of new knowledge acquired from external sources. Transformation denotes the organization's ability to develop and refine exercises that combine existing knowledge with new knowledge acquired and assimilated. Exploitation refers to refining, extending, and exploiting existing skills, leveraging the knowledge gained, assimilated and transformed.

4.2 DCAP Model

Desorptive capacity, according to the definition formulated by Lichtenthaler et al. (2010), is the ability of an organization to identify, based on its strategy, opportunities for technology transfer to the outside world to facilitate the application of technology. Therefore, the desorptive capacity can be considered opposed to the absorptive capacity. Absorptive capacity and desorptive capacity are essential components of an organization's ability to create new knowledge. ACAP and DCAP are influenced by the degree of motivation of the actors belonging to the organizations involved to transfer knowledge (Dell'Anno and del Giudice, 2015). The DCAP

model, proposed by Lichtenthaler and Lichtenthaler (2009), consists of identifying opportunities for external exploitation of knowledge and transferring knowledge to the recipient. Thanks to desorptive capacity, organizations identify many technology transfer opportunities. Technology transfers make it possible to improve the market knowledge in which an organization operates. As a result, organizations can gain knowledge through the transfer process to external partners (Lichtenthaler and Lichtenthaler, 2010). Factors that can affect desorptive capacity and determine its success include learning ability, the personal experience of members of organizations, the purpose of the transfer (Dell'Anno and del Giudice, 2015).

5. Theory of Planned Behaviour

The Theory of Planned Behaviour (TBP) was developed in 1991 by Icek Ajzen, and it is an extension of the previous Theory of Reasoned Action (TRA). This theory has been widely applied in social psychology, marketing, and healthcare (Goh and Sandhu, 2014). The purpose of this theory is to explain voluntary behaviours. The authors excluded all those behaviours that are not spontaneous, habitual, or programmed (Liska, 1984). Therefore, Trafimow (2009) highlighted that the proximate cause of a behaviour is the behavioural intention, which indicates what one intends to do or not to do. Individuals decide whether to behave in a certain way, evaluating various factors in advance. Ajzen and Fishbein (1975) identify two main factors determining this behavioural intention: attitude and subjective norm.

5.1 Attitude

The term attitude indicates the predisposition of an individual to produce emotional or behavioural responses, determined by the family or social environment, regarding situations, people or objects. Attitude is how a subject favourably or unfavourably evaluates given conduct (So and Bolloju, 2005). As Bock and Kim (2002) argue, attitude evaluates an individual's belief and consequences in pursuing a particular behaviour. Fishbein and Ajzen (1975) define that the attitude variable is influenced by behavioural beliefs and outcome evaluation. Behavioural beliefs are individuals' beliefs about the consequences of a specific behaviour put in place. Subjects associate the performance of a specific behaviour with the ability to produce a set of results. It refers to how individuals perceive and evaluate the potential impacts of a given behaviour implemented.

5.2 Subjective norm

The variable Subjective Norm, provided by Ajzen and Driver (1992), is: "a person's subjective probability that a particular referent wants the person to perform a given behaviour". From this explanation, the subjective norm represents the social pressure the subjects perceive to perform or not a specific behaviour. Social pressure is the set of opinions of those who enjoy a particular consideration on the part of the individual, such as exerting a specific influence on their behavioural choices (Ajzen and Fishbein, 1975). Ajzen and Fishbein identify two variables that impact the level of influence that the opinions of others have on the behaviour of the individual: normative beliefs and motivation to comply. Normative beliefs include beliefs about other individuals who enjoy consideration from the subject and whose essential preferences, except concerning a specific behaviour.

5.3 Perceived behavioural control

Ajzen and Driver (1992) introduce the variable perceived behavioural control in the Theory of Planned Behaviour. Perceived behavioural control refers to the ease or difficulty of performing a specific behaviour. Ajzen (2002) considers a recent graduate who intends to secure a job position within a high-tech company. The realization of this intention is not entirely under the voluntary control of the individual. While doing everything within his possibilities, sending his resume and showing himself available for a possible interview, he cannot secure employment. Two variables impact perceived behavioural control: control belief and perceived power. Control belief refers to the perception of individuals about any factors that can facilitate or inhibit the execution of a specific behaviour. These factors include both elements of internal control, such as information, skills, abilities, difficulties, and external features such as opportunities barriers. Perceived power refers to the perceived capacity of a particular control factor to facilitate or inhibit the execution of a particular behaviour (Ajzen, 1991).

6. Organizational climate

The organizational climate is the set of relatively durable characteristics that distinguish each organization and influence individuals' behaviour (Forehand and Von Haller, 1964). The organizational climate explains the features of the organization from the point of view of employees. It concerns the subjective impressions, feelings, perception of the actions of the organisation members (Gray, 2008). The organizational climate guides

the conduct of employees by communicating to them what behaviour is desirable and appropriate in the organization (Al-Kurdi, 2020). Ajzen (1991) and Chennamaneni et al. (2012) argue that the organizational climate influences subjective norms. Bock et al. (2005) have particularized the organizational climate in fairness, innovativeness, and affiliation. Fairness refers to the employee's perception that organizational practices are fair. This creates trust between individuals and motivates them to share their knowledge. Innovativeness is the perception of individuals that change, and creativity are fostered within the organization. Finally, affiliation is the sense of belonging that employee perceive.

7. Data collection

The latent variables presented in the previous paragraph are measured by indicators or items adapted from the existing literature. Five items for attitude variable and ten items for the organizational climate variable (4 for affiliation, 3 for innovativeness, 3 for fairness). Concerning the latent variables subjective norm and perceived behavioural control, the items are taken from the SEM conducted by Zhang et al. (2013). The 16 manifest variables measuring absorptive capacity (4 for each dimension) are adapted by Pavlou and El Sawy (2006). Finally, the five items that measure the desorptive capacity construct are adapted from Kalar and Antoncic (2015). The items of each latent variable are subject to a 7-point Likert scale, where 1 represents the lowest acceptance value and seven the more excellent value. The decision to proceed through an electronic questionnaire involves individuals who live in different geographical places of the planet in a relatively short period. The number of valid and complete responses received is 161. Therefore, it can be deduced that the limited sample number of 161 is appropriate for using the PLS-SEM methodology. Table 1 shows the demographic information of the respondents.

Table 1: Respondent demographics

	Categories	Frequency	Percentage
Gender	Male	102	63,30%
	Female	58	37,70%
Age	Less than 25	1	0,62%
	25-34	44	27,30%
	35-44	57	35,40%
	45-54	33	20,50%
	More than 54	26	16,20%
Country	Africa	15	9,30%
	North America	8	4,90%
	South America	9	5,70%
	Asia	63	39,10%
	Europe	62	38,50%
	Oceania	3	2,50%
Position	Full Professor	32	19,90%
	Associate Professor	29	18,10%
	Assistant Professor/Researcher	42	26,10%
	Ph.D. Student	34	21,10%
	Other Academic Position	24	14,90%
Working Experience	0-5 years	44	27,40%
	6-10 years	24	14,90%
	11-15 years	29	18%
	More than 15 years	64	39,70%

7.1 Theoretical model and hypothesis development

The PLS-SEM model in the Higher Education sector was built and analysed using the SmartPLS3 software. The hypotheses formulated recall some works present in the literature. The first six hypotheses were developed from the survey conducted by Lo and Tian (2020). They hypothesised a relationship between the knowledge sharing behaviour assumed by academics and the university's ability to absorb and surrender knowledge. They suppose the relationships between the constructs of the TPB, which express the behavioural intentions of the subjects (Ajzen, 1991), and the absorptive and desorptive capacity. The other three hypotheses were defined based on empirical investigations (Bock et al., 2005 and Lo and Tian, 2020). In the light of the contributions in

the literature just described the nine hypotheses that led to the construction and representation of the model have been formulated are:

H1: The attitude of academics significantly influences the university's absorptive capacity (ACAP).
H2: The attitude of academics significantly influences the university's desorptive capacity (DCAP).
H3: The subjective norm of academics significantly influences the university's absorptive capacity (ACAP).
H4: The subjective norm of academics significantly influences the university's desorptive capacity (DCAP).
H5: The perceived behavioural control of academics significantly influences the university's absorptive capacity (ACAP).
H6: The perceived behavioural control of academics significantly influences the university's desorptive capacity (DCAP).
H7: The university's organizational climate significantly influences the attitude of academics.
H8: The university's organizational climate significantly influences the subjective norm of academics.
H9: The university's organizational climate significantly influences the perceived behavioural control of academics.

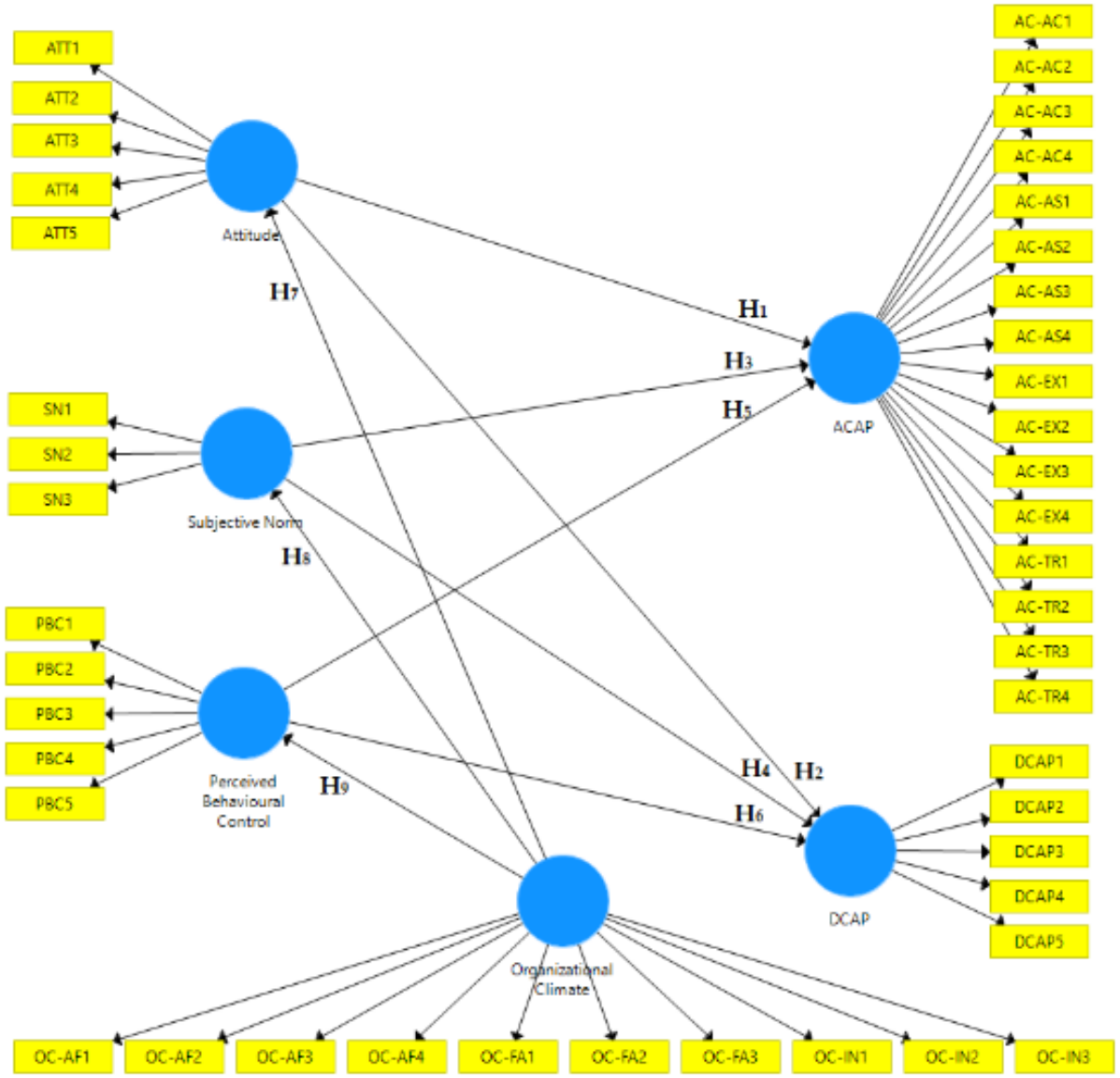


Figure 1: Path model

8. Data analysis

To analyse and validate the external model, we proceed with verifying the reliability of the internal consistency, the reliability of the indicators, the convergent validity, and the discriminant validity. As long as the block turns

out to be one-dimensional, Cronbach alpha values, rho_A and Composite reliability at least equal to 0.7 are preferable (Bagozzi and Yi, 1988).

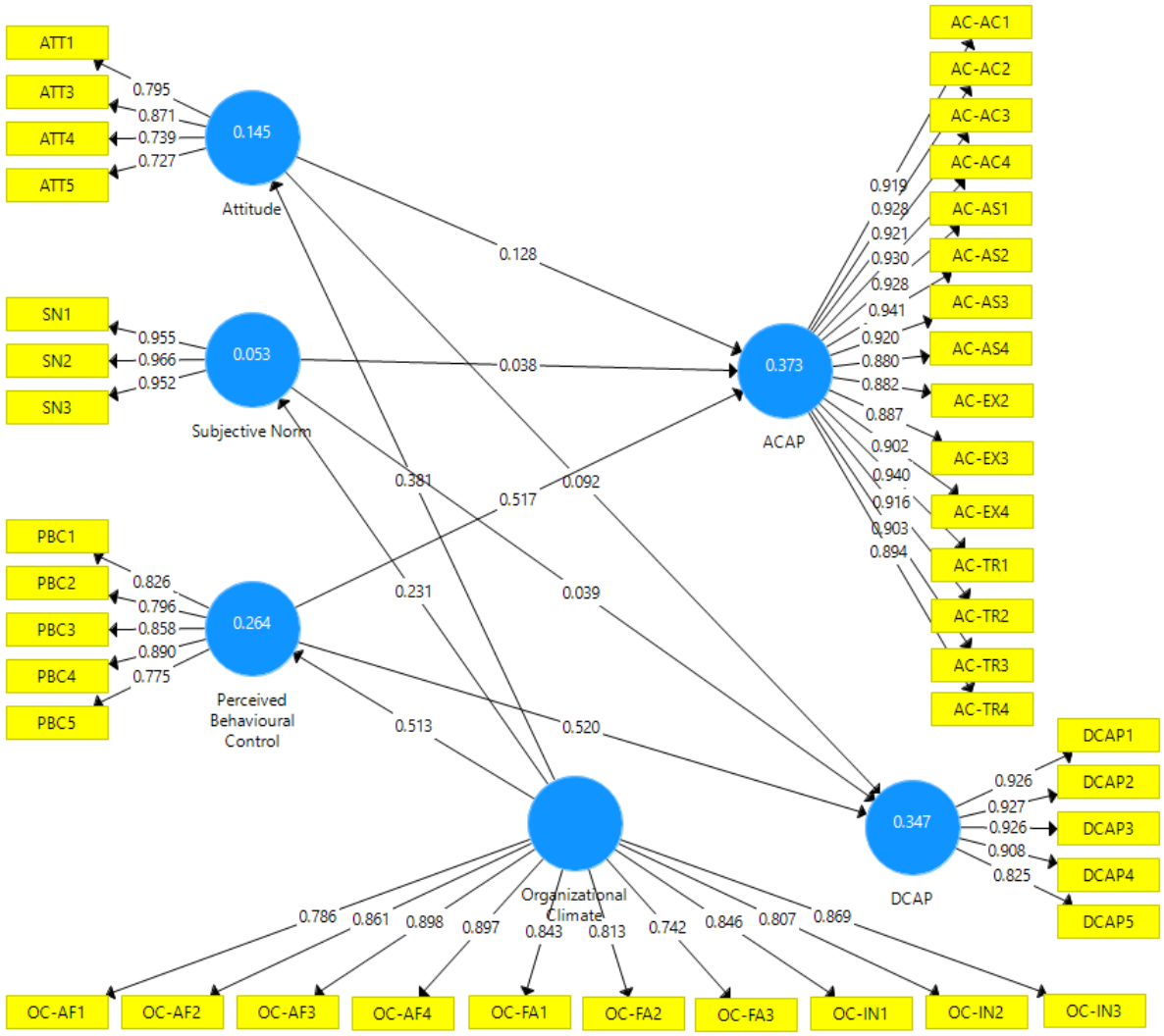


Figure 2: PLS Algorithm Results

From Figure 2, the three indices relating to each block of variables assumed values greater than 0.7: this demonstrates the one-dimensionality of the blocks. Convergent validity indicates the correlation between the indicators and their latent variable. We accept models with an AVE greater than 0.5, models in which the latent variable explains more than half of the variance of its indicators (Bagozzi and Yi, 1988). From Figure 3 in the model in question, the AVE is more significant than 0.5 for each latent variable. The discriminant validity is expressed by the Fornell-Larcker concept, whereby the square root of the AVE, in each latent variable, must be greater than the values of the correlations between the latent variables (Fornell and Larcker, 1981).

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
ACAP	0.986	0.986	0.987	0.833
Attitude	0.803	0.842	0.865	0.616
DCAP	0.944	0.956	0.957	0.816
Organizational Climate	0.952	0.955	0.959	0.702
Perceived Behavioural Control	0.888	0.907	0.917	0.689
Subjective Norm	0.955	0.962	0.971	0.917

Figure 3: Construct reliability and validity

8.1 Evaluation by resampling methods: Bootstrapping

When adopting the PLS methodology, the distribution is unknown, and therefore, conventional methods for testing significance are not applicable (Garson, 2016). SmartPLS3 software can generate T statistics to verify the relevance of the internal and external model, using a resampling method called *bootstrap*. This procedure takes many data from the original sample to calculate a statistic and estimate its distribution without making assumptions about the distribution model. In Figure 4, the *T-statistics* column allows understanding if the structural model's path coefficients are significant.

	Original Sampl...	Sample Mean (...	Standard Devia...	T Statistics (|O/...	P Values
Attitude -> ACAP	0.128	0.135	0.082	1.562	0.119
Attitude -> DCAP	0.092	0.095	0.095	0.968	0.334
Organizational Climate -> Attitude	0.381	0.396	0.083	4.596	0.000
Organizational Climate -> Perceived Behavioural Control	0.513	0.521	0.064	7.963	0.000
Organizational Climate -> Subjective Norm	0.231	0.230	0.094	2.455	0.014
Perceived Behavioural Control -> ACAP	0.517	0.515	0.083	6.235	0.000
Perceived Behavioural Control -> DCAP	0.520	0.520	0.095	5.453	0.000
Subjective Norm -> ACAP	0.038	0.036	0.069	0.548	0.584
Subjective Norm -> DCAP	0.039	0.040	0.066	0.591	0.555

Figure 4: Bootstrap results for the internal model

Using a T-test with a significance level of 5%, the path coefficient will be significant if the T statistic is greater than 1.96. The table shows that the links Attitude – ACAP, Attitude – DCAP, Subjective Norm – ACAP, and Subjective Norm – DCAP are not statistically significant in the model under consideration. All other path coefficients in the internal model are statistically significant.

9. Discussions

Higher education institutions have tried to change their internal structures and strategies in recent decades. As a result of these increasing pressures and needs in higher education, the growing attention of scholars has been directed to show the great potential of KM for HEI (Quarchioni et al., 2020). The literature has discordant opinions regarding its impact on KM in HEI. For example, researchers have suggested that university culture is individualistic and sometimes selfish and instrumental (Fullwood et al., 2013; Tian et al., 2009). Technology, especially information technology, which plays a critical role in supporting strategies and operations, is seen as an enabler for KM in HEI. In addition, many authors agree that while the use of appropriate information and communication technologies can help universities move towards a knowledge-based organization, a good adaptation between information technology, socio-organizational factors, and sustainable organizational culture is also needed (Arntzen et al., 2009; Gill, 2009; Raj Adhikari, 2010). On the other hand, two recent studies do not agree on the importance of sharing knowledge. In the UK, academics are neutral about the importance of technology, probably because of their high level of autonomy and engagement in disciplinary communities. On the other hand, in the public universities of developing countries. Devi Ramachandran et al. (2013) have identified IT (Information Technology) as the methods and technologies used to store, transmit, and process data and information using networks, computers, and telecommunications equipment as the strategic enabler of the most used KM. Rewards and incentives are seen as critical motivators of behaviours. Universities must ensure, through incentives, the recognition of the contribution of each academic to any system of knowledge sharing (Arntzen et al., 2009; Gill, 2009). Academics expect their commitment to knowledge sharing to improve and extend their relationships with colleagues and offer internal promotion and career development opportunities at other universities (Fullwood et al., 2013). Such an incentive system can further foster collaboration in research, contributing innovative ideas and solutions.

9.1 Comparison of hypotheses and results

This article examined the behavioural factors, expressed by the constructs of TPB (attitude, subjective norm, perceived behavioural control), that influence the relationship between KM and absorptive and desorptive capacity processes in the university context. Inside the model was inserted the exogenous variable Organizational Climate, which acts as a predictor of the endogenous variables Attitude, Subjective Norm and Perceived Behavioural Control. The results processed by the software after bootstrapping start suggests that Organizational Climate is a good predictor of the three latent variables that express the behavioural intention of academics to be involved in KM activities. Therefore, the hypotheses H7, H8 and H9 appear to be supported.

These results align with the survey conducted by Bock et al. (2005). The organizational climate has a positive impact on the intention of academics to share their knowledge. Wu and Zhu (2012) also supported the hypothesis that the organizational climate, characterized by a high level of equity, innovativeness and affiliation, positively impacts the behavioural variables attitude, subjective norm and perceived behavioural control. The results obtained in this work, on the other hand, show that the only behavioural control perceived by academics (perceived behavioural control) influences the abilities above. According to, among the factors that impact the university's ability to yield (desorptive) and acquire (absorptive) knowledge, there is precisely the perception of control and, in general, power perceived by the members of the organization who occupy top positions. The hypotheses supported are H1, H2 related to the supposed relationships between Perceived behavioural control – ACAP and Perceived behavioural control – DCAP.

9.2 Limits of research and suggestions for future developments

The investigation has some limitations that could represent the starting point for future research developments. First, the number of samples could be increased by extending the number of interviews. In the present case, the total number of valid answers is 160 and, therefore, the minimum requirement of the PLS-SEM analysis is met. Nevertheless, a larger sample would give rise to greater statistical power. Therefore, the results of this study should be verified with a larger model since greater statistical power would lead to greater generalizability of the same results (Lo and Tian, 2020). The reduced number of the answers is due to the short period dedicated to the survey and, also, to the type of survey chosen (electronic questionnaire via email). In addition, the presence of incomplete answers is probably due to many questions proposed. Finally, although the variable data are considered to be valid and reliable, it is possible that some academics, in the survey, provided socially desirable answers (Podsakoff et al., 2003). To this end, in a brief introduction, the participants were reassured about the anonymity of the questionnaire. According to Tan et al. (2010), according to which the administrative staff of universities play a significant role in the process of knowledge sharing, future research could extend the investigation to non-academic staff involved, in some way, in knowledge management processes. A suggestion for future research developments is to proceed to a multi-group analysis, which allows testing if predefined data groups have significant differences in their estimates of the parameters of the PLS model (Sarstedt et al., 2011). Finally, for some of the latent variables in the PLS model, second-order constructs could be created, that is, constructs involving more than one dimension. This would reduce the number of relationships in the structural model, making PLS-SEM more sparing and, at the same time, less complex (Edwards, 2001; Law et al., 1998).

References

Ahmed, E., Ward, R., 2016. Analysis of factors influencing acceptance of personal, academic and professional development e-portfolios. Computers in Human Behavior 63, 152–161.

Ajzen, I., 2002. Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior1. Journal of Applied Social Psychology 32, 665–683.

Ajzen, I., 1991. The Theory of Planned Behavior. Organizational Behavior and Human Decision Processes 50, 179–211.

Ajzen, I., Driver, B., 1992. Application of the Theory of Planned Behavior to Leisure Choice. Journal of Leisure Research 24, 207–224.

Ajzen, I., Fishbein, M., 1975. A Bayesian analysis of attribution processes. Psychological Bulletin 82, 261–277.

Al-Kurdi, O.F., 2020. The role of organisational climate in managing knowledge sharing among academics in higher education. International Journal of Information Management 11.

Andersen, P.H., Drejer, I., 2008. Systemic innovation in a distributed network: the case of Danish wind turbines, 1972—2007. Strategic Organization 6, 13–46.

Aurelie Bechina Arntzen, A., Worasinchai, L., Ribière, V.M., 2009. An insight into knowledge management practices at Bangkok University. J of Knowledge Management 13, 127–144.

Bagozzi, R.P., Yi, Y., 1988. On the evaluation of structural equation models. JAMS 16, 74–94.

Bock, Zmud, Kim, Lee, 2005. Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate. MIS Quarterly 29, 87.

Cepeda-Carrion, G., Cegarra-Navarro, J.-G., Cillo, V., 2018. Tips to use partial least squares structural equation modelling (PLS-SEM) in knowledge management. Journal of Knowledge Management 23, 67–89.

Chennamaneni, A., Teng, J.T.C., Raja, M.K., 2012. A unified model of knowledge sharing behaviours: theoretical development and empirical test. Behaviour & Information Technology 31, 1097–1115.

Cohen, W.M., Levinthal, D.A., 1990. Absorptive Capacity: A New Perspective on Learning and Innovation 30.

Crisci, A., D'Ambra, A., 2012. Permutation test for group comparison in PLS-Path: Modeling. Electronic Journal of Applied Statistical Analysis 5, 339–345.

Dell'Anno, D., del Giudice, M., 2015. Absorptive and desorptive capacity of actors within university-industry relations: does technology transfer matter? J Innov Entrep 4, 13.

Devi Ramachandran, S., Chong, S., Wong, K., 2013. Knowledge management practices and enablers in public universities: a gap analysis. Campus-Wide Info Systems 30, 76–94.
Duhon, B., 1998. It's all in our heads. undefined.
Edwards, J.R., 2001. Multidimensional Constructs in Organizational Behavior Research: An Integrative Analytical Framework. Organizational Research Methods 4, 144–192.
Forehand, G.A., Von Haller, G., 1964. Environmental variation in studies of organizational behavior. Psychological Bulletin 62, 361–382.
Fornell, C., Larcker, D.F., 1981. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research 18, 39–50.
Fullwood, R., Rowley, J., Delbridge, R., 2013. Knowledge sharing amongst academics in UK universities. J of Knowledge Management 17, 123–136.
Gill, A., 2009. Knowledge management initiatives at a small university. Intl Jnl of Educational Mgt 23, 604–616.
Goh, S.-K., Sandhu, M.-S., 2014. The Influence of Trust on Knowledge Donating and Collecting: An Examination of Malaysian Universities. International Education Studies 7, 13.
Gray, R., 2008. How it Feels to Work here: Improving Organisational Climate. The International Journal of Knowledge, Culture, and Change Management: Annual Review 8, 85–92.
Guimón, J., 2013. Promoting university-industry collaboration in developing countries (Innovation Policy Platform,OECD and World Bank).
Hajipour, B., Ghollamzadeh, R., 2010. The Effects of Market Entry Strategy Dimensions on the Performance: An Empirical Study of Iranian Food & Chemical Industries. European Journal of Economics, Finance and Administrative Sciences 22.
Halberstadt, J., Timm, J.-M., Kraus, S., Gundolf, K., 2019. Skills and knowledge management in higher education: how service learning can contribute to social entrepreneurial competence development. JKM 23, 1925–1948.
Iqbal, A., Latif, F., Marimon, F., Sahibzada, U.F., Hussain, S., 2019. From knowledge management to organizational performance: Modelling the mediating role of innovation and intellectual capital in higher education. JEIM 32, 36–59.
Julien, P.-A., Ramangalahy, C., 2008. Competitive Strategy and Performance of Exporting SMEs: An Empirical Investigation of the Impact of Their Export Information Search and Competencies. Entrepreneurship Theory and Practice 27, 227–245.
Kalar, B., Antoncic, B., 2015. The entrepreneurial university, academic activities and technology and knowledge transfer in four European countries. Technovation 36–37, 1–11.
Law, K.S., Wong, C.-S., Mobley, W.M., 1998. Toward A Taxonomy of Multidimensional Constructs. AMR 23, 741–755.
Lee, V.-H., Foo, A.T.-L., Leong, L.-Y., Ooi, K.-B., 2016. Can competitive advantage be achieved through knowledge management? A case study on SMEs. Expert Systems with Applications 65, 136–151.
Liao, S.-H., Wu, C., 2010. System perspective of knowledge management, organizational learning, and organizational innovation. Expert Systems with Applications 37, 1096–1103.
Lichtenthaler, U., Lichtenthaler, E., 2010. Technology Transfer across Organizational Boundaries: Absorptive Capacity and Desorptive Capacity. California Management Review 53, 154–170.
Lichtenthaler, U., Lichtenthaler, E., 2009. A Capability-Based Framework for Open Innovation: Complementing Absorptive Capacity. Journal of Management Studies 46, 1315–1338.
Liska, A.E., 1984. A Critical Examination of the Causal Structure of the Fishbein/Ajzen Attitude-Behavior Model. Social Psychology Quarterly 47, 61.
Lo, M.F., Tian, F., 2020. Enhancing competitive advantage in Hong Kong higher education: Linking knowledge sharing, absorptive capacity and innovation capability. Higher Educ Q 74, 426–441.
Mahdi, O.R., Nassar, I.A., Almsafir, M.K., 2019. Knowledge management processes and sustainable competitive advantage: An empirical examination in private universities. Journal of Business Research 94, 320–334.
Marabelli, M., Newell, S., 2014. Knowing, Power and Materiality: A Critical Review and Reconceptualization of Absorptive Capacity: Absorptive Capacity Revised. International Journal of Management Reviews 16, 479–499.
Martin, J.S., Marion, R., 2005. Higher education leadership roles in knowledge processing. The Learning Organization 12, 140–151.
Miao, Q., Newman, A., Schwarz, G., Xu, L., 2013. Participative Leadership and the Organizational Commitment of Civil Servants in China: The Mediating Effects of Trust in Supervisor: Participative Leadership and Civil Servants in China. Brit J Manage 24, S76–S92.
Miranda, S., Saunders, C., 2003. The Social Construction of Meaning: An Alternative Perspective on Information Sharing. Information Systems Research 14, 87–106.
Nonaka, I., 1994. A Dynamic Theory of Organizational Knowledge Creation 25.
Nonaka, I., Konno, N., 1998a. The Concept of "Ba": Building a Foundation for Knowledge Creation. California Management Review 40, 40–54.
Nonaka, I., Konno, N., 1998b. The Concept of "Ba": Building a Foundation for Knowledge Creation. California Management Review 40, 40–54.
Pavlou, P.A., El Sawy, O.A., 2006. From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology 88, 879–903.

Quarchioni, S., Paternostro, S., Trovarelli, F., 2020. Knowledge management in higher education: a literature review and further research avenues. Knowledge Management Research & Practice 1–16.

Raj Adhikari, D., 2010. Knowledge management in academic institutions. Intl Jnl of Educational Mgt 24, 94–104.

Sarstedt, M., Henseler, J., Ringle, C., 2011. Multi-Group Analysis in Partial Least Squares (PLS) Path Modeling: Alternative Methods and Empirical Results. Advances in International Marketing 22, 195–218.

Siadat, S.A., Hoveida, R., Abbaszadeh, M., Moghtadaie, L., 2012. Knowledge creation in universities and some related factors. Journal of Mgmt Development 31, 845–872.

So, J.C.F., Bolloju, N., 2005. Explaining the intentions to share and reuse knowledge in the context of IT service operations 13.

Tan, B., Wong, V., Lam, C.-H., Ooi, K.-B., Chee, F., Ng, Y., 2010. Assessing the link between service quality dimensions and knowledge sharing: Student perspective. African journal of business management 4, 1014–1022.

Taylor, S., Todd, P.A., 1995. Understanding Information Technology Usage: A Test of Competing Models. Information Systems Research 6, 144–176.

Tian, J., Nakamori, Y., Wierzbicki, A.P., 2009. Knowledge management and knowledge creation in academia: a study based on surveys in a Japanese research university. J of Knowledge Management 13, 76–92.

Tsang, E.W.K., 2002. Acquiring knowledge by foreign partners from international joint ventures in a transition economy: learning-by-doing and learning myopia. Strategic Management Journal 23, 835–854.

Veer Ramjeawon, P., Rowley, J., 2017. Knowledge management in higher education institutions: enablers and barriers in Mauritius. TLO 24, 366–377.

Yew Wong, K., Aspinwall, E., 2004. Characterizing knowledge management in the small business environment. J of Knowledge Management 8, 44–61.

Yoo, Y., Alavi, M., 2001. Media and Group Cohesion: Relative Influences on Social Presence, Task Participation, and Group Consensus. MIS Quarterly 25, 371–390.

Zhang, P., Ng, F.F., 2013. Explaining Knowledge-Sharing Intention in Construction Teams in Hong Kong. J. Constr. Eng. Manage. 139, 280–293.